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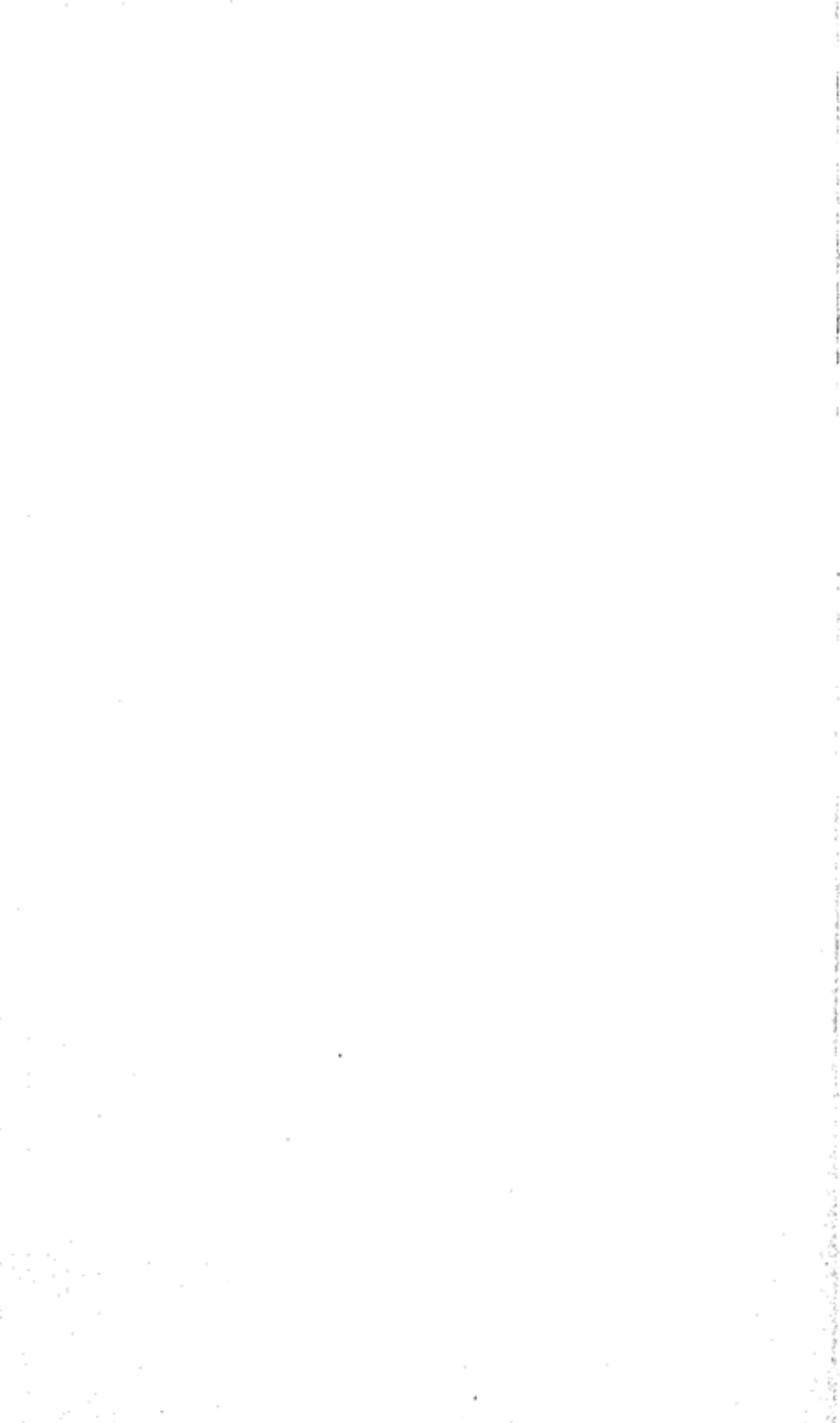
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**TEMPLES  
OR  
TOMBS?**



# TEMPLES OR TOMBS?

INDUSTRY VERSUS ENVIRONMENT  
THREE CONTROVERSIES

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Darryl D'Monte



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CENTRE FOR SCIENCE AND ENVIRONMENT

*To Zarine and Samir*

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## Preface and Acknowledgements

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Towards the end of 1977, when I was working in "The Times of India" in Bombay, I was involved tangentially in a campaign against the location of a massive fertiliser plant on the mainland near the metropolis. The controversy ended when the factory was sited at Thal-Vaishet but it raised many issues concerning the apparent conflict between environment and development.

Two close friends of mine, Navroz Mody, a publisher, and S.K. Das, an architect, spearheaded the campaign. In the course of the three-year conflict, they gathered mounds of material which we were never able to use in newspaper articles. I thought then that if I ever had the time, it would be good to document the entire case, from start to finish, as a valuable case-study in decision-making in an environmental controversy.

That opportunity arose when I was forced to leave the "Indian Express" in 1981: I was its Resident Editor in Bombay. The following year, I obtained a Homi Bhabha Fellowship to research a book on three environmental controversies in the country which had been landmarks in the making of policy. These were the Silent Valley hydroelectric project in Kerala, the Mathura oil refinery near the Taj Mahal and the Thal-Vaishet fertiliser case.

I was able to travel extensively to the sites of these three projects and have prolonged discussions with project engineers and officials, as well as with the environmentalists who opposed the location of these projects. By coincidence, the Silent Valley campaign was largely masterminded from Bombay, as was that against the fertiliser factory to be put up by Rashtriya Chemicals and Fertilisers Ltd. The opponents of the Mathura refinery included the Indian Heritage Society in Delhi, along with Prof. J.M. Dave of the School of Environmental Sciences at Jawaharlal Nehru University and Prof. T. Shivaji Rao of Andhra University in Waltair (Visakhapatnam).



The title is derived from Pandit Nehru's oft-quoted remark, when he was opening the Nangal canal, that modern industrial and agricultural projects were "the temples of today". The book questions whether these are in fact symbols of hope and promise for those who live in their vicinity or turn out to be symbols of disillusionment. The cover depicts the controversial lion-tailed macaque of Silent Valley, the habitat of which was threatened by the dam. It is used to symbolise the apparent conflict between industrial growth and the natural environment, in which all living things—human beings, most of all—have a stake.

The introduction sets out the terms of the "environment versus development" debate globally and then examines its context in India. It shows how the documentation of three major cases in detail highlights problems which recur whenever large so-called development projects are planned. The following six chapters deal with the three cases: one chapter tells the story of what transpired in each case and the second draws the appropriate conclusions. The last two chapters sum up the lessons of the book and examine what alternatives were available in place of these major projects.

I have tried to make this book as readable as possible, so that it interests not just those who have been following environment issues but also anyone who is concerned about the way in which decisions are made in massive industrial projects. Although some of the material is inevitably "technical", I hope I have presented it in a manner which will not put off the uninitiated. I should also make it quite clear that I do not possess the answers to many of the questions that I raise, which are both technocratic as well as presuppose a different political system in which certain alternatives are available. However, the criticism of existing technology may lead to a larger questioning of the decision-making process.

I have been greatly supported in my work by my colleague at the Centre for Science and Environment, Anil Agarwal. He not only provided many of the insights by way of comments on the manuscript but also made a convincing case for publishing this book ourselves. I owe him and other colleagues at the Centre a special debt of gratitude: it made all the difference, working on this book and our "State of Environment" reports, that we were a group of like-minded people, most of whom started out as journalists but grew more concerned about environment and development issues.

I must also thank the Homi Bhabha Fellowships Council and particularly its former Honorary Secretary, Dr. Narayana Menon, for the very generous assistance for two years which enabled me to write this book. The Council also funded a trip to England and the US, where I was available to collect a lot of material on environment issues in other Third World countries. The United States Information Service facilitated a two-week visit to Washington, which was very useful. This period abroad confirmed that this is the first time that anyone from the Third World has done an in-depth study of specific environment controversies.

Dilnavaz Variava, who co-ordinated the work of groups in Kerala in the Silent Valley case, very kindly made available all her files to me, as did Shyam Chainani of the Bombay Environmental Action Group in the Thal-Vaishet controversy. I was helped by two officials in the Indian Oil Corporation—S.G. Nayak, former General Manager of the Mathura refinery, and V.S. More, who heads its Pollution Control Cell. Dr. S. Varadarajan, now Director General of the Council for Scientific and Industrial Research, who headed the expert committee to examine how to minimise the environmental impact of the Mathura refinery, was also most co-operative.

There are officials in other government agencies—the Archaeological Survey of India, Indian Meteorological Department and so on—too numerous to name who were quite forthcoming with information. Prof. J.M. Dave and Prof. Shivaji Rao were supportive too; the latter actually gifted me several files. Among the many environmentalists whom I have to thank I should single out Dr. V.M. Meher Homji of the French Institute in Pondicherry, Zafar Futehally of the World Wildlife Fund, Dr. Madhav Gadgil and Dr. D.K. Subramanian of the Indian Institute of Science, and Fr Cecil Saldanha of St Joseph's College, all in Bangalore. A person who literally spent hours in Cochin with me was Prof. M.K. Prasad of the Kerala Sastra Sahitya Parishat; his fellow-activist, Prof. V.K. Damodaran, enlightened me about some of the more complicated aspects of the supply of electricity from hydroelectric stations. The late S.N. Chib of the Indian Heritage Society showed me his files and generously gave me several slides of the Taj Mahal and other endangered monuments.

I have to thank several librarians—at the Department of Science

and Technology in Delhi, Jawaharlal Nehru University, Indian Institute of Science, "The Times of India", Tata Energy Research Institute, Centre for Education and Documentation, Bombay and Data Centre in Bangalore. Among the many libraries I consulted abroad were at the International Institute of Environment and Development (IIED) in London, USAID and Worldwatch in Washington, and the Sierra Club in San Francisco.

I was helped by discussions with members of Earthscan and IIED (the latter in Washington as well), Friends of the Earth in San Francisco, Worldwatch, Resources for the Future and USAID in Washington. After extensive conversations with members of these organisations, I was convinced that although there was an understanding of the general issues which big projects in Third World countries gave rise to, there was no detailed documentation of controversies which looked not only at environmental impact but also economic and political factors. Perhaps the privilege of the journalist is to draw on several disciplines and hopefully arrive at some reconciliation between conflicting demands.

Several people read either my original research proposal or parts of the manuscript and provided valuable comment. I have to thank Ashok Khosla, Thomas Mathew, Naren Panjwani, D.K. Biswas, David Fernandes, Ramachandra Guha and Sailen Ghosh. I remain responsible for any of the mistakes that may have entered the book—especially on some of the more technical points.

Finally, many thanks are due to colleagues at the CSE whom I constantly badgered about this book, and to the artist Manjula Padmanabhan who sketched the cover. Vinay Aditya of "The Word" was always a model of patience in getting this book typeset and Pradip Malhotra attended to its publishing. I must last of all reserve a word of gratitude to my mother who kept clippings, transferred corrections in the manuscript and proof-read this book, all onerous chores which relieved me of a big burden.

The manuscript was completed in April 1984 and though it has been revised, certain events occurred too recently to be included. R. Balakrishna Pillai had to resign as Kerala's Electricity Minister; the Mathura oil refinery may be expanded to 7.5 million tonnes; in September 1985, Prime Minister Rajiv Gandhi officially opened the Silent Valley National Park, described as a "gift of his mother to the country"; the Karnal and Mangalore refineries, with the Salimpur

petrochemical plant near Mathura, will now cost Rs 3,500 crore; natural gas worth a crore of rupees is now being wastefully flared at the Bombay High offshore field every day.

Darryl D' Monte

October 1985



## ABBREVIATIONS

ASI	: Archaeological Survey of India
ASTRA	: Application of Science & Technology to Rural Areas (Indian Institute of Science, Bangalore)
BARC	: Bhabha Atomic Research Centre
BEAG	: Bombay Environmental Action Group
BMR	: Bombay Metropolitan Region; BMRDA: Bombay Metropolitan Regional Development Agency
BNHS	: Bombay Natural History Society
BSI	: Botanical Survey of India
CEA	: Central Electricity Authority
CIDCO	: City & Industrial Development Corporation, Bombay
CMIE	: Centre for Monitoring Indian Economy, Bombay
CPM	: Communist Party Marxist
CSE	: Centre for Science & Environment
DoE	: Department of Environment
DMCC	: Dharamsi Morarji Chemical Co, Bombay
DST	: Department of Science & Technology
EIL	: Engineers India Ltd
EPA	: Environmental Protection Agency
EPW	: Economic & Political Weekly
ESP	: Electro Static Precipitator
FAO	: Food & Agriculture Organisation
FCI	: Fertiliser Corporation of India
FoT	: Friends of Trees
GDP	: Gross Domestic Product
GNP	: Gross National Product
GSi	: Geological Survey of India
GWh	: Gigawatt hour (1 GWh = 1 million kWh)
IARI	: Indian Agricultural Research Institute
ICAR	: Indian Council for Agricultural Research

ICCROM	: International Centre for the Study of the Preservation & Restoration of Cultural Property, Rome
ICOLD	: International Commission on Large Dams
IHS	: Indian Heritage Society
IIED	: International Institute for Environment & Development, London & Washington
IIS	: Indian Institute of Science, Bangalore
IIP	: Indian Institute of Petroleum, Dehra Dun
IMD	: Indian Meteorological Department, Ministry of Tourism & Civil Aviation
IPCL	: Indian Petrochemicals Corporation Ltd, Baroda
IRRI	: International Rice Research Institute, Los Banos, Philippines
ITDG	: International Technology Development Group, London
IUCN	: International Union for Conservation of Nature, Switzerland
JNU	: Jawaharlal Nehru University
KPC	: Karnataka Power Corporation
KSEB	: Kerala State Electricity Board
KSSP	: Kerala Sastra Sahitya Parishat
LPG	: Liquefied petroleum gas
MW	: megawatt (1MW = 1,000 kilowatts)
$\mu\text{m}^3$	: micrograms per cubic metre
MU	: million units
MIDC	: Maharashtra Industrial Development Corporation
MPWPB	: Maharashtra Prevention of Water Pollution Board (now Maharashtra Pollution Control Board)
NAL	: National Aeronautical Laboratory, Bangalore
NCEPC	: National Committee on Environmental Planning & Co-ordination (later NCEP)
NEERI	: National Environmental Engineering Research Institute, Nagpur (formerly CPHERI)
ONGC	: Oil & Natural Gas Commission
OPEC	: Organisation of Petroleum-exporting Countries
PASS	: Parisara Asoothrana Samrakshana Samithy (Environmental Planning & Conservation Society), Trivandrum
PWP	: Peasants & Workers' Party
RCF	: Rashtriya Chemicals & Fertilisers Ltd (formerly part of FCI)

SIICOM	: State Industrial & Investment Corporation of Maharashtra
SPM	: Suspended particulate matter
SSVC	: Save Silent Valley Committee, Bombay
tpd	: tonnes per day; tph: tonnes per hour
UNEP	: United Nations Environment Programme
UNESCO	: United Nations Educational, Scientific & Cultural Organisation
UNIDO	: United Nations Industrial Development Organisation
WHO	: World Health Organisation
WWF	: World Wildlife Fund, Switzerland
ZSI	: Zoological Survey of India

## NUMERALS

lakh	: one hundred thousand (1,00,000)
crore	: ten million (1,00,00,000)





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# 1 Development or Environment

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When he declared open the Nangal canal—part of the massive Bhakra multi-purpose project in Punjab—in 1954, Pandit Jawaharlal Nehru made the memorable observation: “When I walked around the site, I thought that these days, the biggest temple and mosque and gurdwara is the place where man works for the good of mankind. Which place can be greater than Bhakra Nangal, where thousands of men have worked or shed their blood and sweat and laid down their lives as well? Where can be a holier place than this; which can we regard as higher?” In the first flush of independence, this bold and unequivocal assertion from the high priest of modernisation himself has become mythologised: today, everyone recalls how Nehru described mammoth development projects as “the temples of today”. I remember visiting the gigantic Bhakra dam a few years later as a teenager and marvelling at the vast ocean-like reservoir behind the concrete barrage; as my face tingled with the fine mist rising from the waters cascading through the sluices, I was infused with an emotional upsurge, the feeling that I was witnessing the rebirth of a country that had long slumbered in the throes of its colonial past.

Nehru represented, unlike Gandhi or any other leader, not only a clean break with tradition but the symbol of a new era, where poverty would soon be left behind in the face of the relentless onslaught of industrialisation. Actually, he was preceded by another exponent *par excellence* of the same philosophy—Dr M. Visvesvaraya. He built the Krishnarajasagar dam across the Cauveri—the country’s largest reservoir at the time (1918)—and later set up the Mysore Iron & Steel Works at Bhadravathi. Nehru, after independence, advocated a Soviet-style pattern, where the country went in for investment in heavy industries, starting with the First Five-Year Plan in 1951. Today, the euphoria of those early days has evaporated; hardly anyone seems to be even aware that the

country is on the verge of entering the Seventh Plan. Although the "modern-day temples" have indeed helped lay the foundations of industrial growth, it is by no means clear that the relative neglect of other sectors of the economy has paid dividends. Even so, there is the conviction that "India is a rich country, with poor people"; in other words, that its resources are not being properly utilised. The answer, inevitably, is seen as spurring economic growth by launching many more industrial projects: the bigger, the better. There is the universal belief that the benefits of these schemes will trickle down to the people: in the words of the First Plan, "a process of development which will raise living standards and open out to the people new opportunities for a richer and more varied life."

But it will be apparent to all but the most myopic that nothing of the kind has in fact happened. One could in fact invert the popular saying and state that "India is poor because its people are." One very simple statistic should make this clear: according to the UN's Food and Agriculture Organisation (FAO), India has the largest number of under-nourished people in the world—201 million citizens. Despite rapid strides in both industrial and agricultural production and a steadily rising per capita income in money terms, the conditions in which the majority live are still abysmal. Half the population lives below the poverty line, estimated as those whose daily expenditure per person is Rs 2.50 or less.<sup>1</sup> About four out of every ten people live in one room. Two out of every three cannot read or write. The litany can go on, remorselessly; indeed, one has become inured to such statistics. Clearly, there is something amiss with the notion that rapid economic growth, reflected in the burgeoning Gross National Product (GNP), which is now increasing by about 6 per cent per year, can come to the rescue of the large number of the needy in a country like India. It will be little consolation, for instance, to reflect on the calculation made by the American futurologist, Herman Kahn, that India, with its recent per capita income growth rate of 2.3 per cent per year, can look forward to an income per head of \$10,000 in the year 2176! By the turn of this century, there will be more people below the poverty line than the entire population at independence.

"Development", therefore, has come to be a very loaded word: it is imprecise, self-fulfilling and normative. Very often, it is seen as the process through which relatively simple, traditional, agrarian societies become "modernised." The French sociologist Raymond

Aron has cited three interpretations of what development may constitute.<sup>2</sup> In the first place, it is the long-term, statistical trend of economic growth. Alternately, it is the contrast between rich and poor countries. Both these views are incorporated in the "stages of growth" theory propagated by W.W. Rostow, in which development is a linear path along which all countries travel. At various stages in history, advanced countries reached the stage of "take-off"; poor countries, or at least the more fortunate among them, will approach it in due course. If they do not, it is because, in Rostow's view, they lack capital, technology, expertise and motivation. A third interpretation of the process, and one which applies only to the West, is the gap between affluent capitalist countries and the Soviet bloc. The actual technologies which made societies develop are socially and culturally determined; in turn, these technologies transform the societies.

Most planners in Third World countries have their schooling in welfare economics which, as the economist Sanjay Lall points out, "furnished the paradigm within which conventional development economics operates."<sup>3</sup> This also provides for social cost-benefit analysis which, together with development economics, provides welfare theory with, in Lall's view, "the meaning of the language used, the value judgements adhered to, the questions asked, and the methods used for interpreting the answers found." A high Gross National Product is associated with rapid consumption and hence high social welfare. A contribution to a volume which is the classic for the ground covered by this book, *The Careless Technology: Ecology and International Development*, edited by Taghi M. Farvar and John P. Milton (1972), argues that these goals may be conceptualised by sociologists and politicians in a developing country, but the means are prescribed primarily by economists. "Planners and administrators are frequently professional economists who view the development task as an exercise in applied economics. But the economics of development tend to be partial and specialised theories of the industrial and commercial societies that were transformed by Keynes and others into the macro-theories of national and international economic control." The Third World, with its rapidly shrinking natural resource base, to mention only one factor, calls for a planning approach which deviates from textbook theories.

The disenchantment with GNP and the growth process is now

becoming increasingly widespread. The well-known Pakistani economist, Mahbub ul Haq, articulated it well at an international development conference in 1972: "Developing countries have no choice but to turn inwards ... and adopt a different style more consistent with their own poverty".<sup>4</sup> Development goals should be "elimination of malnutrition, disease, illiteracy, squalor and unemployment and inequality." They should not merely be concerned with "how much is produced, but what is produced and how it is distributed ... this requires a redefinition of economic and social objectives ... of truly staggering proportions." Within this country, a person who has been arguing for precisely such an approach with passion and has been drawing attention to the potential of alternative technology is Prof Amulya Kumar N. Reddy, head of the cell for the Application of Science & Technology to Rural Areas (ASTRA) at the Indian Institute of Science at Bangalore.<sup>5</sup> Central to what would comprise genuine development, in his scheme of things, is the index how much energy a person consumes, rather than his per capita income; this comprises both calories in the shape of food and other external forms like fuel for cooking and lighting. Reddy has been doing seminal work at ASTRA, identifying alternative sources of energy.

His scenario is to see energy as a component of a development strategy which does three things: satisfies basic human needs, starting with the needs of the neediest; is directed towards endogenous self-reliance and is in harmony with the environment. In other words, it views development from the base upwards, instead of expecting the benefits to trickle downwards. Economists like Dandekar and Rath, who have been painstakingly assessing the degree and extent of poverty in India, use calorie levels as an index not just of malnutrition but of pauperisation.<sup>6</sup> Despite near-self sufficiency in food production, the 20 per cent of the population at the base of the social pyramid, who spend 85 per cent of their income on food, are unable to consume more than 1,500 calories a day, as against a minimum of 2,300 prescribed by the Planning Commission for rural areas. Should they be comforted by the fact that the country was till recently the tenth biggest producer of goods and services in the world?

### Quality of life

This concern with the deteriorating *quality of life*, as distinct from physical or money indices, has led, over the past dozen years

or so, to the examination of the relationship between the environment and development. The "environment", admittedly, can mean many things to many people. At one level, it can refer to the preservation of a scenic natural landscape or dwindling wildlife species; at another, it can comprise industrial pollution or the threat to a citizen's amenities caused by the building of a road or a major factory. For the purposes of this book, however, it will be more appropriate to treat the environment as the source of natural resources; energy, land, water, atmosphere and minerals. The economist Biplab Dasgupta, author of a book on India's oil industry (among others), has made a useful analysis of the functions that the environment performs in relation to man in an article in the *Economic and Political Weekly*.<sup>7</sup> The first is broadly termed "recreation"; the second, the source of natural resources — agricultural, mineral and forestry—which humans consume directly or indirectly. Thirdly, environment acts as a "sink" for assimilating wastes produced by human civilisation. The capacity of the environment to perform these functions should not be impaired by human action, which imposes four types of "stresses" on the environment. First, "eutrophic"—the task of decomposing wastes produced by consumption and production activities. Second, "exploitative" — cropping of plants, extraction of minerals and hunting of animals. The rate of exploitation should not exceed nature's capacity to reproduce. Third, "disruptive"—which are brought about by activities like forest clearance, construction of a highway or the setting up of a new township. And fourth, "chemical and industrial" stress which mainly results from technological development—heavy concentration of lead, mercury or radioactive substances.

Traditional neo-classical economics treated the environment in two ways. One was to view it as an "externality" with either positive or negative impact on the cost of operation of an individual firm; the other was to treat it like a commodity for which, like any other, the consumer was expected to pay a price. "Both these approaches shared a common belief in the efficacy of the market mechanism in solving all economic problems, including environment ones." Environment was seen as a "bottomless pit" with unlimited capacity to withstand stresses: its impact was believed temporary and marginal, it could be isolated into small segments for which specific policy decisions could be made. By the late 'sixties and early 'seventies, it became apparent that such an approach would no longer do. This saw the emergence of what Dasgupta calls the

environmentalist "lobby": it was not a "school" because those expressing concern did not share a common body of ideas, they ranged from "conservative-conservationists", structuralists and reformists to Marxists of various hues. Besides, there was a "propagandist", missionary tone in much of the environment literature. The inspiration for this lobby came from two distinct sources: economists or structuralists who were disillusioned with the GNP approach towards development and the ecologists who were alarmed by the increasing pollution and rapid depletion of scarce resources. The first, as we have already seen, did not treat development "as merely an economic goal but as a multi-dimensional concept encompassing economic as well as political, social and cultural aspects of life. Accordingly, interest shifted from the quantitative to the 'qualitative' aspects of life ... Environment entered the field both as an objective and as an indicator of development."

Whereas the structuralists were primarily concerned with the "social environment", and viewed environment mainly as an *objective* of development, the ecologists viewed it mainly as a *constraint* on development. The word ecology was coined by a German biologist in 1869 and is derived from the Greek *oikos*, meaning "house". It refers to the science of inter-relationships between living things and their natural environment. Thus it was obvious that the ecologists would be most concerned with pollution and the exhaustion of natural resources. The classic in this genre was Rachel Carson's epoch-making *Silent Spring* in 1962 which showed the inter-connectedness between seemingly minute levels of pesticides which could become concentrated in food chains and thus pose a serious environmental problem.<sup>8</sup> An extreme ecological stand was taken by the *Limits to Growth* study produced by the Club of Rome exactly a decade later. It predicted, amidst great consternation, that unless technology changed its current course, the world was in danger of running out of its resources ... Indeed, it set the actual date of collapse some time in the latter half of the 21st century. To avert doomsday, the Club of Rome (whose membership is restricted to rich Western countries) advocated a voluntary reduction in consumption levels (particularly of fossil fuels) and a "zero-growth" economic policy. This was predictably attacked by those who felt that technology could both take care of environmental problems as well as provide the key for yet higher growth patterns. More

importantly, the Club looked at the issue from the perspective of the affluent West and neglected to point out the vast disparity in consumption of resources between the First and Third Worlds. A citizen in a poor country consumes over his lifetime energy which is equivalent to just six month's consumption of his counterpart in a rich country. Another way of looking at the disparity is to realise that if the entire world consumed oil at the US rate of 30 barrels per person per year, the entire globe's petroleum reserves would be exhausted in five years! In 1975, every adult and child in the US consumed 40,000 pounds of mineral matter alone—stone, cement, petroleum, natural gas etc, quite apart from agricultural products, wood and water.

Understandably, developing countries also feared that "no growth" advocacy was a neo-imperialist plot to keep them backward, thereby perpetuating the unjust status quo. One noted "doomsdayer", Paul Ehrlich, has asserted that some poor societies are not fit for industrialisation, while the industrialised countries should now cry a halt to their growth. "Concern for environment in the developed countries," according to Dasgupta, "was seen by them alternately as a luxury which only the developed could afford; yet another fashion introduced by the international development lobby—like stress on capital accumulation and saving, or on family planning in the past—in order to divert their attention from more fundamental issues; and as a device to keep the Third World countries 'in their place'. Some Third World observers even suggested that poor countries, given their low level of industrial development, should be both willing and able to absorb a certain degree of controlled environmental degradation as a price for industrial progress, generation of employment and alleviation of poverty." Brazil comes most easily to mind in this context: it has even extended a blanket invitation to any multinational barred in the US for environmental reasons to invest in this vast country, with forests larger in area than all of Western Europe (barring the Soviet Union). The conventional Marxist approach, on the other hand, would also be to scoff at environmental concerns and consider that all such problems would be solved once the means of production are in the hands of the state. This has obviously neither happened in the Soviet Union nor China.

It was against this backdrop that the UN decided to hold the now famous conference on the environment at Stockholm in 1972.



Stockholm was chosen not because, as it may be imagined, it was a neutral country but because it had for some years been very apprehensive about the threat from "acid rain". This is the phenomenon by which sulphur dioxide in the atmosphere, spewed out by factories as far away as in England and West Germany, was contaminating fresh water lakes and other fragile natural systems as well as man-made structures in all Scandinavian countries. Canada is also an unwilling recipient of such largesse from the US, and this makes acid rain the leading issue concerning pollution across national boundaries in the West, which only a supranational agency can perhaps solve. It was clear to the UN that there was no consensus between the First and Third World regarding environmental problems, which is why the Canadian, Maurice F. Strong, who was appointed Secretary-General of the Stockholm conference, summoned a preparatory meeting of international experts at Founex in Switzerland in 1971. India was represented by Pitambar Pant from the Planning Commission who was to later provide the inspiration for setting up the country's first environmental organisation.

The basic difference in the approach was summed up thus at Founex: in industrialised countries, it is appropriate to view development as the *cause* of environmental problems; in developing countries, development becomes essentially a *cure* for their environmental problems, of which the most pressing is poverty itself. At the same time, however, it was recognised that while poor countries face environmental problems because of the *lack* of development, the very *process* of development also gives rise to such problems. "Indeed, as the process of development gets under way," the conference pointed out, "the latter type of problem is likely to assume increasing importance. The process of agricultural growth and transformation, for example, will involve the construction of reservoirs and irrigation systems, the clearing of forests, the use of fertilisers and pesticides and the establishment of new communities. These processes will certainly have environmental implications. Similarly, industrialisation will result in the release of pollutants and react on the environment in a number of ways ... Urbanisation is already a pressing problem for many developing countries and some of their cities are experiencing problems common to those of industrialised countries. In addition, with the urgent need for the rural areas to sustain a growing population, the

problems of rural environment assume a new significance." The side-effects of development were identified as resource deterioration (the dwindling of forest, mineral or soil resources), biological disruption, chemical pollution, physical disruption and social dislocation.

The Founex report recognised that the roots of most current environmental problems could be found in the activities of industrialised countries but they were of equal concern to the Third World for three reasons. First, many of these problems extend beyond national boundaries and threaten the entire world's population. Second, some problems are common to both countries—the urban crisis, for example. Further, Third World countries had to learn from the mistakes and distortions that had characterised the development of the industrialised countries ... "social" or "human" environment thus emerged as an important area of concern. This demonstrated to the Third World the relevance of environmental issues, assured them that they were in no way conflicting with the present or future development potential of a country and did not serve only the interests of a rich minority. All the same, there was some amount of conceptual confusion: if environment encompassed a social dimension as an objective and development was to improve "the quality of life", the two terms became almost synonymous.

The Stockholm conference took up the theme and elaborated it further. The Afro-Asian bloc, representing two-thirds of the globe, emphasised that the human environment was dominated by poverty, malnutrition, illiteracy and sheer misery. Mrs Gandhi emerged as the most articulate spokesman of this viewpoint. "The profit motive, individual or collective," she declared, "seems to overshadow all else. This is the basic cause of the ecological crisis. This affluence was achieved by the Western world at the price of domination of other countries." In India, she stated, "we do not wish to impoverish the environment further, and yet we cannot for a moment forget the grim poverty of large numbers of people. Are not poverty and need the greatest polluters?" She suggested that there was a growing feeling in the country that there should be a reordering of priorities and perhaps a move away from the orthodox notion of economic growth, towards priorities centred around man. Further, she maintained that India and other developing countries must be helped to reach a higher standard of living

before they could be asked to help the rich nations to improve the environment: "On the one hand, they look askance at our poverty; on the other they warn us against their own methods ... The environment cannot be improved in conditions of poverty. Nor can poverty be evicted without the use of science and technology." Such a stand has now come to be paraphrased as "poverty is the worst form of pollution." Nevertheless, the conference reached a consensus on the need to safeguard the earth's resources for the benefit of present and future generations and stated that economic and social development was essential for the improvement of the quality of life. Mrs Gandhi herself clarified that "the inherent conflict is not between conservation and development, but between environment and the reckless exploitation of man and earth in the name of efficiency." The central focus was well expressed by the head of the Chinese delegation, who said: "We hold that of all things in the world, people are the most precious."

Another group of experts met in 1974 in Cocoyoc, Mexico, at the initiative of the late Barbara Ward, a guiding spirit of the environment and development movement and author (with Rene Dubos) of the book *Only One Earth* issued at the time of the Stockholm conference and its sequel, *Progress For A Small Planet*.<sup>9</sup> The declaration that was issued from Cocoyoc clearly identified the economic and social factors which lead to environmental degradation: "The problem today is not one primarily of absolute physical shortage but of economic and social maldistribution and usage ... The task of statesmanship is to guide the nations towards a new system more capable of meeting the 'inner limits' of basic human needs for all the world's people and of doing so without violating the 'outer limits' of the planet's resources and environment ... Human beings have basic needs ... Any process of growth that does not lead to their fulfilment—or, even worse, disrupts them ... is a travesty of the idea of development." Thus the concerns of Cocoyoc quite rightly extended beyond environment.

In the period after the Stockholm conference and the jolt received by the OPEC oil price hike the following year, there was a call for a New International Economic Order in which developing countries were to be given a fair deal in trade and other economic spheres. The old shibboleth of "environment *versus* development" (also variously described as the choice between preservation or progress, ecology or economics, equity or energy) has now given

way to a new understanding of the mutual dependence and interaction between the two. Thus economic growth is being seen as a necessary, but by no means sufficient, condition for achieving development. Environmental goals are subsumed within the large set of objectives and are thus an integral component of development. Comprehensive planning is therefore required to arrive at environmentally sound and sustainable development. This new awareness is being called "eco-development", a term which was coined by Maurice Strong. With the setting up of the UN Environmental Programme (UNEP) in Nairobi—significantly, the first UN headquarters in a Third World country—eco-development has become a password among planners and environmentalists alike through most of the globe. The emphasis has now shifted to the need for "sustainability" of the earth's resources, which was codified in the "World Conservation Strategy" declared in 1980 by the International Union for Conservation of Nature (IUCN). It would be a mistake, however, to imagine that these concepts explain conflicts and contradictions that exist at various levels—between countries or classes within the same country. They have now become part of the somewhat sanitised jargon employed in international and national forums on environment and while they help reach a consensus on tricky issues, they do not negate the need to look at each environmental issue in its social and political context.

There is an interesting parallel in the earlier attitude to environmental problems and population growth. Just as the West saw large populations as the major impediment to the economic growth of "backward" countries, and advocated birth control, so also did the doomsdayers implore all nations to tighten their belts and reduce the runaway consumption of natural resources. Population—or rather, simply *people*—was seen as a problem, whereas after the UN population conference in Bucharest in 1974, the Third World stoutly opposed this interpretation and expressed their resentment against attempts to preach to them when in fact the West had cornered such a major share of the world's resources: their poverty was caused at least in part by the economic domination of the rich countries. As is so often cited, the US, with 6 per cent of the world's population, consumes 35 per cent of its raw materials.<sup>10</sup> Countries with relatively small populations—in Africa and Latin America—are particularly adamant about not being told

to reduce their populations, in much the same way that they have been against toeing the Western environmental line.

Just as the slogan "Poverty is the worst form of pollution" came to be bandied about after Stockholm, so did one regarding population gain currency after Bucharest. This *mantra* was first raised at the conference by an Indian as well: Dr Karan Singh, then Family Planning Minister, stated that "Development is the best contraceptive." Although both slogans contain a great deal of truth, they remain rhetoric when viewed against the actual record of some of the countries which protest most vigorously against browbeating by the West. Thus Brazil, which is three times the size of India and contains the world's largest tropical forests, has shown no hesitation whatsoever in decimating its indigenous Indian population in the name of "development"—clearing the forest for multinational industrial firms. Closer home, Mrs Gandhi's government during the emergency cracked down simultaneously on slumdweller and the "redundant" poor with forced evictions and sterilisations. This too was done in the interests of helping the country to "progress" without too many fetters. Even today, the attitude of various state governments towards the "wretched of the cities" indicates only too clearly that whatever the official protestations about environment and development, people—or more specifically the poor—are not seen as a component of the environment at all.

### Debate in India

Where does India figure in the environment or development debate? As a large, predominantly agricultural, nation which also recorded impressive industrial growth—from heavy engineering to a wide range of consumer goods—it seems to constitute a "test country" for attempting to reconcile these apparently conflicting demands. Besides, it is well endowed with scientific and technical power, as also a high degree of political freedom, both of which encourage debate between ends and means. It is only necessary to single out one statistic, how the real per capita income in 1982-83 was Rs 713—Rs 2 less than it was in 1978-79—to underline the need to study how the country has been "developing". If one cuts through the economic jargon that cloaks development issues, this simply means that the resources of the country have not been nurtured to meet the basic needs of the people but have been exploited only for certain sections of society. In other words, not

enough is being produced, but even more significantly, what is produced is not being equitably shared. The resource base is not being properly utilised. Take land itself. In the Sixth Plan document, the Planning Commission observed: "In spite of the large investment made in the irrigation sector and the phenomenal growth of irrigation during the past 30 years, the return from the investment both in terms of yield as well as finance are very disappointing. Irrigated land should yield at least 4 to 5 tonnes of grains per hectare a year. However, at present it is hardly 1.7 tonnes on an average." Significantly, no other country has invested as much on irrigation in the last few years. With a total of 40 million hectares in the country which are irrigated, a minimum of 160 million tonnes of food should be well within the nation's reach. By contrast, the output has only touched a record of 150 million tonnes in 1984-85. As B.B. Vohra, India's most concerned administrator and lone voice on land and water management issues (he was former Petroleum Secretary, interestingly enough), who was head of the National Committee on Environmental Planning till it was disbanded in 1983, put it in his 1980 Sardar Patel memorial lecture: "We can barely manage to produce 130 million tonnes of foodgrains from 143 million hectares of agricultural lands while China produces significantly more than 300 million from a mere 112 million hectares." Despite the fact that the cultivated area per head of China's population on the farms is only 28 per cent of India's, its per capita availability of food is higher. He ascribes this failure to land degradation and bad water management.

The Centre for Science and Environment (CSE), the Delhi-based organisation run by journalists and researchers—I am associated with it as a Fellow—brought out its first "state of environment" report<sup>11</sup> for India in 1982, in collaboration with voluntary organisations and leading environmentalists. It has this to say about the loss of agricultural productivity because of soil degradation: "As many as 175 million hectares (constituting 53 per cent of India's total land area) are subject to serious environmental degradation ... The formation of 1 cm of soil *in situ* can take about 500 to 1,000 years ... It is extremely difficult to calculate the total national soil loss as a result of erosion, but certain estimates put it at around 6,000 million tonnes in 1972, which, in terms of the major nutrients—nitrogen, phosphorous and potassium—alone represented an annual loss of 5.37 million tonnes, priced at Rs 700 crore in the year.

The corresponding loss today must be of a much higher order, with fertiliser prices much higher and a greater extent and intensity of erosion. Considering that in 1980, India's fertiliser consumption amounted to 5.5 million tonnes, this means that the country is losing as large a quantity of inorganic fertilisers every year as it is putting in artificially." This distressing phenomenon is by no means confined to India: Dr M.K. Tolba, head of UNEP, estimates that the world loses 25 million tonnes of precious topsoil every year. Environmentalists point out, only half jocularly, that Nepal's main export—of which India is an unintended beneficiary—is soil!

The other cause of low productivity is the sheer waste of water. It has become a familiar pattern, year after year, to witness massive floods during the monsoon, followed by drought in summer or when the rains fail. These are not, as is so often imagined, natural visitations alone, over which man has no command. On the contrary, it is the relentless deforestation of hillsides and the failure to protect land on the plains that have accentuated the problem. It is because floods are not seen as "acts of men" that their staggering cost—in physical and financial terms—is seldom realised. According to the National Commission on Floods, the country suffers a damage of over Rs 1,000 crore every year on this account and the figure is rising steadily. What is more, the total area subject to flooding has doubled from 20 million hectares in 1971 to 40 million hectares in 1981. Big irrigation works, which are also meant to arrest floods, on the other hand, have not proved half as beneficial as they were supposed to be. Even such a world-renowned agricultural scientist as Dr M.S. Swaminathan admits that "irrigation has not been an unmixed blessing." Dr D.R. Bhumbla of the Society for Promotion of Wastelands Development cites how the country spent Rs 6,000 crore between 1950 and 1980 on irrigating a net area of 5 million hectares; this amounts to an expenditure of Rs 12,000 per hectare at today's prices. "What have we got in return?" asks Bhumbla pointedly. In several areas—particularly with canal irrigation in Punjab and Haryana—the soil has got water-logged and become saline. Farmers in Hoshangabad district of Madhya Pradesh have launched a unique "mitti bachao" (save the soil) movement in areas serviced by the Tawa dam; it is one of the few grassroots environmental movements in the country. According to Vohra, almost half the world's irrigated land is affected by these twin problems. "Ground irrigation is far more economical than canal irrigation,"

he believes, "because it does not call for any expenditure on storage and transport. It does not involve loss through submergence of large areas of valuable land under reservoirs or the disturbance of ecological balance as is caused by big irrigation projects." The untapped groundwater potential in the country today is estimated to be capable of irrigating another 20 million hectares.

The proper use of land and water resources is as major an economic problem facing the country as an environmental one. Indeed, if one takes the people living in the shadow of the Himalayas by the turn of the century—in Pakistan, Nepal and Bangladesh, in addition to India—a colossal 1,000 million people will be affected by the incapacity of this fragile ecosystem to provide water and arrest the erosion of soil. This makes it, in terms of sheer numbers, probably the world's single biggest ecological crisis, calling for a massive afforestation and soil conservation campaign on a war footing. But the destruction of life support systems along the Himalayas is being repeated, albeit on a smaller scale, not only along the western and eastern ghats, but in many other parts of the country as well. Indeed, this "eco-catastrophe" is an inexorable process, as the CSE document makes it clear. What is more, a detailed study of the damage likely to be caused to any ecosystem like Silent Valley will help to throw light on the gargantuan problems of the Himalayas.

Granting that it is more profitable to view environmental problems as an on-going process rather than a one-shot experience, it is my conviction that many of the undercurrents in the "ecology or economics" dilemma can be gleaned through the case studies of specific large projects. These have an advantage because the damage they can do is limited in scope and area and they thus lend themselves to documentation and analysis. By contrast, the problem of the Himalayas is far too diffuse, varied and complex to be easily studied as a test case. In the context of this debate, three projects in the country have stood out as milestones in the shaping of public opinion, as well as the formulation of official policy. The first of these, and easily the most interesting, is the Silent Valley hydroelectric project in Kerala, which is the only scheme out of the three in this book which has been halted on environmental grounds. The second is the threat to the Taj Mahal from the Mathura oil refinery and the last, the Thal-Vaishet fertiliser plant near Bombay. All three were sponsored by state-owned or public sector organisations and the latter two, in particular, envisaged the investment not



only of huge sums of money directly but also indirectly in associated industries. At first glance, it is inconceivable that these projects should have proved the source of such bitter controversy between environmentalists on the one side and the state-owned enterprises and governments on the other. In a country like India, the provision of electric power from Silent Valley, petroleum products from the Mathura refinery and fertiliser from the Thal-Vaishet factory would be seen as crucial inputs for both agricultural and industrial development, inputs which a developing country could ill afford to do without. Interestingly, in all three cases, the engineers and planners responsible for the projects had not the slightest inkling initially of their possible environmental consequences. What is more, local people clamoured for these "temples of today" in the fond hope that they would bring much-needed "progress" to their backward rural areas. Whether it was Malabar (the poorest region in Kerala), western UP or the Konkan coast just south of Bombay, people assumed that their misfortunes were compounded by the absence of any big industry in the area — a lack that the launching of a major scheme would immediately set right.

The shortage of power is said to be one of the most important reasons why the industrial progress of the country has been held back. Kerala is one of the fortunate states in that till recently, it could not consume all the power it produced and was in fact exporting it to its neighbours. Even from the strictly narrow viewpoint of "pollution", hydroelectric power generation—unlike thermal and, of course, nuclear—is clean and uses a renewable natural resource. The Silent Valley project, which would have dammed the Kunthi river in Palghat district, was seen as a perfect site from the engineering and hydrological point of view. The power produced, it was argued, could have helped to start industries and create employment in north Kerala. It is difficult in the country as a whole and particularly in the highly politicised state of Kerala to convince anyone that a dam, by creating a reservoir and in the process flooding a forest tract, may be causing ecological damage. A pamphlet<sup>12</sup> brought out by the Kerala State Electricity Board (KSEB), which was to keen on going ahead with the Silent Valley, quoted the sentiments expressed at a meeting of the International Commission on Large Dams: "A dam is one of the most impressive works of man and its influence on nature, one of the mightiest."

Similarly, the oil refinery in the north-west of India was seen as

the answer to the crucial problem of providing petroleum products—fuel and fertiliser—for the new farm strategy based on high-yielding varieties. In this sense, both the Mathura refinery and Thal-Vaishet plant were bound by a similar objective: both were to use oil and gas respectively from the Bombay High off-shore field and the output of both would go to the same northern states. The petroleum industry commands a major share of the nation's investment funds today. In the decade till 1990, the Oil and Natural Gas Commission (ONGC) will be spending Rs 30,000 crore—mostly on off-shore drilling. The Mathura refinery, which began functioning in April 1983, cost Rs 250 crore; the Thal-Vaishet plant, ready by November 1984, cost Rs 918 crore; around it will come a petrochemical complex worth Rs 1,167 crore. Thal-Vaishet, in fact, consists of two giant ammonia plants based on Bombay High associated gas and is the biggest producer of urea in the world from a single site. Another eight such plants will be built in Gujarat, Madhya Pradesh, Rajasthan and UP, at a current cost of around Rs 7,000 crore. The pipeline to carry the gas from Bombay High to Jagdishpur in UP will add up to Rs 1,700 crore alone. These are colossal investments even by international standards and it is regrettable that no thought was given, at the time when these projects were planned, to their likely environmental consequences. The possibility that fumes from the refinery could damage the world-famous facade of the Taj Mahal was totally ignored, even though the monument was not just the country's biggest tourist attraction but also stood as a symbol of its ancient culture. Similarly, despite the havoc caused by Rashtriya Chemicals and Fertilisers Ltd (RCF) at its plant in Chembur, a highly populated suburb of Bombay, it decided to locate its massive new factory very close to the metropolis.

The immediate objection raised by environmentalists to these three projects was their specific location. Silent Valley was one of the last vestiges in the western ghats of tropical rain forest which was in a very good state of preservation and thus represented a veritable Pandora's box for scientists. The flawless beauty of the Taj was threatened, as were other monuments in Agra and Fatehpur Sikri; these were sites which were revered throughout the globe. As Edward Lear wrote in his *Indian Journal* of 1874: "Henceforth, let the inhabitants of the world be divided into two classes—them as has seen the Taj Mahal; and them as hasn't." On a somewhat more

mundane level, the choice of Thal-Vaishet was opposed, firstly, because it was too close to Bombay and later, because it would add to the concentration of industry around the metropolis. While the dilemma in the case of Silent Valley was especially acute, because it was a question of either producing power from the site or not at all, alternate locations would have largely met the environmentalists' objections in the other two cases. Even so, alternative methods were suggested of producing an identical amount of power that Silent Valley would have generated.

A detailed documentation of what occurred in each of these controversies—from the very first feasibility reports and economic justification to the initial rumblings of protest and the denouement—helps in understanding how the apparently conflicting demands of environment and development are resolved or not within a certain socio-political context. This is specially true of the Silent Valley project, which was resisted by the Central government despite the fact that every political party in Kerala was anxious to get the green signal for it. I have tried to assess the relative weight of the protagonists and antagonists in each case; they include politicians and bureaucrats at both the state level and at the Centre. Since the execution of such large industrial projects calls for decisions regarding technology as well, these case studies reveal the predilections of planners who tend to assume that big is better in terms of economies of scale or keeping up with the most technologically advanced nations.<sup>13</sup> One can also gain an insight into the functioning of scientists who were called upon to provide an "expert" view to settle an environmental conflict; this was specially true in the Taj case. There are references to the intervention of foreign agencies as well. Such an approach to environmental controversies may be criticised as "liberal" or "pluralist" because it does not take into account the opposing material or class interests. It seems to me, however, that such questions do not directly arise in these three cases for the simple reason that they did not provoke opposition from the people affected (with the partial exception of Thal-Vaishet, where the plant was opposed initially by farmers and fishermen). Ranged on the side of the "opposition" in this book were middle class, urban activists, often aided and abetted by sympathetic administrators and MPs or MLAs. Even the Kerala Sastra Sahitya Parishat (KSSP), a committed group which fought the Silent Valley project, consists of school and college teachers,

scientists and other middle class employees. At no stage was there any popular resistance to the hydel scheme. In fact, local people in all three cases were often ranged on the other side and lobbied for projects under the erroneous assumption that their prospects would improve as a consequence of a big scheme being located in their area.

I have been accused of "elitism" in my choice of these three major controversies since they only concerned the urban intelligentsia and the state machinery, not the people. Apart from the KSSP in Kerala in the Silent Valley conflict were groups like Friends of the Trees, which till then had relegated itself to a "save-a-tree-in-distress" approach. Another was the Bombay Natural History Society (BNHS), presided over by the towering figure of Dr Salim Ali, the internationally acclaimed ornithologist, which concerns itself with studies of the nation's flora and fauna. The World Wildlife Fund (WWF), with an office in Bombay, and the IUCN in Switzerland, till recently were preoccupied solely with campaigns to save endangered species like the tiger and Chinese panda; their active role in drafting the World Conservation Strategy indicates that they are broadening their horizons. In the Taj case, the credentials of the environmentalists—apart from the academics—were even more "respectable". The Indian Heritage Society, in particular, was run largely by owners and senior managers of leading travel agencies, whose vision of the "environment" was then largely restricted to threats to the facades of important tourist sites. While everyone is agreed on the need to save archaeological monuments, the holistic vision enjoined by ecology necessarily extends far beyond such concerns. In the instance of Thal, the Save Bombay Committee had among their activists those who believed that it was their task to "beautify" the environment and would not hesitate to support the eviction of slum and pavement dwellers from Bombay on this ground. The active involvement of leading industrialists like Dr S.P. Godrej in the Friends of Trees and WWF in Bombay betrays their essentially conservative nature and underlines the gulf between a narrow concept of "conservation" and environment.\* Not for a moment, for instance, would these industrialists ever suspect

\*In the case specifically of the Godrejs, who figure prominently in the Thal case, it has often been pointed out that their family-owned firm owns sufficient vacant land in Vikhroli, a distant Bombay suburb, to house practically all of the city's 4 million odd slum population!

that it is at least partly their policies which are responsible for creating urban agglomerations and depriving the countryside of investment. My reply to the charge regarding the choice of these three projects is that their very *conception*, if anything, was elitist, which only bolsters my thesis that "temples of today" do little good for the majority of the poor. As Susan George, author of *How The Other Half Dies*,<sup>14</sup> observed in another context, "If you want to help the poor, study the rich!"

### Government's response

Environment is a far more dynamic concept than may have been perceived by many of antagonists of these three projects. It is also interesting to see the response of the state to the opposition of environmentalists in these three instances. The late Prime Minister, Mrs Gandhi, had always prided herself on the fact that she had a great deal of concern for the environment. She had enormous respect and affection for Salim Ali, who was able to use this to good advantage—he was involved in all the three cases, though most often only as a signatory of letters drafted by environmentalists. Mrs Gandhi had been responsible for setting up a separate Department of Environment (DoE) in 1980; till then, it functioned as the National Committee on Environmental Planning and Co-ordination (NCEPC, later abbreviated to NCEP) under the Department of Science and Technology (DST). The NCEPC was summoned to provide expert opinion in Silent Valley and Thal-Vaishet, while the DoE has set up a high power committee for pollution control in the Agra-Mathura region to protect the Taj Mahal. However, the functioning of the DoE has been somewhat erratic; despite good intentions, it simply does not have the men and material resources to keep an eye on the many facets of the deteriorating environment in the country. What is worse, by disbanding the NCEP in 1983 — ostensibly because it was duplicating the work of the DoE but also because of inter-departmental rivalry—the government has deprived the country of the only agency where the services of outside experts could more easily be sought in an environmental dispute. Furthermore, the NCEP enjoyed a little more autonomy than a full-fledged government department like the DoE to initiate an inquiry and recommend a course of action. At any rate, the heat and dust raised over these three major controversies has generated a good deal of awareness in official circles of the need to take

environmental safeguards whenever a large project is being planned. For instance, harried by the objections raised by environmentalists against the ONGC's projects in Nhava Sheva and Uran, on the mainland across Bombay's harbour, the Petroleum Ministry has even set up an advisory environmental committee which includes activists from leading city organisations—to avoid future acrimony. Thus, by and large, the Centre has been extremely responsive to the arguments of respectable environmentalists—somewhat of a paradox, since they can get a hearing at the highest levels even more easily than in a country like the US, with the most formidable environmental lobby groups in the world. Possibly this is because one section of the intelligentsia, embroiled in environmental campaigns, can get a sympathetic hearing from another in the government in what is often seen as a “non-political” issue.

There are other cases in the country where the people have launched spontaneous movements against various threats to their environments. The best known of these is the Chipko movement in the Garhwal region of UP. It originated in Chamoli district in 1973, when women from hill villages began to hug trees rather than allow timber contractors to fell them. The novel protest caught the imagination of the local people and today, it has considerably widened its appeal. The happy blend of environment and development is well illustrated by the approach of Chipko leader Chandi Prasad Bhatt, who sees the solution not just in terms of stopping the axing of trees but the larger dilemma of the impoverishment of the entire hill region, which forces men to migrate to towns in the plains to seek employment. Bhatt, therefore, advocates selective felling of trees along with a massive afforestation programme in which the entire community is involved; interestingly, the saplings grown by Chipko activists have the highest survival rate in the country. The timber thus obtained would be used to set up forest-based industries *locally*, thereby providing a permanent source of employment. In such a situation, it is somewhat ostrich-like to call for a total halt to any logging.

Similarly, adivasis all over India have been agitating against the planting of commercially valuable trees like teak in place of traditional species like *sal*. In areas like Singbhum in Bihar, they have even cut down teak trees planted by state-run enterprises; violent incidents there culminated in the “Gua massacre” in 1980 in which 13 tribals and three policemen were killed. In Bastar, the country's

largest adivasi belt, a World Bank-sponsored project to plant tropical pine by cutting down *sal* has fortunately been scrapped. "Popular" movements have been sparked off, and continue to be, because of the dire threat of the loss of livelihood: forests sustain a large number of hill dwellers and tribals. The divergence of interests is clear here: there is an insatiable demand for timber from the pulp, paper and related wood-based industries, which is a major reason for the denuding of forests. Hence forest departments plant fast-growing species like eucalyptus, which has a much bigger yield than traditional species. But this not only has undesirable ecological consequences but deprives forest dwellers of food, fuel and fibre. A pragmatic compromise would be to plant commercial species in hill or forest tracts which are already bare; the "management" problems this is seen as posing could be solved by enlisting the co-operation of local communities in planting and protecting trees. Their own needs, as opposed to those of industry, should be met by social forestry schemes in the true sense of the term. Today, such schemes are a thinly disguised excuse for providing yet more commercial timber; even the Swedish match multinational WIMCO sponsors them!

Yet another instance of the victims of ecological ruin rising in protest is in traditional fishing all along the coasts of the country. In Goa, for instance, the *ramponkars*, who manually haul in their nets from the shore, have been badly hit by mechanised craft which disturb the shallow breeding grounds for shrimp by trawling in coastal waters instead of going deep into the sea. The demand, mainly for export, for shrimp has led to this situation; while the profits of the trawler owners and exporters are rising, catches are dropping and local people are finding that they can no longer afford quality fish. Fishermen in Kerala have also been the sufferers along the Chaliyar river near Calicut, into which the Birla-owned Gwalior Rayon has been emptying its effluent. Local residents, led by the KSSP, have succeeded in forcing the management to close the factory on a couple of occasions till proper anti-pollution measures were taken. Farmers and fishermen have similarly agitated against another Birla concern, Zuari Agro Chemicals Ltd, which was contaminating a coastal area in Goa. The dilemma, when owners of large private factories are concerned, is that they often threaten to shut shop for good if harassed for environmental reasons and this can effectively stifle the slightest whimper of opposition in regions

which do not have big industries. Awareness of the damage that factories can cause is growing rapidly: the People's Union of Civil Liberties has published a pamphlet<sup>15</sup> detailing the health hazards faced by workers in the Gwalior Rayon company in Nagda, MP. Till recently, industries in the private and public sector have been treating the environment as a bottomless pit for their effluents. It is revealing to contrast the government's attitude towards these people's environmental movements as distinct from the more respectable urban ones. Mrs Gandhi once told an interviewer that she was "not sure" what the aims of the Chipko movement were — this was in 1980, a full seven years after the movement had been launched and received national and worldwide acclaim! Similarly, the adivasi agitations against commercial plantations are treated as law and order issues, rather than life-and-death crises.

In all such blatant cases of environmental degradation, it is clear who stands to gain by "development". The situation is somewhat more complex, however, in the three cases in this book. If anything, local people welcomed the launching of these projects and the environmentalists were often seen as the villains with vested interests—specially in Thal-Vaishet—who were obstructing the path to progress. Indeed, those in charge of executing the projects had not the slightest doubt that what they were doing was rational and scientific, as against the sentimental and impractical views of the environmentalists. Power engineers in Kerala, for example, believed that Silent Valley was a perfect site for a dam and the failure to tap natural resources there would be nothing short of a criminal waste. The experience of these three cases, however, shows that the conventional wisdom regarding huge development schemes, on which vast sums of money (much of it in foreign exchange, willingly provided by international lenders) are so easily spent, is flawed because short-term gains alone seem to be the most important criterion. Enlightened environmentalists, on the other hand, argue not for conservation of resources for its own sake but to distinguish between resource "capital" in the form of fixed assets (fossil fuels being a classic example) and "income" in the shape of renewable resources. No entrepreneur worth his salt would like to dip thoughtlessly into his capital for a functioning enterprise and yet this is precisely what is happening time after time. The potential genetic value of an undisturbed rain forest, given the fact that there are such an infinitesimal number of those patches left in the



country, is precisely this kind of asset which will have tremendous value in the long term. It would be wiser to treat some forests as a natural resource which can yield wood and water on a renewable, sustainable basis, rather than an asset which can be permanently destroyed to produce power. Any form of human intervention that adversely affects the generation of such resources on a long-term basis can hardly be said to constitute development. The problem is how to marry resource *use* planning (economics) to resource *management* (ecology). Development can then be seen as the creation of a livable environment.

Since the three cases in this book deal with energy and fertiliser, crucial factors in development, one can view the controversies not just as one-time case studies but as part on the ongoing debate on environment. It is by looking at the specific factors in such cases that we can throw light on the general problem of whether to extract the most we can from natural systems in the shortest possible time or to nurture them carefully for sustained use. The kind of choices that had to be made in the three projects—broadly, between immediate returns and adverse consequences in the long run—are the same that confront planners in the country regularly. Both the Mathura refinery and Thal-Vaishet are intimately connected with the Green Revolution, which represents an attempt to raise the productivity of land by applying extra inputs—energy (diesel, fuel oil and electricity), fertiliser, irrigation and pesticides. The rationale for this agricultural strategy is quite clear: an average Indian consumes less than 200 kg of foodgrains per year versus about one tonne in the US. The solution was to produce much more, in other words, by making farming more capital-intensive. What the “Green Revolutionaries” forgot, however, is that the soil’s fertility begins to fall after intensive application of chemical fertiliser. Thus, worldwide, it was found that during the ’fifties, an additional tonne of fertiliser produced 11.5 tonnes of grain; by the ’sixties, the figure had dropped to 8.3 and in the ’seventies, to just 5.8—about half the productivity two decades ago. There are also economic and social consequences of creating pockets with highly advanced agriculture in a country where more than half the holdings are less than one hectare. It cannot be anybody’s case, as Dr H.K. Jain, Director of the Indian Agricultural Research Institute, told the first National Environment Congress in Delhi in 1982, that the country should go back to traditional systems of agriculture.

Instead, he said, "the answer to the degradation of the environment lies not in less science but in *more* science." He points to the danger of the narrowing genetic base of crop plants: out of a potential 30,000 varieties of rice in India, for example, the country may be dependent on just 300 in the next decade. To combat pests and disease, scientists will have to identify and propagate different plant species to suit environmentally diverse regions in the country. Similarly, the problem of soil toxicity induced by fertiliser can be tackled by using more organic manures and farm wastes. It is estimated that rain water adds 40 million tonnes of nitrogen to the soil worldwide every year; biologically fixed nitrogen contributes as much as 175 million tonnes, while industrially produced nitrogen totals just 60 million tonnes. With orders of this magnitude, as Jain stresses, it should not be beyond the ingenuity of researchers to replace to a greater extent chemical fertilisers by organic nutrients, which have a beneficial environmental impact. Similarly, experts can work out far better ways of raising crop yields with more scientific irrigation and use of biological predators instead of pesticides. These are only the immediate alternatives to the Green Revolution technology, which is now taken as an article of faith in the nation's development plans. Instead of quick returns, these alternatives would guarantee a slow but steady increase in output. More science, advocated by diehard "modernists" like Jain, however, would seek to mitigate some of the undesirable consequences of the new agriculture, while the alternative strategy, stressed by many environmentalists, would look to improving some of the positive aspects of traditional agriculture like inter-cropping and the planting of legumes to fix nitrogen in the soil.

The ultimate question that this book raises is not just whether these projects could have been planned in a manner in which there would have been the least environmental disturbance but whether the same massive outlays could have been spent in more beneficial ways. If one examines the short and long term impact of the projects, one eventually ends by questioning who gains by this pattern of industrial growth. This may sound extremely heretical in a country which is so devotedly wedded to Nehru's vision of a modern, industrial India. But as the evidence accumulates of the widening gulf between the two halves in the country—as the government itself puts it euphemistically, those above and below the poverty line—it is necessary to raise some awkward questions

about the continuing emphasis on big development projects. As a journalist, I do not pretend to possess the answers to these admittedly complex questions; by the same token, however, I do not believe that this is sufficient reason not to raise these issues. Is a higher per capita consumption of electricity necessarily an index of the country's prosperity? Is the reliance on fossil fuels as the major input in agriculture wise? Are there alternative technologies which would provide energy to rural areas on a sustained basis? These questions are relevant because in the final analysis, the well-being of the country lies in raising living standards in rural areas, not in the cities and towns where only one-fifth of the total population lives. This would also prove the only long term salvation for Indian industry, which now cannot grow steadily because such a few consumers in the countryside can afford its products; as the economists term it, "the market is limited."

I can hardly do better than end this introduction by quoting extensively from "A Statement of Shared Concern" which we, the contributors to the CSE State of India's Environment report, jointly signed in 1982: "With efforts to conserve the country's ecological bank still minimal, India is rapidly becoming a vast wasteland. Indians cannot now close their eyes to continuing degradation of their natural environment. It is false to argue that environmental conservation acts as a brake on economic development. On the contrary, the experience gained in the last three decades has convincingly shown that there can be no rational and equitable economic development without environmental conservation. Environmental degradation invariably results in increased economic inequalities in which the poor suffer the most. Environmental degradation and social injustice are two sides of the same coin. The human condition and the state of the environment are closely related to each other . . .

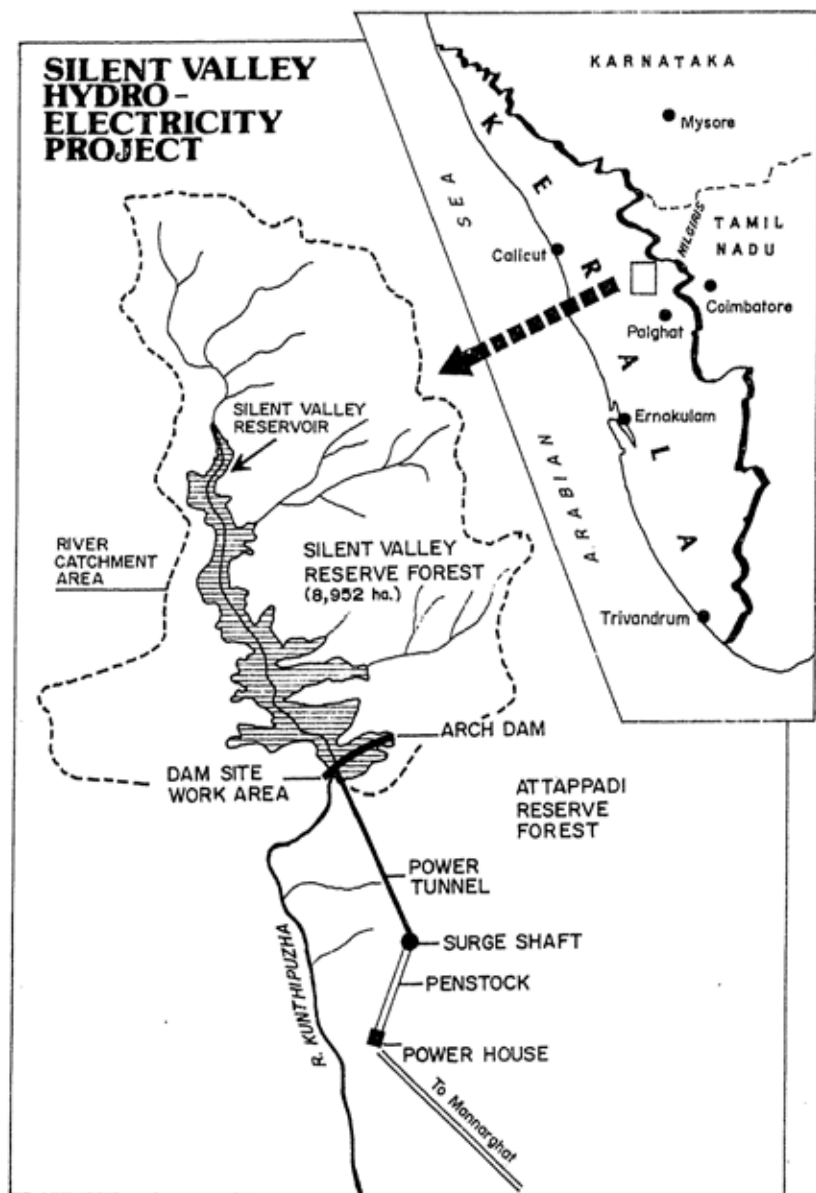
"In a country like India, with a high population density and high level of poverty, virtually every ecological niche is occupied by some occupational or cultural human group for its sustenance. Each time an ecological niche is degraded or its resources appropriated by the more powerful in society, the deprived, weaker sections become further impoverished . . . Current development can, in fact, be described as the process by which the rich and more powerful reallocate the nation's natural resources in their favour and modern technology is the tool that subserves this process . . .

"But science and technology cannot be allowed to impose their own value system on society. On the contrary, the use of science and technology has to be governed by a human, socially appropriate, value system . . . We never ask the question: developing towards what? It is a reflection of our prevalent culture that development has come to mean a mere increase in consumption and production of material goods and services. Development is not a product that can be obtained with economic growth. On the contrary, it is a process which enables all levels of society—individual, community and nation—to become more self-reliant and more independent in choosing and deciding their own future . . ."

As a post-script, it is only necessary to point out that India can be said to be one of the first countries to recognise the need to protect the environment. As many as 22 centuries ago, Emperor Ashoka ordered the establishment of what were probably the first *abhayranyas* or wildlife sanctuaries. Carvings on stone pillars from this era depict how wild animals were treated with medicine. Indeed, the reverence for all things natural is a familiar sentiment in the country's ancient culture. In the 18th century, 360 men and women from the Bishnoi community in Rajasthan were hacked to death because they clasped the trees that the Maharaja of Marwar wanted felled; the trees were required as fuel for a brick kiln to make slabs for his palace. This was the precursor of the Chipko movement. The preservation of sacred groves till today, which often stand out as the only patch of green in an enveloping brown landscape, is an eloquent reminder of the protection afforded to nature. It now seems that this age-old tradition is fast giving way to more crass forms of worship at the altars of "the temples of today".



# SILENT VALLEY HYDRO- ELECTRICITY PROJECT



“I saw this massive rat snake in a patch of eucalyptus on the road to Silent Valley,” recalls Romulus Whitaker, the youthful director of the Madras Snake Park. “In the hills, these snakes are jet black, though absolutely non-poisonous and harmless. I grabbed it by the tail and just then I heard something else crawling close by. It was another, also a big male, over eight feet long. I reached and caught hold of it too.

“Here I was, really wrapped up, when one whipped around and bit me on the cheek and lips! It felt like it was pulling my face off: I couldn’t even let the other one go. I shoved my thumb into its fangs and yanked it off. I was really freaked out, zapped in the face, dripping with blood; Chris Pruett, a British entomologist who had come with me, came to my rescue. He even took pictures of me!”

Whitaker, an American who has now taken Indian citizenship and runs the highly successful snake park in Guindy, Madras, had been visiting Silent Valley since 1969. “I would go up once or twice a year. In those days, the road was barely jeepable. I searched for intact forest and looked for reptiles and amphibia. Wherever there were elephants, usually was a good sign of well-preserved forest,” he told me as we sat in his snake park office, surrounded by slumbering reptiles.

“My first impressions of Silent Valley were marvelling at the sheer size of the trees. The Brits who had done logging in the area years ago had already cut the biggest trees, naturally. And yet everything was so big: trees, snakes, hornbills—bigger than an albatross. I remember seeing, on one of the early trips, the freshly-shedded skin of a 15-foot-long king cobra; there are very few places in the world where such dangerous creatures are still allowed to exist.”

Within ten years from then, Silent Valley had changed a great deal. Dr Sathis Chandran Nair, a Trivandrum zoologist who has

spent a total of some three months in the forests of this part of Kerala, more than any other researcher, corresponded with Prof M.K. Prasad, a fellow environmentalist, in January 1979: "I am writing to you from Silent Valley. We are camping at the dam site. We will be here for a week and then shift camp to the interior . . . I am attempting to cover as extensively as possible the whole of the reserve forest . . . Around the (proposed!) dam site the vegetation is extensively altered . . . The amount of destruction already done is staggering. The animals indicate by their speed of flight how harassed they are . . . There is a lot of sleeper extraction going on even deeper than the dam site. There is evidence of elephant poaching and I saw parts of a skull yesterday. Occasionally, gunshots can be heard . . ."

Yet another early visitor to Silent Valley was the chief geologist of SNC, the Canadian dam construction company, named, ironically, Rock Poulin. "It was around 1969. One of the superintending engineers of the Kerala State Electricity Board (KSEB) told me: 'Rock, let's go and have a look at the place—it's like Idukki!\*' I'll be the first to admit that it's a beautiful site for a picnic; I've been there more than four times. Once I walked a long way down the river with my wife: it's one of the nicest spots in the world. I've worked in a lot of countries, building dams—Tunisia, Morocco, Algeria. There's sand as far as the eye can see there, people living in tents, no vegetation."

Many people—environmentalists and engineers alike—believe that Silent Valley was the provocation for the fiercest ecological controversy ever in India simply because its evocative name caught the attention of everybody. A hitherto unknown and unfrequented forest plateau about 1,100 metres high in the Palghat district of Kerala, it is believed to have been so christened because of the relative absence of cicadas. A more plausible explanation, however, is that the name is a corruption of "Sairandhri", which can be traced to the Mahabharata. As Ayesha Kagal wrote in *New Delhi* magazine in November 1979: "Deprived of their kingdom, local legend goes, the Pandavas set out on their 13-year exile. They wandered south, into what is now Kerala, deeper and deeper into its forests, until one day they came upon a magical valley where rolling

\*SNC had helped build Kerala's biggest hydroelectric power station at Idukki, also in a forested area of the western ghats.

grassland dipped into wooded ravines ... Beside that river, in a cave on the hill slope, the Pandavas halted. Every morning they would rise with the sun and bathe at the river. And to that river they gave their mother's name—Kunthipuzha (*puzha*—river in Malayalam). Draupadi, their common wife, also known as Sairandhri, was with her husbands. Once in the not so distant past, a nameless Englishman ventured into the area. He discovered an uninhabited, barely penetrable forest, where after nightfall, there was silence—unlike other forests, the cicada's comforting call could not be heard after dusk. Thus Sairandhri, the unpronounceable, was rechristened as Silent Valley."<sup>1</sup> In 1887, the Governor of Malabar, William Logan, described it in his *Manual of Malabar* as "an enormous tract of mountainous forest and grassland" where "the timber is not worked on account of the inaccessible nature of the locality."

The geography of Silent Valley was most graphically described to me by Dr B.K. Nayar, head of the Botany department of Calicut university, who is regarded as something of a heretic by fellow botanists for heading a Kerala government team that made out an elaborate case for the hydroelectric scheme in the area. Outstretching three pudgy fingers, palm downward, he likened it to the valley between two high ridges, running parallel to another similar valley beside it. Through the first of these valleys runs the Kunthi river, from north to south; it is flanked to its south and west by steep escarpments descending a thousand metres to the plains of Kerala, and to the north and east by sheer walls rising another thousand metres to the upper plateau of the Nilgiris. Ooty is only a two-day trek away. Down the second of the valleys flows the Bhavani, which runs through Kerala to return eastwards to its neighbouring home state of Tamil Nadu.

The nearest city is Calicut, on the north Kerala coast. About 100 km to its east, at the foot of the mountains, lies Mannarghat. A steep climb on a ghat road takes you to musical-sounding Mukkali, from where the only access to Silent Valley is a *kuchcha* forest department jeep track, strewn with boulders, fallen trees and, if you are lucky, the odd wild elephant. Silent Valley occupies an area of only 8,950 hectares, but is surrounded by the Nilgiri and Nilambur forests to the north and by the Attappadi forests to the east; together they comprise 40,000 hectares of pristine forest. The Kunthipuzha originates at a height of almost 2,400 metres on the



outer run of the Nilgiris, descends rapidly to 1,150 metres on the northern edge of the plateau and then pursues a gentle southwardly course for 15 km before cascading down to the Mannarghat plains through a gorge at an elevation of 1,000 metres.

It is this narrow gorge which can be dammed to form a reservoir to generate electricity. Although the British identified Silent Valley as an ideal site for the generation of hydel power as early as in 1929, technical investigations were carried out only in 1958. The project was sanctioned by the Planning Commission in 1973; its cost was estimated at Rs 25 crore and it could produce 120 megawatts (MW) of power. Preliminary works were started in 1973, but due to the shortage of funds, they were discontinued. Significantly, when the KSEB Chairman published a statutory notification regarding the project in June 1973, no one raised a murmur of protest.

The KSEB wanted to resume work on the project in 1976—till then, only large trees in the area which would be submerged by the reservoir, formed by damming the Kunthi had been felled and the road to the dam site improved—when, practically by accident, someone threw a spanner in the works. Nalni Jayal, former joint secretary in the Department of Environment (DoE) in New Delhi and then of the same rank in the Ministry of Agriculture, looking after wildlife and forests, happened to be sent a file, in routine fashion, relating to the clearance of forest for the Silent Valley project. An impassioned conservationist, later in the Planning Commission, he claims the credit for alerting the attention of the Central Government to the possible dangers to the environment of this stretch of the western ghats if the project went through.

A couple of years earlier, Zafar Futehally, who was Vice President of World Wildlife Fund (WWF) in India, had returned from a three-month fellowship in Canada. "I came back very conscious of the role of mountains in relation to climate and so on," Futehally recalled. "I began to become very concerned about the role of the Western ghats—it's one of the most important assets of the western peninsula. I obtained an interview with Mrs Gandhi through Salman Haider in the PM's secretariat and told her about the very serious effects of deforestation in these ghats. She asked me for a memo, which I sent." It was referred to Ashok Khosla, a young Harvard-educated scientist who had joined the National Committee on Environmental Planning and Co-ordination (NCEPC, later abbreviated to NCEP) when it was started by the charismatic first

Chairman, Pitambar Pant. Khosla passed it on with his comments to the Prime Minister, who asked the NCEPC to create a task force to go into the ecological problems of the western ghats. This task force, with Futehally as Chairman and 19 members, was appointed in April 1976 and reported a year later.

### **NCEPC report**

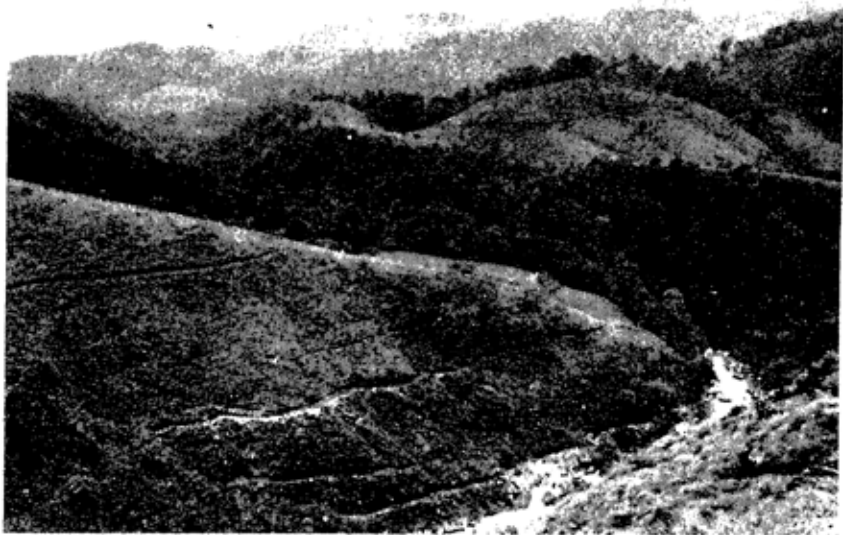
My first encounter with the name "Silent Valley" was when a slim green pamphlet landed on my desk in *The Times of India* in Bombay towards the end of 1977, titled "Report of the Task Force for the Ecological Planning of the Western Ghats."<sup>3</sup> The report referred to what was envisaged in Silent Valley: "construction of an RCC arch dam across the Kunthipuzha river to a height of about 130 metres . . . the power house will be 8 km north of Mannarghat. The river flows through a gorge formed by two hillocks rising approximately 160 to 250 metres above the bed level. The length of the arch dam will be about 400 metres at the top. The dam will store 270 million cubic feet of water in a reservoir spreading over 670 hectares. The catchment area will be 77 square km." By August 1977, the KSEB had revised its project cost from Rs 25 crore to Rs 51 crore, and the dual-purpose scheme was to have been completed by 1984. Futehally's report pointed out, quite rightly, how the project cost would probably have to be revised (from the original Rs 25 crore) and how capital losses like the forest which would be submerged had not been taken into account. It put this at a conservative Rs 1.56 crore. The disturbance to the forest, by humans who would come into construct the dam, was also cited. Concluded the report: "The result will be that the last vestige of natural climax vegetation of the region and one of the last remaining in the country, will be lost to posterity and various adverse ecological consequences listed in the report will follow. The task force feels very strongly that the project should be abandoned and the area declared a Biosphere Reserve. It seems unjustifiable to sacrifice this unique environment for the sake of generating 120 MW of power. Thermal or nuclear energy, the production of which does not devastate natural areas, could be explored as an alternative. We understand that after the Idukki project is completed, Kerala would have a surplus of electrical energy, and it seems therefore that continuing with the Silent Valley project is not a matter of overriding importance. It might be remembered that the

Moyar project, which was estimated to yield 150 MW, was abandoned by the Tamil Nadu government which is in fact short of electricity, when it was pointed out in the NCEPC report that the project would result in the destruction of the finest wildlife area of the Mudumalai and Bandipur sanctuaries.

"The task force would like to emphasise that the tropical rain forest is an environment of a very special category. It is the richest expression of life that has evolved on this planet. In some areas there has been continuous history, on much the same site, for about a million years—since the flowering plants began to evolve . . . new and valuable uses for organisms are constantly being discovered in medicine, pest control and in the breeding of economic plants and animals, and it would be blind and irresponsible to destroy the source of so much potentially valuable material."

Futehally's task force listed 17 "safeguards" in case the Kerala government felt that "the project cannot be abandoned for any reason", which proved its undoing. A second project it dealt with was the Kudremukh iron ore mines near Mangalore in Karnataka state. The mines were already being excavated and the task force once again prescribed various measures to protect the environment from extensive damage. This was to lead, later on, to charges by the KSEB that the task force gave the green signal to Kudremukh even while it said "no" to Silent Valley. What such critics forgot is that energy can be produced in different ways from water, while iron ore has either to be mined or left buried in the earth.

Around 1976, when the KSEB was all set to start work again on Silent Valley, a dedicated band of school and college teachers and scientists, belonging to the (now famous) Kerala Sastra Sahitya Parishat (KSSP) began to get interested in the environmental consequences of the hydel scheme. It had already done signal service to Kerala's highly literate and politically conscious population by launching a "science-for-the-people" movement in 1962, starting (as its name implies) by translating scientific works into Malayalam. "When I first came to teach in Calicut in 1975 I didn't have any idea of what Silent Valley was," recalled Prof M.K. Prasad, probably the man who has singly done more to fight the Silent Valley project than anyone else and President of the KSSP in 1981-82. "One of the first environmental issues that the KSSP was involved in was the proposal to distribute forest land belonging to the Kannan Devan tea estate to landless labourers. The Kerala Chief Minister at the



Panoramic view of Silent Valley, with Kunthi river (Kamal Sahai)



Hydel dam would have extended till hill (below peak), submerging valley

time, Achutha Menon (of the CPI), managed to persuade his cabinet not to permit this.

"I wrote to Achutha Menon in May 1976 about the cruel destruction of forests for hydel projects. 'I do not fully agree with your statement that no more hydel projects are required,' Achutha Menon replied. 'In the next five years, we may require more power and will have to take up more schemes.' He was always a nature lover and when I met him a couple of years later, when he was out of power, he said he was fully aware of both sides to the Silent Valley question; till then he had only the KSEB version."

For two years, the KSSP mulled over the Silent Valley issue. Another veteran KSSP activist, Prof V.K. Damodaran, who teaches at the Regional Engineering College in Calicut, pointed out that it was Prasad who put forward a resolution at the KSSP's Kottayam conference in 1978, calling for a halt to the hydel scheme. The resolution was carried, though many members — including engineers from the KSEB! — had their misgivings and Prasad was appointed convenor of the organisation's environment brigade. In November the previous year, Prasad had been able to accompany Dr Salim Ali to Silent Valley; the famous "birdman of India" first visited it in the 'thirties when he was writing *Birds Of Travancore*. They spent three days in the area as guests of the forest department and Salim Ali was so moved by the splendour of the valley that he exclaimed: "This is among the most magnificent forests I have seen in my life!"

When Zafar Futehally's report was finalised towards the end of 1977 — astonishingly, only four members, excluding the Chairman, visited Silent Valley before submitting it! — the Kerala government got hold of a copy and made its findings public even before the NCEPC could pass its verdict on it. By this time rumblings against the project from members of the KSSP had begun to be heard loudly and Chief Minister A.K. Anthony, his colleagues and members of the opposition wanted to lose no time in pushing the scheme through. In January, 1978, the KSSP organised the first mass signature campaign to stop the dam from being built: nearly 600 academics, students and prominent citizens signed a memorandum to the Chief Minister.\*

\*Interestingly, one of the signatories was none other than Dr B.K. Nayar, who later spearheaded the attack on environmentalists by so-called scientists.

A month later, the Kerala assembly passed a unanimous resolution, calling for the speedy implementation of the project. The only other occasion when state legislators had displayed such rare unanimity was when they had raised their own allowances! Soon after, an all-party delegation of Kerala MLAs went to Delhi and met Prime Minister Morarji Desai, then presiding over the tottering Janata coalition at the Centre. Quick to sense the ageing politician's quirks, the legislators told him (alleges Prasad) that Sanjay Gandhi had been instrumental in withdrawing support to the project during the emergency. Sanjay's four-point programme during those infamous 18 months included tree-planting and it would not have been difficult to persuade the Prime Minister, who had been imprisoned by Sanjay's mother, that the "rising son" had intervened to stop Silent Valley's forests from being cut down. They also informed him that poor farmers in Palghat and Malappuram districts, downstream of the Kunthipuzha, stood to benefit by the multipurpose scheme, since it would irrigate 10,000 hectares. Desai was reportedly swayed by this and later advised the Kerala government that it should enact a special law to govern the area so that the safeguards prescribed by the task force could have legal sanction. If this was done, he would have no objection to the scheme. Rumours did circulate that Desai, known for his pet fads and an ardent advocate of prohibition, attempted to strike a deal with Kerala: in return for okaying the dam, the state would have to enforce prohibition. However there is no basis to such a story since Kerala's liquor revenue was around Rs 70 crore a year — much more than the revenue of Silent Valley!

Thus the safeguards which the Futehally task force had unwittingly prescribed became the escape clause for those who wanted to dam Silent Valley, come what may. The Kerala government readily agreed to the conditions, which mainly concerned restrictions on the number of people the KSEB would bring in to build the dam, felling of the trees in the forest and so on.\* The state government appointed a monitoring committee to ensure that the safeguards were observed: many of the members of the task force were

\*Naively, the report suggested that at Kudremukh the authorities should insist that labourers' families with more than three children would not be employed and "simultaneously, intensive family planning measures should be instituted in the labouring colonies."

asked to join it, including Futehally himself. The NCEPC, which was then headed by Dr B.P. Pal, a well-known plant geneticist, had never endorsed the findings of its task force since the Kerala authorities had jumped the gun before it could deliberate on them. Unofficially, it disowned the report and it reluctantly went along with the constitution of a monitoring committee. An ordinance to protect "the ecological balance in the Silent Valley Protected area" was passed in 1978 and in March the following year, the Kerala assembly passed an act to this effect unanimously. The text of the act was approved by the Planning Commission, in consultation with the Department of Science and Technology in Delhi, then headed by Prof M.G.K. Menon. In May 1979, Morarji Desai in his capacity as ex-officio Chairman of the Planning Commission wrote to the new Chief Minister P.K. Vasudevan Nair (in Kerala they are quick-change artistes: there have been seven since 1977), stating that in view of the fact that the state government had taken the necessary precautions, New Delhi was giving the Silent Valley project the green signal.

Meanwhile, opposition to the project was growing rapidly. One of the unknown figures in the Silent Valley saga is an American primatologist named Steven Green. With his companion, Karen Minkowski, he studied the habits of the lion-tailed macaque — the second most threatened primate in the world — in the thickly-forested Kalakkad hills which are at the southernmost tip of the Western ghats, in Tamil Nadu. Since these monkeys are also found in Silent Valley, and the threat to their continued existence there with the proposed dam quickly became a *cause celebre*, he was indirectly able to help focus international attention on the controversy. This is why the Switzerland-based International Union for Conservation of Nature and Natural Resources (IUCN), which is a private agency like the WWF, was persuaded to pass a resolution, as early as in September 1978, on the preservation of Silent Valley. J.C. Daniel, Curator of the Bombay Natural History Society (BNHS), raised the issue at the 14th session of its general assembly at Ashkhabad in the USSR. The IUCN specifically urged the Indian government "to conserve more effectively the forest areas of the Western ghats, including the undisturbed forests of the Silent Valley of the state of Kerala and the Kalakkad hill forests in the state of Tamil Nadu." The reference to these prime forest areas reveals that it was in a sense the controversial lion-tailed macaque

which was responsible for raising Silent Valley in world forums. Such is the importance of this monkey that an international symposium was devoted solely to it in Baltimore in 1982. Although the IUCN has no official status as such, it is closely associated with other international bodies such as the World Wildlife Fund and has governments among its members. In fact, WWF-India was launched three days after the tenth general assembly of the IUCN in Delhi in 1969. The IUCN resolution brought considerable pressure to bear on the Indian government to proceed cautiously in Silent Valley.

The impact on the highly politicised parties in Kerala was entirely different. When the IUCN, WWF and later, other international agencies, made pronouncements on Silent Valley, this was taken, first of all, as undue interference in the internal affairs of the state and, what is more, a thinly disguised plot by the affluent West to keep it from developing its own resources. Kerala, it must be recalled, was in 1957 the first in the world to elect a communist government through the ballot, not the bullet—albeit at the state level, not nationally—and despite repeated efforts by the Central government and local right wing elements to erode the base of the left, it has a hard core even to this day. About 45 per cent of the population of 26 million live below the poverty line. The Marxist Communist party (CPM) still has the largest following there and is easy to understand the reaction within the state to an attempt to “internationalise” Silent Valley. Kerala has always got a raw deal from the Central government: it has become a cash crop producer of coconut, cashew, spices, tea and coffee, and is thus perpetually dependent on the largesse of New Delhi for its foodgrains; there is no industry worth its name (for a variety of reasons, which will be discussed in the next chapter). With seven out of every ten people literate—twice as many as in the country as a whole—and a history of progressive land and other reforms, a call from a foreign agency to halt a development project in a remote corner of the state on such supposedly flimsy and intangible grounds was bound to be treated with grave suspicion—a fact which Bombay environmentalists who later jumped into the fray hastened to underline to their IUCN and WWF counterparts abroad.

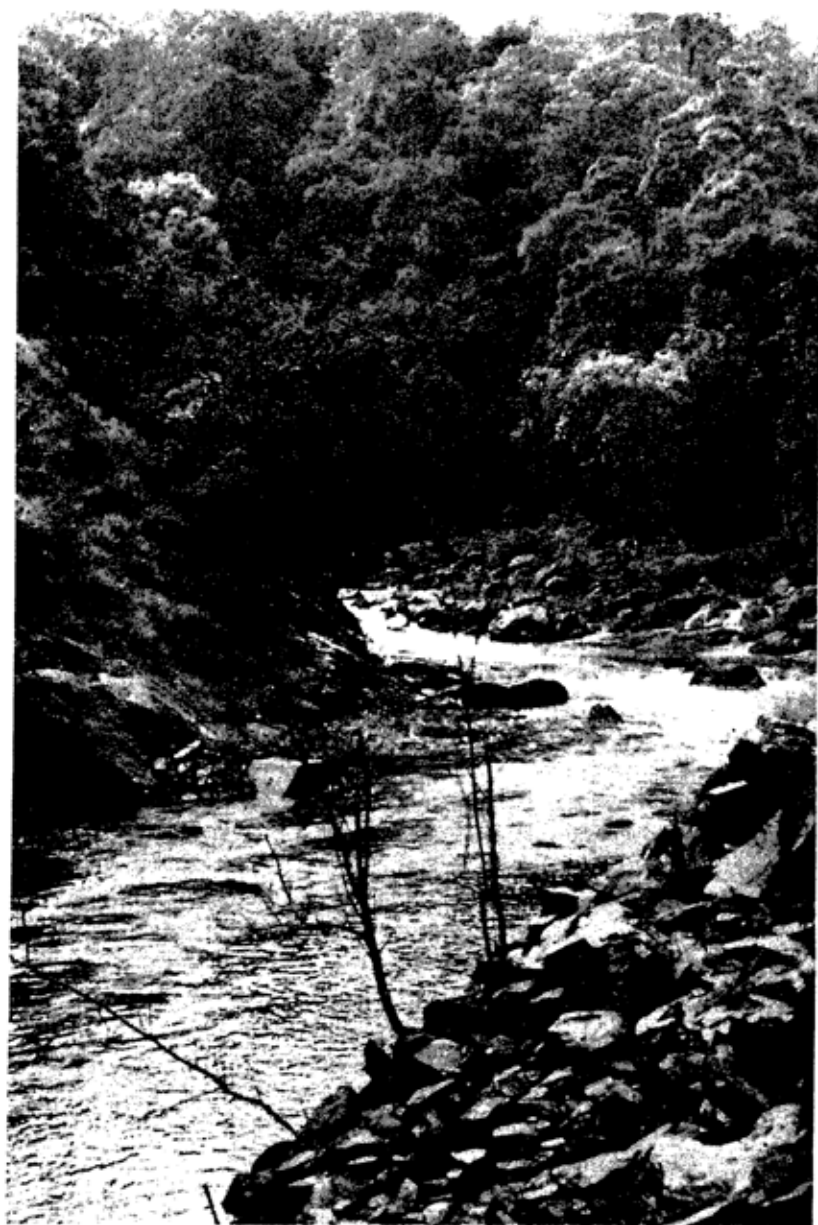
To compound matters, Zafar Futehally, as Vice-President of WWF-India, accepted \$10,000 from the IUCN for his task force as part of the world body's campaign to save rain forests. What is not known to fiery protagonists of the Silent Valley project like K.O.



Habeeb, a CPM activist and head of the KSEB union, E. Balanandan, the party's former spokesman in the Lok Sabha, and K. Vijaychandran, formerly on the state planning board, all three of whom have written pamphlets on Silent Valley printed by the KSEB, is that Futehally actually invited Dr Chew Wee-Lek, an IUCN project officer abroad, to attend the second meeting of the task force in Coimbatore in July 1976, which he dutifully did! Futehally displayed a lack of sagacity in extending such an invitation to a foreign national to attend an official meeting and later even sent the minutes of the first meeting to an American zoologist in the University of Michigan. The IUCN's contribution was to fund aerial photography and satellite imagery of the forests of Silent Valley, which was not in fact carried out. Had the Marxists any inkling of this, it would only have confirmed their worst fears—which they openly aired anyway—that the CIA was conspiring to keep "red" Kerala backward by denying it a project which would provide power for development, which the state desperately lacks.

### KSSP campaign

By the first half of 1979, the KSSP campaign against the Silent Valley dam had reached impressive proportions. Because of its genuine grassroots support—thanks to countless rural science forums, journals like *Sasthragathy* ("Flow of Science"), *jathas* (processions) and a committed membership today of 7,000 teachers, students and progressive-minded citizens, what otherwise would have been an esoteric exercise in debating an ecological dispute became an issue which was discussed on public platforms, reaching a large public audience. Five prominent KSSP members decided that the only way to counter the criticism that they were being exposed to, for opposing the project, was to undertake a thorough technoeconomic and socio-political assessment of the problem.<sup>4</sup> Their document, the cyclostyled draft of which ran into 75 pages, is indeed an object lesson to other environmental groups in the country—especially those in Bombay with access to greater material resources than the modest KSSP could ever hope to enjoy. As the organisation itself pointed out later, this document had four broad conclusions. In the first place, the construction of the dam would ultimately lead to the destruction of Silent Valley which contains "India's substantial stretch of tropical evergreen forest (and) is perhaps the only vestige of a near virgin forest in the whole



Kunthi river, which flows through the valley (Denzil Siqueira/Save Silent Valley Committee, Bombay)

of the Western ghats." (This was quite incorrect: there are better preserved patches in these ghats like Kalakkad, not to mention much larger tracts in north eastern states like Arunachal Pradesh.) Besides, the project was unjustified because 40 per cent of Kerala's power was being 'exported' to the neighbouring states of Tamil Nadu and Karnataka, because of the lack of proper distribution and transmission to power-starved areas of the state, particularly the northern area of Malabar, where Silent Valley is situated. Thirdly, the hydel scheme would contribute (at the time) only 7 per cent of the total power produced in the state which would not, in any case, solve the shortage that north Kerala faced. And finally, the same area which the project sought to irrigate—10,000 hectares—could be serviced at a much lower capital investment by exploiting ground and surface water.

The report was put together by Prasad, Damodaran, M.P. Parameswaran (a former scientist from the Bhabha Atomic Research Centre in Bombay who resigned to work in the CPM's Chintha Publications in Trivandrum, the capital), K.N. Syamasundaran Nair (a planner), and K.P. Kannan (an economist from Dr K.N. Raj's Centre for Development Studies in Trivandrum). As is obvious from the composition of the group, it took a multidisciplinary approach to the problem. P. Govinda Pillai, a respected CPM intellectual and ex-editor of the party's daily *Deshabhimani*, explained: "The KSSP enlivened scientific debate over Silent Valley. Previously, there were a large number of 'science for science's sake' people in it: they believed that the propagation of science in the villages would gradually remove the cobwebs of ignorance and help the progressive movement." But some KSSP members departed radically from the conventional programmes of the organisation and tackled the issue in an altogether novel way. They located the problem, not in terms of the vulgar dilemma of "to dam or not to dam" but in the overall context of the energy needs of the Malabar region specifically and Kerala generally. They cited how eminent Indian scientists, like those attending a seminar on "Floristic Studies in Peninsular India" organised by the Botanical Survey of India (BSI) in Madras in December 1978 and members of the Kerala and Bombay Natural History Societies had appealed to the Kerala government to call off the project (the latter two wanted a thermal plant to be considered as an alternative). The Kerala Forest Research Institute, near Trichur, had recommended that the Silent

Valley-Attappadi area should be declared a biosphere reserve.

Outside Kerala, protests against the project—on which work had begun—were snowballing. In January 1979, Union Finance Minister H.M. Patel, as President of the Indian Wildlife Board, appealed to the Kerala authorities to give it up. In May, 30 MPs headed by the late Piloo Mody, made a similar plea. Another prominent Malayali, the late diplomat K.P.S. Menon, lent his considerable weight to the campaign by writing letters to top leaders in Delhi. Contributing to a series titled "If I were Reborn" in the *Malayala Manorama* daily, he said that given another chance, he would have devoted his life to planting trees. In Bombay, where conservationists were already active in several organisations, Dilnavaz Variava, honorary adviser to the WWF, the industrialist S.P. Godrej, who was Vice President of the Friends of the Trees (FoT), Kisan Mehta from the Save Bombay Committee and others were concerned about the threat to Silent Valley and anxious to do what they could to save it. The first time some of them had heard about the area was an article by Romulus Whitaker in a WWF newsletter as early as in 1974; besides, J.C. Daniel from the BNHS was from Kerala and knew the area. In the summer of 1979, they decided to form an ad hoc "Save Silent Valley Committee". Variava was the most effective lobbyist against the project outside Kerala. She was instrumental in building bridges between Kerala environmentalists and officials who wielded power in the ministries of Delhi—men like Nalini Jayal and Prof M.G.K. Menon, who then was in charge of the Department of Science and Technology (DST), which later gave birth to a separate DoE. She used her considerable acumen in constantly keeping Delhi and Kerala informed about developments: in fact, she was actually responsible for bringing together Kerala's disparate environmentalists who otherwise functioned independently of each other. Joseph John, a founder of FoT, and the principal of the Bharatiya Vidya Bhavan's Journalism college in Bombay, retired to his native town of Kottayam and continued saving trees there. Quite independently of the KSSP, he took up the Silent Valley issue, formed a local protection committee for it and in April 1979, it was he who fired the first legal salvo with the support of Kisan Mehta. Yet another committee was formed in Trivandrum by S. Sharma, from the Indo-Soviet Cultural Society.

In a writ petition filed before the Kerala High Court in Cochin, John sought to quash the Kerala government's decision to proceed

with the project. The petitioner, whose application was in the nature of a writ of mandamus against the state (represented by the Chief Secretary and Secretary of the KSEB), contended that Silent Valley was one of the few remaining rain forests in the world.\* John also cited studies by UNESCO to bolster his argument. The writ was admitted—a shot in the arm for antagonists of the project, who were beginning to despair of ever being able to halt it. The same year, the KSSP had also formed a Society for the Protection of Silent Valley in Calicut; R.K. Remesh, an affable young architect, acted as its Secretary. In August, when the writ came up for hearing, the judge granted a two-week stay on the construction of the dam—a decision that exceeded environmentalists' wildest dreams. He also admitted a similar petition by Remesh.\*\*

The High Court stay galvanised both sides in the dispute; the KSEB, in particular, which had little imagined that legal action would interfere with its work, was really worried. The decision also precipitated stands in Delhi. A meeting of the NCEPC (which, it must be recalled, dissociated itself from the views of Futehally's task force) in September, recorded that it "does not favour the hydel power project, which it feels should be preserved in its natural form". Some NCEPC members felt that it was still worthwhile, before the confrontation got too fierce, to initiate a dialogue with the Kerala government and KSEB regarding alternatives to the project. Early in October, Salim Ali, Kisan Mehta and Variava called on the new Prime Minister, Charan Singh, who headed a caretaker government between the collapse of Morarji Desai's Janata coalition in July 1979 and fresh elections in January 1980. Variava wrote a week later to Prasad: "He was aware of the project and seemed reasonably sympathetic, but indicated that develop-

\*This was wildly wrong, since the Amazon forests in Latin America are bigger than many countries! Tropical forests, which are a broader category than tropical rain forests, in fact, cover half the world's forested area; tropical rain forests, around 600 million hectares, comprise two-thirds of the tropical forests. Brazil alone has a third of the world's tropical forests—an area three times the size of France.

\*\*As is clear from frantic letters written by Variava to groups in Kerala: Dr M.P. Parameswaran in Trivandrum, John in Kottayam, Prasad in Cochin and Remesh in Calicut—geographically, these coastal cities extend from the southernmost tip of the state to its northern extremity—there was plainly little or no co-ordination between KSSP members and the more traditional conservationist "trees for trees' sake" approach of John and others.

ment needs have to be taken into account and promised no more than he would look into the matter." Salim Ali and Variava had detailed discussions with the DST, where Prof M.G.K. Menon emphasised that the environmentalists did not have a sufficiently well-documented case for saving Silent Valley (KSSP members believe that Menon, also from Kerala, was by no means convinced till much later about the "worth" of Silent Valley's forests). In the Power Ministry, a key official told them that it was not authorised to halt a project at its own initiative on ecological considerations.

They met Mrs Indira Gandhi as well, and found that she had already taken action on an earlier letter to her from Salim Ali, requesting her Congress(I) faithful from Kerala, C.M. Stephen, to discourage her party members in the state from pressing for the project. Specifically, Variava was referring to A.K. Abdur Rahiman, a local Mannarghat Congress demagogue who was agitating for the dam because of the jobs that it would bring to the area, at least during the construction. He formed his own society *for the protection of the project*, organised a *bandh* in the town and repeatedly alleged that those against the scheme were in league with rosewood and sandalwood smugglers who were carrying their contraband to Tamil Nadu through Silent Valley, and wanted the area to remain "undeveloped" to carry on their nefarious activities. The advocate K. Sukumaran, who fought the case on behalf of Remesh (he was later made a judge of the High Court himself), revealed how Mrs Gandhi had praised the Silent Valley litigation at the Indian Science Congress in 1980, when she was back in power. "Perhaps it was her enlightened vision—more than anything else—that was responsible for halting Silent Valley," he said. Whatever her other faults of omission and commission, Mrs Gandhi had certainly displayed a greater awareness of environmental problems than other Indian leaders, though I suspect this was often as much because of a shrewd appreciation of her image abroad as genuine commitment. She released the World Conservation Strategy (of the IUCN) in Delhi herself; her exposure to environment issues had always been oriented towards the West. She had for instance, played an active role in promoting Project Tiger, which proved an enormous success. The very fact, as we shall see later in this chapter, that David Munro, the IUCN Director General, felt confident enough to write to her when she returned to power in 1980 to intercede and save Silent Valley speaks for itself. What is more, Mrs

Gandhi's concern was also largely aesthetic—in the Nehru tradition of pride in national heritage. In November 1984, the IUCN conferred the John C. Philips medal, its highest honour, on her posthumously.

The confrontation over Silent Valley was now reaching boiling point. C.K. Kochukoshy, an IAS official who had taken over as Chairman of the KSEB at the end of 1978, soon found his major preoccupation was to ward off allegations about the damage to Silent Valley that the Board would have caused. Yet more scientists entered the fray, one of the most influential groups being the Geological Survey of India (GSI) which organised a multi-disciplinary team to visit the area.<sup>5</sup> The experts included Dr R.S. Pillai, Deputy Director of the Zoological Survey of India (ZSI) in Madras, Sathis Chandran Nair and an anthropologist from the Tribal Research Centre in Calicut, who pointed out how the presence of Cholanaickan tribals in the New Amarambalam forests, just north of Silent Valley, was added evidence that areas were worthy of preservation. Only around 200 of these tribals, survive today; they are still at the food-gathering stage and live nomadically in rock shelters along river banks.\* The Kerala government scoffed at reports that Silent Valley was a "virgin" forest, as described by environmentalists: it produced records of how felling of trees had been taking place there since 1847: coffee had also been planted in an area cleared of forest but had to be abandoned after a while. The disturbed patch is still identifiable today.

Panic-stricken at the gathering momentum of the environmentalists, the state authorities took the unprecedented step of obtaining an injunction against a public meeting that the Save Silent Valley Committee had organised in Trivandrum in October 1979. It obtained a court stay on the ground that the hearing on the original writ petition had come up in September and hence any public discussion was *sub-judice*, thereby restraining Salim Ali and 11 other scientists from addressing the meetings. Daniel and Variava had already come all the way from Bombay for it. The ploy was roundly condemned by *The Hindu*, the only national newspaper which was backing the environmentalists unequivocally and carried nearly a

\*What is more, as I discovered during an arduous trek to their habitat from Nilambur town, most of the women are suffering from venereal disease, contracted from the middlemen who buy the forest produce which the men folk are perpetually engaged in collecting far away from "home".

dozen editorials on Silent Valley, literally scores of letters and full-page features on it. A 1,200-word lead editorial titled "Silent Valley and Prior Restraint on Freedom of Scientific Expression", written by N. Ram, one of the owners of the paper, put it pithily: "If proof were needed, this episode established to the whole nation that those who sought the restraint have a great deal to lose by a scientific discussion of the controversy, which is making a deep impact on public opinion. No criticism would be too harsh so far as the attitude, the manoeuvres and the tactics the Kerala State Electricity Board, and related government bureaucrats, have adopted ..."

If the ambitious and aggressive Kochukoshy thought he had scored a point, he was badly mistaken. For a few weeks prior to this incident, Variava and others had been working overtime persuading all non-governmental members of Futehally's task force, who had been invited to join the monitoring committee which the state government was setting up to implement the safeguards, to refuse to serve on it. Thirteen (out of a total of 20 members), agreed, including Dr Madhav Gadgil from the Centre of Theoretical Studies at the Indian Institute of Science in Bangalore; a population geneticist by training, he had developed the reputation of becoming one of the few professional environmentalists in the country. What really proved a slap in the face of the Kerala authorities was Futehally's own refusal to serve on the committee. He wrote to the state government: "As Chairman of this task force, I was largely responsible for suggesting ecological safeguards for Silent Valley. I have been considering the developments subsequent to this report and I feel that I, and the task force, were completely mistaken in recommending these safeguards. These are my reasons: a) Safeguards will neither prevent the submergence of a very vital portion of this area, nor prevent critical damage through large scale human interference with this fragile eco-system. In fact, Silent Valley will be mutilated to the point that it no longer remotely resembles the valuable biotope it represents today. b) The recommendation of the safeguards has resulted in negation of the task force's real position on the subject, namely that in view of its unique ecological character, Silent Valley should not be touched at all. It has only encouraged the Central and State Government to proceed with the project without considering viable alternatives ... I therefore resile totally from the statements made in our report regarding the safe-



guards and would like to emphasise again the substantive portion of the report which asked that the project be abandoned and the area declared a Biosphere Reserve."

The second official scientific study<sup>6</sup>—in the sense of being initiated by the Central government—of the Silent Valley dispute was conducted by Dr M.S. Swaminathan, then Secretary to the Union Agriculture ministry and internationally respected as India's top "Green Revolutionary" (he now heads the International Rice Research Institute in the Philippines and has been made the current President of the IUCN). He visited Silent Valley in October 1979, along with Nalni Jayal from his ministry and Prof A. Abraham, Chairman of the Kerala State Committee on Science and Technology, among others. He re-emphasised the need to create the entire area of 40,000 hectares—Silent Valley and the adjoining forests of New Amarambalam, Kundas and Attappadi—into a National Rain Forest Biosphere Reserve, and added that this "can become a sanctuary for valuable genes in several medicinal and plantation crops such as pepper and cardamom. This whole region has also been found to be a reservoir of useful genes in rice, conferring resistance to some major pests." At the same time, he saw that "if steps are not taken to satisfy the legitimate socioeconomic aspirations of the people of the area, mere talk about ecology and environment will be met with cynicism and with the question, who is more important—man or monkey?" (a reference to the celebrated lion-tailed macaque). He called for alternative ways of providing power and irrigation: he specifically cited the possibility of tapping groundwater for the latter objective, after discussions with the Central Ground Water Board in Coimbatore.

### **Dropping the project**

The weight of scientific opinion finally had its effect: unknown to the environmentalists who met Charan Singh in October, he had already written to Chief Minister Vasudevan Nair, saying he would like to discuss Silent Valley because of the national and international concern over it. He had received a confidential background note from the NCEPC which stated: "The NCEPC does not recommend the project and feels strongly that the Silent Valley should be preserved in its entirety as representing not only a most valuable heritage for research and education purposes for foresters, botanists, zoologists, geneticists and other scientists, but as a pre-



Naturalists marvel at massive size of trees in valley (Kamal Sahai)

cious reservoir of genetic diversity which has not been fully explored. It is one of those species-rich areas where little-known plant and other forms of life have survived for centuries in the wild. It is to gene pools like this that man will have to turn to in the future to find new materials for agriculture, for the life-saving drugs and the many other needs which will arise." Towards the end of October, Charan Singh, the outgoing PM, requested C. Mohammad Koya—who had replaced Vasudevan Nair as Kerala's Chief Minister hardly a fortnight earlier but was also on the way out himself!—to drop the project because so many scientists were against it. Charan Singh had obviously been influenced by Swaminathan's report. Because Koya's ministry fell soon after on November 30, the Chief Minister did not have the opportunity to pass on the PM's letter to the Kerala authorities. I wrote an editorial in *The Times of India* titled "A Reprieve?" where I questioned whether the KSEB, hellbent on a project whose estimated cost had by then risen to Rs 73 crore, would observe such a directive and end the protracted controversy.\*

\*The editorial appeared, incidentally, on the very day I quit the paper to join the *Indian Express* as its Resident Editor in Bombay: subsequently, the *Times* took a stand against environmentalists in Silent Valley but performed a *volte face* when it was abandoned.

Koya's fall paved the way for the state to be ruled by the Governor, Jothi Vencatachellum, till state elections were held a fortnight after the national polls on January 3, 1980. This saw the triumphant return to power of Mrs Gandhi, thanks to the bungling and in-fighting of the Janata Party. The new year also marked a tilt, in the see-saw-like fortunes of the Silent Valley conflict, in favour of the KSEB. On January 2, a Division Bench of the High Court dismissed the two writ petitions against the project and lifted the stay, as Prasad wrote to Variava, "on the grounds that the Kerala government had taken into consideration all aspects of the environment problems and the apprehensions of the petitioners were not valid." Charan Singh's request to drop the project had come too late. Kochukoshy mentions in his lengthy memoirs *Into An Hour Glass*, which he has published himself, that as soon the stay was vacated, the KSEB resumed work.<sup>6</sup> "Within 48 hours, the KSEB moved in its bulldozers," Variava informed WWF in the UK. "In three days, before telegrams to the PM designate, the President, the Governor of Kerala etc could take effect, they did as much damage as they possibly could in order to make the area unworthy of further conservation interest. The Central government, presumably at the instructions of Mrs Gandhi, stopped the KSEB temporarily till a new government was installed in three to four weeks." How much Mrs Gandhi directly had to do with this decision is difficult to say, since she was just returning to office after three long years: it was probably Swaminathan who was responsible, prompted by Jayal. Mrs Vencatachellum confirmed that work on the project had been stayed, following environmental objections, and that the state government to be elected shortly would have to decide on it.

In the state elections held in the third week of January, the CPM reasserted itself and headed a left front coalition with E.K. Nayanar as Chief Minister. In election speeches, he had referred to how vital Silent Valley was to the development of Malabar, which as the state's most backward region, was a CPM stronghold. He said that the state had spent Rs 3 crore on the project, a figure which the KSSP thought was inflated.\* In October, when Variava had come

\*Mrs Gandhi, soon after her return to power, also came to Kerala to address election meetings and she flew from Coimbatore over Silent Valley. According to Prasad, when Dr B.K. Nayar of Calicut university subsequently told her that there was no forest in the area, she retorted indignantly: "I've seen it!"

for the abortive seminar in Trivandrum, she met the veteran Marxist leader, E.M.S. Namboodiripad. "He gave us a long and attentive hearing to the economic arguments," she recalled, "and seemed convinced, although a little worried, about the political acceptability of dropping a project at this stage. He was specially interested in the scientific worth of wild species of plants." In *Deshabhimani*, he subsequently indicated that the scientific arguments for saving Silent Valley should receive due consideration and not be dismissed out of hand; both the necessity of producing power as well as scientific counter-arguments ought to be taken into account. Everything now rested with the stand of the ruling CPM; however EMS, as he is popularly known, characteristically prevaricated, just as he did on the far more important issue of the communist party line after the Sino-Indian war in 1962. The rank and file of the CPM like KSEB Union Secretary K.O. Habeeb naturally wanted the project at any cost and fought bitterly against anyone who opposed it; intellectuals like Parameswaran and Govinda Pillai, after initial vacillation, came around to supporting the environmentalists. This earned them the abuse of Habeeb and other party stalwarts, even to the extent of condemning them as CIA agents! Their independent stance, in a party where conformism is the order of the day, was extremely courageous. On a public platform where Silent Valley was being debated, Govinda Pillai made the memorable declaration that "even if Karl Marx tells me to support the project, I won't do so!"

Bombay environmentalists sensed that in the return of Mrs Gandhi they had the best opportunity yet to press for a stay on Silent Valley. Soon after she was elected, Salim Ali cabled to congratulate her and to suggest that only the creation of a Department of Environment would avoid the kind of deadlock witnessed over Silent Valley. Kisan Mehta was even more euphoric: "Ecologists the world over are highly grateful to you for the new orientation and leadership provided by you in the fields of ecology and conservation, as well as the personal interest taken by you in saving Silent Valley," he wrote. Variava reported that "our Kerala contacts indicate that the tension would be greatly diffused if there was even a private assurance from Mrs Gandhi to Mr Nayanar in a personal letter that if the Silent Valley project is dropped, the Central government will reimburse the amount already spent by the KSEB and will consider an alternative hydel project (preferably in

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Malabar)." The Nayanar regime, caught in a bind, sought to counter scientific opinion against the project by stagemanaging a seminar in Trivandrum at the end of April 1980 to get an "objective appraisal" of the pros and cons.<sup>8</sup> Prof A. Abraham, as head of the State Committee on Science & Technology, invited the participants, which excluded anyone from KSSP! (Abraham, a botanist, was a time-server and suggested at the seminar that an island be created in the midst of Silent Valley's reservoir, on which all rare animal and plant species could be put—rather like a natural Noah's Ark!) Only later did Parameswaran use his influence with his party colleague Nayanar to get himself invited. Salim Ali was asked; Variava represented him and read out his speech. The only other prominent conservationist was Joseph John, who protested against the choice of invitees, pointing out that the individuals and institutions concerned about Silent Valley (like the ZSI, BSI and GSI), Dr V.S. Vijayan from the Kerala Forest Research Institute, Dr K.N. Raj from the Centre for Development Studies and a representative of the Centre for Earth Science Studies in Trivandrum were conspicuous by their absence.

Instead, the Kerala authorities had commandeered the services of scientists who would toe their line on Silent Valley. The best-known of these were Dr B.K. Nayar, who a couple of months later published his pamphlet<sup>9</sup> somewhat ungrammatically titled: "Silent Valley, An Ecological Hyperbole", and Dr K. Raghavan Nambiar, who brought out his assessment<sup>10</sup> of Silent Valley. These were printed at the expense of the Parisara Asoothrana Samarakshana Samithy (PASS, which in Malayalam means Environmental Planning and Conservation Society)—a thinly-disguised front for KSEB propaganda! These "pseudo-scientists", as the KSSP branded them, included Professors George Verghese and M. Stephen<sup>11</sup> of University College, Trivandrum, whose authority to speak on Silent Valley was questionable, along with Abdur Rahiman of Mannarghat. Prof M.G.K. Menon was present at the seminar and had the last word, where he quite categorically made it clear that more scientific facts were necessary to assess the worth of an area like Silent Valley; the DST under his charge had already sent out a fact-finding team and this had to be supplemented by data from other scientists, present at the seminar and otherwise. As he put it: "The whole basis of science is based on measurement, people who disagree, people who agree, and finally you build up what is the consensus ..."

The following month, the Kerala cabinet tried to jump the gun again by announcing its decision "to go ahead" with the project. What that really meant, since Delhi held the purse-strings, was that the Chief Minister would write to Mrs Gandhi to sanction the scheme, now upped to Rs 80 crore. R. Balakrishna Pillai—who remained Kerala's Electricity Minister irrespective of the parties in power: he had held the portfolio since Nayanar's regime in 1980—warned, "We are not for a confrontation with the Centre. Since this is a development project, we expect clearance for it." Considering Kerala's recent history, it was not difficult to whip up populist fervour by converting Silent Valley into a Centre-state issue.\*

The KSEB guessed which way things were moving: in a letter to Nayanar, Mrs Gandhi had referred to the BSI's finding that Silent Valley was an "untapped gene pool" with a number of medicinal plants of great value. Kochukoshy persisted in describing environmentalists' fears as "completely baseless or highly imaginary." Members of the ruling front even attributed dubious motives to the "sustained and powerful" propaganda against the project, pointing out how Silent Valley was notorious for smuggling ganja, ivory, cardamom and sandalwood. Officials alleged how a "Cambridge-educated" plantation owner who had a large 350-acre estate adjacent to the valley—Moideen Kutty, who died in 1980—was funding the agitation. The KSSP, on its part, insinuated that the Hindustan Construction Co, owned by the Walchand Hirachand group in Bombay, had a vested interest in building the dam since its equipment was lying idle ever since it had constructed Idukki. It had prepared the documents but could not tender for Silent Valley because the controversy intervened.

The scene then shifted to Delhi where Nayanar and others from Kerala went in August to meet Mrs Gandhi about Silent Valley for the first time. Writes Kochukoshy: "As we reached Madras, we heard rumours that the project had already been written off, since

\* Balakrishna Pillai, incidentally, had also been a leading advocate of Canadian aid for Kerala's hydel power ever since the country's first arch dam was completed at Idukki. Although the public sector Bharat Heavy Electricals Ltd was keen to supply the equipment for the second phase of Idukki, Balakrishna Pillai insisted on going to Canada to obtain it from there, despite the Centre's determined attempt to prevent him from proceeding abroad. In August 1983, Kerala's Chief Minister, K. Karunakaran, agreed to hold an enquiry into his conduct in handling the power portfolio. He had to resign in 1985 for making a tactless political remark about the need to start a "Punjab-type" agitation in Kerala.

the high level scientific group that had visited the valley earlier had recommended to the Union government to do so. *The Hindu* of Madras carried the story prominently . . . As we landed at Palam, some of our people in Delhi also told us that we were going to plead for a lost case. So it was with great trepidation that I accompanied Nayanar and Balakrishna Pillai to the office of the Prime Minister." Kochukoshy, from what he recounted to me, seems to have presented Kerala's case. He correctly told Mrs Gandhi first, that Silent Valley was not the last vestige of evergreen tropical forest; in fact, there were "millions of hectares" of such forest scattered around the equatorial belt.\* Mrs Gandhi replied that they were at least unique to India and that in Kerala itself, there were no other forests which were denser or more awe-inspiring. Kochukoshy pointed out that other forests got more rain—the wet belt on the ghats was in former Travancore-Cochin, not dry Palghat; the Neyyar dam, 50 km from Trivandrum, also had better forests. "She kept quiet, she was reasonable," recalled the former KSEB Chairman. He also told her that though "a few scientists from the north" (of the country) said that Silent Valley had rare flora and fauna, "our botanical expert", Prof Abraham, who was present too, had claimed that these plants were available even near Trivandrum! Abraham's credentials as a botanist, however, have been questioned by environmentalists. His version is that the first thing that Mrs Gandhi said as she entered the room was: "This is not a matter which is to be decided by a few individuals; it is a matter of international importance. It won't be wise to go ahead with the hydel project." Nayanar replied: "Madam, we came to discuss the matter—you say that you have already come to a conclusion?" Mrs Gandhi eventually turned to Menon and said that if all "those studies" had been completed, a group of scientists should be formed to go into it. This is how a joint committee, consisting of four members nominated by the Centre and four from Kerala, was appointed with Prof Menon as Chairman and D.K. Biswas from the DoE as Secretary. It was to submit its report in three months. Those three months eventually stretched to three years—a result as much of the difficulty of coming to a conclusion regarding the "uniqueness" of the valley as of hammer-

\*He later pointed out that the total was 935 million hectares, according to an article by the well-known environmentalist, Erik Eckholm, author of *Losing Ground* and other books which take a global view of the ecological crisis.

ing out a consensus between the two sides who held diametrically differing views.

In December 1980, the Kerala government issued a notification under the Wildlife Protection Act, declaring Silent Valley and surrounding forests a national park. Variava must have been tipped off about this because in September, she wrote WWF-UK that the Kerala government had agreed to constitute a National Park and that it was examining alternatives to the Silent Valley dam in view of the delay in dropping of the project. This was "a very sensitive matter for the Kerala government since local expectations have become so fixed on this project as to make it politically hazardous to announce dropping. The creation of a National Park . . . will mean the introduction of the Central government, check poaching, felling, etc and supervise the KSEB. (We) wish to minimise public utterances to provide the atmosphere in which the Kerala government could retreat gracefully from its public pronouncements about proceeding with the project at all costs." But the state authorities were not going to give up so easily. Balakrishna Pillai clarified a few days later that the actual area earmarked for the hydel project was excluded from the National Park, which came as a rude shock to the environmentalists! Despite strident protests against this subterfuge, it remained the legal position till the entire valley was included in 1984. However the DoE, which Mrs Gandhi created in November 1980, announced a major five-year, Rs 75 lakh project to study the long-term environmental impact of three river schemes in Kerala. Idukki, Sabarigiri and "to some extent", Silent Valley. This indicated that the newly-created Department was not prepared to be browbeaten on the issue.

The Menon committee—the third official study of Silent Valley—took tortuously long before presenting its report to the Central government (in April 1983). In September 1981, the Kerala Chief Minister announced the State's intention of taking up the Rs 80 crore Kerala Bhavani multi-purpose scheme (the Bhavani being the river which flows into Tamil Nadu, parallel to the Kunthi) because of the delay over Silent Valley. By October, a draft on Silent Valley had been written for the Menon committee by Madhav Gadgil: it reviewed both points of view in the raging debate over both the scientific and socio-economic issues. Balakrishna Pillai seized on this inside knowledge brazenly to announce, on the floor of the Kerala assembly in July 1982, that the Menon committee had



"cleared" the scheme. The redoubtable Minister was referring to the study<sup>12</sup> published a little earlier by the KSEB Public Relations department titled "Flora and Fauna of Silent Valley, Attappadi and Sabarigiri Forest". This was masterminded by Dr B.K. Nayar and sought to make out that the forests of Silent Valley were in fact inferior to the latter two in every way. The 108-page document, well illustrated with colour and black and white pictures, was based on brief and cursory field visits; according to Fr Cecil Saldanha, the eminent Bangalore botanist who was one of the experts consulted by the Menon committee, the study must have cost the KSEB around Rs 2 lakh. The Central government quickly clarified that the Menon report had not even been signed at that stage. This last-ditch ploy to force the Centre's hand failed miserably.

In the summer of 1983, the Menon committee report was submitted and though it remained cautious about its conclusions, after weighing the pros and cons, a personal letter appended by Prof Menon made it clear that as Chairman, he was in favour of conservation. That set the seal on the hydel project. In November, Balakrishna Pillai announced that the Kerala government had finally scrapped the Silent Valley project in deference to the wishes of Mrs Gandhi. "We accept her feelings, though we have totally rejected the MGK Menon report," he added. Ominously, he declared that the state government would now take up an alternative—to create a reservoir with the waters from the Kunthi outside Silent Valley—and hoped the Prime Minister would okay this project, which would change the face of Malabar, one of the most backward areas in the State. Such a scheme would have to be submitted to the most rigorous environmental scrutiny: by altering the flow of the Kunthi, the fragile ecosystem of Silent Valley could easily be disturbed. Early in 1984, the Central Electricity Authority declared that it had given techno-economic sanction for the Puyankutty hydel project in Idukki district; the KSSP had cited this as an alternative and there is no doubt that Kerala was able to extract this even bigger "modern temple", which will cost a staggering Rs 1,000 crore and produce 750 MW of power, as its pound of flesh for sacrificing Silent Valley. Opposition leader Nayanar (he was dethroned as Chief Minister in 1982) continued to plead for a reconsideration of the decision on Silent Valley—a move prompted by the desire to embarrass the Congress(I) front for having succumbed to the pressure from New Delhi.

What finally tilted the scales in favour of the preservation of Silent Valley? One would like to think that it was primarily the groundswell of popular opinion stirred up by the ever-active KSSP, and secondly, the logic of those environmentalists who cited alternatives and the scientists who put forward incontrovertible proof of the necessity of saving the forests. The facts seem to tell a different story. It was as much the personality of the Prime Ministers which counted. Thus Morarji Desai, who has seldom displayed an aptitude for making unbiased decisions, was easily won over by specious arguments (he was to make a facetious statement based on his personal observations in the 1930s, about meteorological conditions in Alibag, the site for a fertiliser complex, as we shall see in the Thal-Vaishet case). Mrs Gandhi, on the other hand, did inherit some of her father's predilection for striving to appear "modern" and "scientific" in a huge, illiterate and superstitious country. More to the point, she—like Jawaharlal—was very concerned about her image abroad; so much so, that it proved her undoing when she decided to hold elections in the middle of the emergency in 1977 to stave off severe criticism in the West about her repressive measures and was unceremoniously bundled out of office. Prof Abraham recalled a Shankar cartoon which showed Panditji dressed like a little girl with a lamb captioned "Foreign affairs" at his side, the implication being that everywhere he went... Said Abraham: "He ignored domestic affairs; international opinion always weighed heavily with the family."

Mrs Gandhi had replied to David Munro, the IUCN Director General, who had asked her to throw her weight behind the environmentalists, that she shared his concern but "unless we can quickly identify some other way for them (the Kerala government), I am afraid that we may not be able to save the Valley." Janet Barber, head of Information of WWF-UK who visited Silent Valley in April 1981, wrote to a Kerala environmentalist that she met Mrs Gandhi in Delhi a little later: "I congratulated her on what she had almost achieved in securing it for a Biosphere Reserve." Prof George Verghese, the PASS chemistry lecturer from Trivandrum's University College, commented sarcastically that the "PM can't give Silent Valley the green signal because she is worried about her image abroad. It's as if the beginning of wisdom was in Morges! (WWF's Swiss headquarters)" Everyone—from officials in the Kerala government and the KSEB, environmentalists in Kerala

and Bombay, officials in the DST and DoE in Delhi—is agreed on one thing: if it were not for Mrs Gandhi, Silent Valley would be well on the way to being dammed forever.\*

It was a fascinating *pot pourri* of factors that went into the halting of the Silent Valley project, of which attitudes of the Prime Ministers concerned were perhaps the most important. At each stage, different scientific arguments were advanced: first, the loss of one of the last remaining tropical rain forests, then the lion-tailed macaque, then the question of it being a "gene pool". Correspondingly, the protagonists of the project tried to adduce their own facts to disprove each of these arguments. The weight of the national institutions which voted against the project was plainly far more impressive than that of local scientists whose command performance was orchestrated by the KSEB. When I asked Prof M.G.K. Menon how the public was to choose between the two apparently contradictory sets of scientific data, he answered with a twinkle in his eye: "Look at the credentials of the scientists!" Undeniably, the rallying force of the KSSP made Silent Valley a unique environmental campaign in the entire Third World because it took the issue out of lecture rooms and the columns of the press to the people. If many people in Kerala today are aware of the meaning of "ecology", it is solely due to Silent Valley. This interplay of international pressure, lobbying in Delhi and counter-lobbying in the state, local agitation for the project, press campaigns and scientific deliberation, is witnessed, in varying proportions, in each of the three cases in this book. It bears testimony to the genuinely democratic process at work in this country, which will be hard to find anywhere else in the Third World. In general, it can be concluded that the access of environmentalists to the highest echelons of power in Delhi turned the tables decisively in Silent Valley (unlike Thal-Vaishet), while scientific opinion took a back seat.

As the most fiercely contested environmental dispute in the country, however, it quickly symbolised the quest for a new paradigm: development without destruction. Although it is only one

\* On another dam issue—Bhopalpatnam and Inchampalli in central India—Mrs Gandhi wrote to activist Baba Amte, who had protested to her about the displacement of tribals: "My own views are well-known. But it is a very difficult battle. We shall pursue the matter. I am asking the Planning Commission to look very carefully into the aspects you have mentioned."

of the unique natural areas in the country which is worthy of preservation, it caught the public eye and is now a useful precedent whenever any industrial project threatens to cause irreversible damage to a natural ecosystem. Immediately after the Kerala government's decision to abandon the project, for instance, experts opposing the Narmada Sagar scheme in the plains of Madhya Pradesh were citing Silent Valley to bolster their viewpoint.





### 3 Ecology, Energy, Economics

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“A lot of armchair environmentalists made their reputations on Silent Valley,” says the primatologist Rauf Ali, whose father Saad is the Vice-president of the Bombay Environmental Action Group which fought the Thal-Vaishet fertiliser plant (they belong to the same family as Salim Ali and in fact shared a quaint bungalow on Pali Hill in Bandra, a suburb of Bombay). Many people jumped into the fray because they were moved emotionally at the thought of the extinction of a pristine forest. Adds the environmentalist Thomas Mathew, “This was Custer’s last stand!” — the implication being that it was fought as if it was a last-ditch struggle to save the one remaining environmental bastion left. The allegations ring true because it was very easy to sentimentalise over the destruction of “one of the last vestiges” of tropical rain forest in the country without knowing precisely why these were worthy of preservation. In fact, the very terms in which the public debate proceeded indicate the sentiments being expressed: the “virgin”, “untouched” forest was being “raped” by the bulldozers of the heartless, mercenary KSEB. Silent Valley lent itself to such metaphor; the colour features on it in magazines revealed hillsides whose gentle contours were covered with lush grass, with dense *sholas*—which one botanist described to me as the “groin” of the valley with its heavy undergrowth—lying vulnerable beneath.

In Kerala, the threatened destruction of an area, which till then no one had heard of, caught the popular imagination. The romantic poet Sugatha Kumari described to me how, as her contribution to saving Silent Valley, she wrote “Maram” (Tree) in the old fashioned style of praying to a deity, where she lavished praise on a tree from head to foot; the Jnanpith award-winning writer Pottekat published a story where a hundred years hence, students were shown a stuffed lion-tailed macaque and films of tropical evergreen forests, both of which had been rendered extinct by a hydel scheme

(the last of the macaques mistook an electric pole for a tree, jumped onto it and electrocuted itself!); film-maker M.T. Vasudevan Nair had wanted to base a feature on the controversy over the dam. To be honest, I could accuse myself earlier of instinctively springing to the defence of Silent Valley before investigations revealed just how correct these instincts had turned out to be.

"Silent Valley serves as an excellent example of the growing environmental awareness in the tropics of Asia and it is discussed in the context of 'Economy Versus Ecology' and the World Conservation Strategy," wrote Dr H.J. Von Lengerke, an agro-meteorologist from Heidelberg University, to the Save Silent Valley Committee in Bombay. It is easy to see why. In a country like India which was desperately poor, the state of Kerala had long had been denied development. In as much as it is some indication, Kerala's per capita income in 1978-79 was Rs 1,091 as against Rs 1,903 in Maharashtra and Rs 2,278 in Punjab. It is now Rs 1,500 in Kerala, while the figures for the other two states are much higher. What is more, because it is a small state, virtually sandwiched between the ghats and the Arabian sea, its farm holdings are hopelessly fragmented. In 1976-77, for example, the average size of holdings was just half a hectare (about 1.25 acres). As many as 2 million people were registered with unemployment exchanges in the state in 1983 — one out of every ten in the country; what is more, half of them were educated, leading, in the words of the state Finance Minister, to an "explosive situation". Within Kerala itself, the northern region of Malabar, where Silent Valley is situated, was the most backward and the only area short of power. And here were people, highly educated and politicised, being asked to sacrifice electricity today for some vague, intangible, unheard-of benefit in the future. As engineer after civil engineer from the KSEB complained, some almost with tears in their eyes, Silent Valley is a textbook case for hydel power generation with a narrow, deep gorge and a "head" of as much as 890 metres (the fall from the top of the dam to the power station below), the highest in south India; besides, Kerala's major resource are 43 westward-flowing rivers, which is a unique natural asset, a renewable source of energy and non-polluting to boot.

"It's a God-given gift!" exclaimed P.R. Haridas, an executive engineer who was earlier based at Mannarghat to dam Silent Valley. "The first arch dam in Asia was the Bhumibol in Thailand; Idukki

was the second and Silent Valley should have been the third." An embittered man who can barely conceal his rage over the obstructionist tactics of the environmentalists, he referred me to a bestseller by Arthur Hailey called *Overload* which he insisted could have been written with Silent Valley in mind. Somewhat incredulously, I waded through the stirring saga, which deals with the heroics of a pragmatic power engineer from a large private utility in the US who wants to put up a massive thermal station in the teeth of opposition from environmentalists—both a respectable, distinguished bunch (shades of the Sierra Club), as well as anarchists who are out to blow up the whole edifice. Our engineer, of course, averts catastrophe in the nick of time and reason and light (literally!) are restored; the moral is as clear as daylight—that environmental objections to big power generation schemes may have an element of truth, but these can be tackled and ultimately good sense must prevail in such confrontations. As Haridas emphasised, giving the "baby and bathwater" a peculiarly Malayali flavour, "To get rid of a rat, you don't burn your house!" In fact, the best of engineers or technocrats whom I met in the course of investigating these three environment controversies made it clear that they were as interested as the most fervent conservationists in protecting the nation's assets (thus an Indian Oil Corporation official asked rhetorically: "Aren't we as keen as anyone else to show the Taj Mahal to our children?").

Easily the most philosophical of these engineers I talked to in Kerala was Rock Poulin, the KSEB's adviser from the Canadian firm, SNC. The rugged, middle-aged geologist also uses the body as a metaphor in describing dams. "Each valley is like a person," he believed. "Idukki dam fits into the contours of its valley like someone curls up in the most comfortable position to sleep. If you look at a river, and see that some of its water goes to the sea, it's like a strong man who's bleeding: if you have the engineering tools to prevent that loss of blood, do you talk to him about the loss of trees? Or suppose he's on the operating table, waiting for a transfusion, and suddenly there's a power failure—how about that? Our job as engineers is to relieve pain, make life better. We realise that we're hurting people: an appendectomy hurts the body but saves life. Just as anaesthesia was invented to take away pain, we have developed technology to do so. I'm convinced what we're doing is right."



### 'Worth' of forests

Given the genuine commitment to their profession of such transparently honest dam builders as Poulin and the tradition of progressive thought in Kerala which equated development with industrialisation, for which power was a *sine qua non*, what is the case for keeping an area like Silent Valley intact and foregoing extra megawatts of power? Dr M.S. Swaminathan, in his brief address at the state government-sponsored seminar on Silent Valley in Trivandrum in April 1980, mentioned the importance of three "Es"—ecology, energy and economics (he added, a fourth, employment, which is linked to the third). The Menon joint committee report deals with these in much the same order. The central ecological issue in this case was the "worth" of these forests. Ironically, the best summing-up of the situation comes from the Kerala government's own notification, declaring the area a national park: "The area in question has a rich and unique heritage of rare and valuable flora and fauna requiring conservation and management for the benefit of the nation as a whole and posterity in general. Besides acting as a precious reserve of life forms and gene pool, the area is the only undisturbed tropical rain forest in its true state in Kerala, the ecosystems of which require permanent preservation."

To take the last statement first, the classical definition of a tropical rain forest is an area where there is heavy rainfall practically throughout the year, the humidity is high and constant, the evergreen trees at least 30 metres tall but often twice as high and greatly varied in species composition and size. Botanists also know it as the "climax" stage of vegetation—one that has evolved the most over thousands of years, with many more species than temperate forests. In his tract, "Silent Valley: An Ecological Hyperbole", Dr B.K. Nayar mentions how the largest tropical rain forest is in the Amazon of Latin America. This contains a staggering quarter of the world's surface fresh water and is easily one of its most sensitive environmental regulators of climate and rainfall.\* Central Africa has such forests as well, and in the eastern tropics, they extend from the west coast of India and Sri Lanka to Thailand and the Philippines, the largest continuous stretches being in Malaysia, Sumatra,

\*The US is now alarmed about the relentless destruction of swathes of forest in the Amazon because it threatens to lower rainfall over America's croplands.

Borneo and New Guinea. "In India," writes Nayar, "the major tracts of rain forests are in the western ghats, lower reaches of eastern Himalayas and hill ranges of Assam, Nagaland, Mizoram, Arunachal Pradesh and Manipur. Wet evergreen tropical rain forest tracts occur all through the western ghats but are in patches interpolated with mixed types of forests in the relatively drier areas." This was certainly borne out by my own observations when I paid an eventful visit to Silent Valley in February 1982 with Hamsa, the legendary guide from Mannarghat who knows the area extremely well. Contrary to images of verdant valleys which were conjured up by magazine photographs taken during or after the monsoons, when we arrived in our rickety jeep at the site where the KSEB had built sheds for its workers, just above where the 130-metre-high arch dam would reach, the hillsides were a vibrant brown; only the *sholas* remained impenetrably dense. These South Indian *sholas* are a botanical relic: they are the only remaining in the entire world and represent the western limit of the former land mass called Gondwanaland, before the continental drift. The eastern boundary of this biogeographic mass is now in Australia, which explains why Australian botanists are most interested in studying Silent Valley.

Tropical rain forests occupy just 6 per cent of the earth's surface but house half its living species, most of which have simply not been studied. Writes Erik Eckholm,<sup>1</sup> formerly of the Worldwatch Institute in Washington: "Estimates of the number of plant and animal species living on earth range from 3 million to more than 10 million. To date, only 1.5 million species have been recorded in scientific literature . . . The IUCN's Threatened Plants Committee finds about 10 per cent (20,000 to 30,000) of the world's flowering plants to be 'dangerously rare or under threat' . . . A 1976 survey . . . concluded that, as of the early 'seventies, the world's original tropical moist forests had already been reduced by more than 40 per cent to a total 935 million hectares, and that they were shrinking by about 11 million hectares (the area of Bulgaria or Cuba) each year."

Nayar, Dr K. Raghavan Nambiar, the Secretary of PASS, and other scientists funded by the KSEB, have sought to challenge the very fact that Silent Valley is a typical tropical rain forest. For instance, Nayar provides statistics to show how for at least a couple of months in the year, it receives no rain at all. He also claims that the neighbouring forest of Attappadi and further south, of

Sabarigiri (where a hydel project has long been completed), is denser than Silent Valley. The Menon committee, however, after surveying all the river systems of the western ghats, concludes: "It is evident that there is no representation comparable to the Silent Valley plateau . . . over the entire stretch of western ghats. The only other habitat approaching Silent Valley is the upper reaches of Periyar on the southern portion of the Peermede plateau. Even here the much smaller overall areal extent and the insidious presence of some cardamom estates rules out its being anywhere as promising as the Silent Valley plateau." Singly, the very fact that there is no human habitation whatsoever—not even tribals—in the 8,950 hectares that comprise Silent Valley distinguishes it from any other such forest in almost the whole of India, with the sole exception, possibly, of the north-east. The presence of humans—not tribals, who live in harmony with the forest—triggers off a series of ecological changes; with disturbance, certain species vanish and hardy weeds like lantana make their appearance. Besides, the high ridges that surround Silent Valley only increase its inaccessibility.

There are other hair-splitting arguments raised by PASS scientists: whether these forests actually affect rainfall patterns; whether the inundation of only one-tenth of the total area of the valley by a reservoir will damage the rest of the vegetation or actually enhance the area (like, they allege, in Periyar and Idukki); whether the tropical rain forest has the capacity to regenerate itself (like the Krakatoa island in the straits between Java and Sumatra which had a volcanic eruption exactly a century ago); whether they are really 50 million years old and represent the genetic "cradle of evolution". Snorted Kochukoshy contemptuously: "I did not believe that Palghat district was the fulcrum of the universe!" A former director of the Central Marine Fisheries Institute in Cochin adds: "This is the nadir of ignorance about the evolutionary process . . . courtesy restrains me from stating anything further on such a ridiculous statement except that no precise spot can serve as a factor for evolutionary process." All these criticisms have been more than adequately answered in public forums and elsewhere by eminent specialists like Fr Cecil Saldanha, the taxonomist who had written an authoritative three-volume *Flora Of Karnataka* (taxonomy is the science of grouping plants in a system based on their natural relations), and Dr V.M. Meher-Homji of the French Institute in Pondicherry, who with his French colleagues, has extensively re-

searched the vegetation and bioclimates of the entire western ghats. In fact, it was the vegetation maps of India as a whole which Meher-Homji showed me in the elegant old institute—some have also been commissioned by the Indian Council for Agricultural Research—that put me literally in the picture. The maps, as the engagingly eccentric botanist explained, show each type of vegetation in a different colour. The tropical rain forests (or, as Nayar prefers to term them, *shola* or monsoon forests) are in purple: the western ghats have little splotches, badly fragmented, compared to more generous areas in the north-east of the country. It comes in a flash, to anyone who sees these maps, that it is not a question of saving Silent Valley or Attappadi or Sabarigiri selectively: there is hardly any of this forest left to be saved, once you view them in their entirety. Logic would dictate that as many of these areas as possible that can be preserved, ought to be, if their exploitation is not absolutely essential.

What is the "worth" of an untouched tropical forest like Silent Valley? These forests, which have evolved over centuries and are far more complex and fragile than temperate forests, not only have species of plants that are invaluable for their contribution to scientific knowledge but are of enormous potential use to mankind. A study<sup>2</sup> called "Forest Management in India: A Critical Review" by Madhav Gadgil, S. Narendra Prasad and Rauf Ali lists four functions of forests—storehouses of living organisms of potential use; regulators of rainfall, soil and water regime; sources of basic needs of the poor (particularly tribals) and sources of many industrial raw materials. Take the crucial question of food. The earth has 80,000 species of edible plants, located mainly in tropical forest areas, but only 12 species at present contribute 90 per cent of the world's food. In fact, just three plants—rice, wheat and corn—account for three-quarters of the cereal crop. There is no reason why new sources of food cannot be obtained from these forests. Eckholm points to the dangers of such extreme dependence: "The Irish potato famine of the 1840s provided the classic example of the dangers of monocultures; the decimation of 15 per cent of the US corn crop in 1970 by corn blight and repeated insect devastations of Southeast Asian rice crops over the last decade have underscored the continuing folly of reliance on a narrow genetic base in agriculture." Geneticists the world over have time and again pointed out to the need for preserving untouched ecosystems so that they remain "laboratories

of genes", as it were. The most dramatic example of this potential is provided in some of the new miracle rice hybrids developed at the International Rice Research Institute (IRRI) in the Philippines; these were found to be highly susceptible to a pest called the brown plant hopper. Scientists searched the world over till they found a few primitive cultivars of rice—the earliest cultivated varieties—in Pattambi, also in Palghat district where Silent Valley is located, and Sri Lanka which alone could resist it. They "married" the high-yielding types with these primitive cultivars and the new hybrids, immune to the hopper, have been successfully introduced throughout South and South-East Asia. As one of India's leading rice breeders, E.A. Siddiq from the Indian Agricultural Research Institute, has written<sup>3</sup> about the threat from the hopper, which is the most destructive rice pest in both tropical and temperate Asia: "luckily varieties from an Indian source came to the rescue in Philippines and Indonesia." Interestingly, he attributes the spread of this pest to the introduction of high-yield varieties, heavy use of fertiliser and intensive cultivation, which provide a dense canopy—an ideal habitat for hoppers. The indiscriminate use of insecticides like BHC and DDT is also responsible. Once again, the recurring problem: higher output or environmental protection?

A paper<sup>4</sup> titled "Genes From The Wild", brought out by the London-based organisation Earthscan (its parent is the International Institute For Environment & Development), tells the story of another wild relative of rice. During the early 'seventies an epidemic known as the grassy stunt destroyed more than 116,000 hectares of rice in India, Indonesia, Sri Lanka, Vietnam and the Philippines. A botanist called Dr S.D. Sharma collected a single strain of resistant wild rice from MP known as *Oryza nivara* and sent it to the IRRI, where new varieties were bred by Prof Gurdev Khush, along with a pathologist who checked over 6,700 varieties of cultivated and wild rice species to find that this was the only strain which could resist the virus. It was introduced in 1974 and the disease has simply ceased to exist in fields. Today, cultivars with *O. nivara* in their pedigree are grown in 30 countries, including India. "To many scientists," reports Earthscan, "it was an act of faith if not of weakmindedness to conserve a wild rice like *O. nivara* in the IRRI gene banks. The plant has no obvious useful characteristics, and many that are highly undesirable. It is squat and floppy with weak stems; it has a very low yield ... Such is the lottery of

agricultural improvement." Genetic diversity, therefore, is as important a national resource to protect as, say, the nation's frontiers, and Silent Valley has done a great deal to focus attention on this factor.

In the course of extensive travelling while I was writing this book, I came across an internationally known rice geneticist called Dr R.H. Richharia in Bhopal, who has identified no fewer than 18,000 types and sub-types of rice varieties, collected them in what are known as "germplasm banks", in just one region of Madhya Pradesh—Chhattisgarh, one of the "rice-bowls" of the world (China is similarly endowed). These varieties, with quaint local names like *Hathi panjar* (the grains resemble an elephant's footprint), have withstood the test of environmental and climatic changes for centuries. Though I tried very hard to check the facts of his story with top agricultural scientists in Delhi like Swaminathan and Pal, I drew a blank and have only to rely on his word. US interests in the IRRI, he alleges, have systematically undermined the importance of his research: in 1977, the World Bank reportedly offered the Indian government Rs 4 crore for rice research on the specific condition that his institute in Raipur be closed down. This it has been, and his lifetime's work—he was earlier the Director of the Central Rice Research Institute in Cuttack—wasted. The germplasm is now said to have been despatched to the IRRI. Indeed, the conservation of genetic resources has become not just a biological issue but has political and economic implications as well. Richharia was much earlier consulted while he was in Cuttack as to whether this institute should be made international. He advised against it on the ground that the nation's scientific integrity should be protected; only then was it established in the Philippines. One has only to read *Seeds Of The Earth*,<sup>5</sup> brought out by the London-based International Coalition for Development Action, to realise how oil multinationals like Shell are now beginning to control the world trade in food crop seeds, thus completing a vertical monopoly beginning with fuel and fertiliser. As Richharia, who is totally apolitical, puts it: "Whoever controls food, controls the world."

In Silent Valley specifically, the Central Plantation Crops Research Institute in Calicut has found no fewer than five new pepper species, though the Director, Dr M.K. Nair, was hesitant to take credit for them till they were properly identified. In an earlier report on collections in the area, the institute observed: "One thing

we noted was that diseases—especially the collar rot and quick wilt—were absent in the pepper plants . . . The very valuable germ-plasm of pepper available in Silent Valley is a rich and extremely valuable heritage, which we should not destroy. The construction of the dam will definitely endanger most of these types found in the valley and be lost forever . . . this in the long run will cost the nation crores of rupees in foreign exchange.” There are other spices like cardamom which are growing wild in the area and need to be studied, as well as pulses like black gram, rice bean and *urad dal*.

The medicinal uses of rare plants are also a factor of great significance in Silent Valley. “By destroying these forests, we’re foreclosing future options,” Nalni Jayal told me. “For example, the rosy periwinkle, found in tropical forests, has been found to cure leukaemia. We need to study these wild cousins to identify the remaining biogeographical provinces in the country.” And Steven Green<sup>6</sup> writes: “These *sholas* serve as a vast natural storehouse of many plant and animal species found nowhere else. Members of this endemic flora form unduplicated raw material for research into the medicinal properties of plant compounds; they can supply seed banks for unique tree species which tomorrow’s foresters may need to find and propagate. New uses are frequently discovered for many organisms in medicine, pest control and the breeding of economic plants and evergreen rain forest trees. Two examples from Indian flora of the western ghats are the climax evergreen rain forest trees, *Hydnocarpus* spp., whose seeds contain an oil used in treating leprosy, and the herbaceous shrub, *Rauwolfia serpentina*, from which is produced the famous drug for combating hypertension. Preserving representative blocks of *shola* ecosystems in a completely undisturbed state is the only way to ensure survival of irreplaceable plant and animal resources.”

The proposal<sup>7</sup> to carve out a Nilgiri Biosphere, recommended by a Central government team seven years ago as part of India’s UNESCO-inspired “Man and Biosphere Programme”—which has been approved of by Tamil Nadu and Karnataka but stalled by Kerala because it includes Silent Valley—notes that “a humble bacterium during its lifetime can produce more chemicals than man can in all his chemical laboratories.” It refers to the immense benefit to mankind from just one discovery: the *penicillium* mould and how the armadillo is being used to fight leprosy. Kerala is justly famous for its ayurvedic medicines, which are entirely derived from



Tree fern in Silent Valley: one of the oldest forms of vegetation



The area is a Pandora's box for zoologists (Denzil Siqueira/SSVC)



plants, but this hereditary knowledge, is fast disappearing with the shrinking forest. Even in the US, a quarter of all medicines are based directly or indirectly on plants.<sup>8</sup> In West Germany, the proportion is twice as much, while in the Soviet Union, more than 200 species are recognised for potential application and over half of these have been approved by the Ministry of Health for prescription use. All this evidence proves conclusively the value of tropical forests such as Silent Valley. "What are we arguing about?" Futehally demands to know. "We want to conserve a certain proportion of India's natural forest for study. Considering the total area, it's infinitesimal." According to Dr S.K. Jain, Director of the BSI in Calcutta, a thousand Indian plants are facing extinction, while Dr T.N. Khoshoo, former DoE Secretary, puts the figure of those immediately threatened at 134. In tropical forests, the world over, according to Norman Myers who wrote the classic book, *The Sinking Ark*,<sup>9</sup> one plant is disappearing a day. As an angry Daniel of the BNHS wrote to Prof Abraham of the Kerala Committee on Science & Technology, "Lowland forest all over Kerala has been destroyed either for cultivation or dams. The stumps of trees in Periyar lake are silent testimony to such destruction . . . It would be unwise (in Silent Valley) to bury this genetic resource under tons of water."

### Monkeys vs man

If the flora of Silent Valley is beyond doubt worthy of preservation, what about its fauna? It is unfortunate that the controversy over the species present in the area degenerated into a "monkeys versus man" debate. Even members of the KSSP now concede that zoologists like V.S. Vijayan and Sathis Chandran Nair over-emphasised the importance of the lion-tailed macaque at the beginning of the controversy and made themselves a trifle ridiculous by getting emotional about their extinction and sidetracking the other issues. However, as we have seen in the earlier chapter, it was partly this rare simian that brought Silent Valley out of obscurity. Steven Green studied the largest lion-tailed macaque population in the world—they are only found in the western ghats—in the Ashambu hills in Tamil Nadu between 1973 and 1975. According to figures he and Karen Minkowski cited in their chapter in the book *Primate Conservation* (1977), there were only 405 of these beautiful creatures left in 1975 in the wild, so named because of the tufts on their tails; they are black like Nilgiri langurs, and have halo-like

white manes. Green clarified to me that these were not the total number but only the observable groups: he put the present figure at a minimum of 900 and a maximum of 2,000. (I have myself only caught a fleeting glimpse of one—not in Silent Valley but in the Ashambu hills. They are on view at the Delhi Zoo, however).

At a KSSP conference in Trichur, P. Govinda Pillai claimed that the main food of the macaque was the prickly fruit of the tall *cullenia* tree and M.K. Prasad stated that the total of 27 observed groups of monkeys (each with 15 members) needed 130 sq km of contiguous forest which Silent Valley could provide. "If the *cullenia* is the monkey's main diet, what does it do those times of the year when it doesn't flower?" ask KSEB supporters sarcastically. "Do they store this delicacy?" The macaque can be taken as an index of the state of any *sholas* like those in the Kunthi and Bhavani valleys, just like the very presence of a tiger indicates that a particular forest ecosystem is at peace with itself. There is a symbiotic relationship between the macaque and the *cullenia*, which is its favourite, but by no means sole, food. Monkeys are extravagant feeders and help to disperse the seed of the tree far and wide (just as birds do to other berries). Without the macaques, which are the only totally arboreal (tree-living) ones left in the world, the majestic *cullenia* would not propagate so easily and this would reduce the rapidly-dwindling *sholas* still further. For instance, Meher-Homji relates how because the dodo had been exterminated by new settlers in Mauritius before the turn of the last century, the *clavaria* tree did not propagate any more since its seeds would germinate only if crushed in the bird's gizzard; now the common turkey is being used as a substitute crusher! I should hasten to add that these *simha valan kurangu*, as these macaques are known in Malayalam, are also extremely interesting to primatologists: being arboreal, they represent a stage which our pre-human ancestors were also at, till tree produce could not sustain their numbers any longer. Says Green: "These macaques are always looked at as a curiosity because of their very restricted habitat and rarity. Theoretically, they have a great deal to tell us about evolution and behaviour." Rauf Ali, who has written his thesis tracking bonnet macaques (which are by no means rare) in the Ashambu hills, believes that a "detailed study of the lion-tailed monkeys will teach us about many human traits: 'agonistic' behaviour, how they interact with members of the same group and others. Social psychologists look to biology for at least some expla-

nations of human behaviour."

The other two rare animals in Silent Valley are the Nilgiri tahr, a sagacious-looking bearded goat which inhabits the upper reaches of the ghats, and the odd tiger. "No one has studied this area of the western ghats properly," conceded P.K. Thampi of the Trivandrum-based Centre for Earth Science Studies, who led the GSI's multi-disciplinary team. "If you remove a big stone in the valley, you will see scores of insects. Anyone who goes there can see fish, reptiles. If the project comes, the loss will be irretrievable." He has the distinction of having a species of frog, which has only been found in Silent Valley, named *Micrixalus thampii* after him. "It's an area where nature still exists as it did years ago, a biological treasure!" exclaims R.S. Pillai of the ZSI in Madras, who has a similar zoological distinction.<sup>10</sup> "A hundred years ago, specimens could be found all over the western ghats; two foreigners, a German called Gunther and Boulenger, a Frenchman, have made extensive collections here—Boulenger lists 100-120 species—but all the specimens are out of the country." The value of conserving natural resources in all their forms is thus clear.

It is extremely difficult, in a country like India, to justify preservation of a forest area for biological research. The protection of wildlife is even more problematical and yet there does exist a precedent that is widely cited in the Silent Valley controversy (as we saw in the previous chapter, the Futchally task force referred in passing to it). In 1973, the NCEPC was asked to intervene in a similar dispute that had arisen over a proposal to dam the Moyar river which separates the Mudumalai sanctuary in Tamil Nadu from Bandipur in Karnataka, both famous as elephant and *gaur* (bison) habitats. The Pandiar-Moyar hydel power project, as it was to be called, would have a capacity of 150 MW but would only generate 100 MW to begin with. In July 1973, the NCEPC observed: "Besides the Indian Board for Wildlife, there are several other quarters which are also concerned with the possible ecological effects of this project. Naturalists like M. Krishnan and Stracey have expressed that the construction of the reservoir . . . would lead to elimination of practically all the wildlife in the sanctuary. According to them, the area of six square miles that would come under submergence . . . is the finest stamping ground in Asia for *gaur*, antelope and herds of wild elephant." A four-member NCEPC inquiry team advised against it—

a stand which the Tamil Nadu government accepted.\* Even a decade ago, however, the NCEPC recognised the need for policy to be laid down on "development or environment". As it said then: "The Pandiar-Moyar project is one of the many development projects that are proposed to be undertaken in areas of wildlife interest. The Kalinadi hydroelectric power project in the Dandeli wildlife sanctuary (in Karnataka), and mineral prospecting work in the Sariska sanctuary (in Rajasthan) are a few other examples. The point that arises for consideration of the NCEPC ... is the need to evolve guidelines for a systematic project appraisal in such contingencies." Yet other examples where wildlife has been directly jeopardised by development, which we shall deal with in the second and third cases in this book, are the threat to the famous Bharatpur bird sanctuary from the Mathura refinery and to the Ranthambor sanctuary from a gas-based fertiliser plant to be located at Sawai Madhopur, also in Rajasthan. On the other hand, the Periyar sanctuary—which falls under Project Tiger—has been created by a reservoir and is held up as an example where a hydel project has protected animals. It would be difficult to argue, however, that the beasts are actually better off than when they were in the wild, with corridors to roam from one thickly forested belt in the ghats to another.

### **Electricity for export**

If the ecology of Silent Valley is to be preserved, what about the second "E"—electric power or energy that will be lost as a consequence? The revised Project Report of March 1978 intones: "Projects are for prosperity. Planning projects for the development of water resources forms part of our venture to develop resources for the benefit of mankind." Writes Kochukoshy in his memoirs, "(Silent Valley) belongs to the family of the great multi-purpose river valley projects initiated in India by Jawaharlal Nehru, after India became free. He had warmly described them as the new temples of India. Such are the Bhakra, the Damodar Valley Corporation, Hirakud and others in India and the TVA, Aswan, Dnieper and other similar schemes abroad." K. Thrivikraman Nair, who succeeded Kochukoshy as Chairman of the KSEB, describes Kerala as the most fortunate state in India in that it is blessed with 44

\* Tamil Nadu has shown greater concern for environmental protection though its electricity needs are far greater than Kerala's.

ivers, with an enormous power potential. But the actual energy situation can best be described in the KSSP's words as a predicament or paradox: despite an apparent "surplus" of power, all of it hydel, the per capita consumption of electricity in the state is *less* than that of India as a whole; for that matter, it is less than power-starved states like Tamil Nadu and Karnataka, to which it *exports* its so-called extra megawatts! Within Kerala itself, Malabar's consumption of electricity is far lower than the rest of the state. The following tables make it clear:

Table 1: Per Capita Consumption of Electrical Energy: 1975-76  
(in kWh)

Sector	Malabar	Rest of Kerala
Agriculture	2.2	4.7
Industry	17.0	98.0
Domestic & Commercial	12.2	21.0
Total	31.4	123.7

Table 2: Comparison of Per Capita Electricity Consumption:  
India, Karnataka, Tamil Nadu and Kerala (in kWh)

Year	India	Karnataka	Tamil Nadu	Kerala
1960-61	38	34	60	30
1964-65	57	52	63	37
1968-69	78	70	226	66
1972-73	97	117	143	76

The KSSP makes a detailed study of this paradox in its technoeconomic assessment and it remains the best analysis of the energy situation in the state—one which the Menon report borrows heavily from. The present installed capacity in Kerala is 1,000 MW, with a "firm" power—roughly speaking the average output—of 533 MW. The average generating capacity is 4,730 million units (MU) and the maximum recorded generation 5,200 MU per annum. The first



Some bigger trees were cut in anticipation of dam being built  
(Denzil Siqueira/SSVC)

Table 3: Per Capita Electricity Consumption:  
India and Some Developed Countries: 1971 (in kWh)

Country	Per Capita Consumption
1. Norway	25400
2. Canada	10000
3. USA	8350
4. Sweden	8250
5. Switzerland	4560
6. UK	4290
7. USSR	3050
8. Italy	2220
9. India	90

(Source: The SV Hydroelectric Project: A Techno-Economic and Socio-Political Assessment, KSSP, July 1979)

phase of Silent Valley consisted a 120 MW power station (when the project was revised, on the advice of the Central Electrical Authority, this was doubled to 240 MW), capable of developing 60 MW of firm power; this is equivalent to 522 MU per annum. If one takes the entire southern region's power grid (in August 1980), the installed capacity is 7,270 MW and Kerala's contribution to it is only 14 per cent. By the end of March 1985, with its capacity having risen to 1,136 MW, Kerala's share in the grid would drop to less than 10 per cent of the total 12,000 MW in the south. If Silent Valley's first stage was completed by then, this project would have contributed less than 1 per cent to the grid. This puts the claims of the KSEB regarding the importance of going ahead with this particular scheme in a somewhat different light. A KSEB pamphlet, published in 1976, itself lists 23 future hydel schemes in addition to Silent Valley, which have a combined installed capacity of 2,870 MW.<sup>14</sup>

The KSSP's thinking on energy has been largely influenced by V.K. Damodaran, who was himself an electrical inspection engineer before becoming a lecturer in the Calicut Regional Engineering College. The Parishat's document carefully dissects what Kerala's total energy demand and supply situation is. Three significant features are: the extremely low consumption of coal; the

very small percentage of cow dung used as fuel compared with the rest of India and dependence on firewood. "Ecological impact apart," it points out, "the cost of firewood forms the costliest source of heat energy. It has gone up to Rs 240 per tonne. Coal from Orissa costing Rs 80-100 per tonne at pithead can be transported to Kerala at a lower total cost . . . Transportation of coal, especially of poor grade with large amounts of ash content, over long distances has always been considered wasteful. So much so that energy planners have formed an almost religious belief that it is sinful to think of transporting coal to Kerala." As early as in 1976, the KSSP made out a case for bringing coal to Kerala.\* According to the Menon report, the demand for power in Kerala has grown at an average of 6 per cent per annum in the 'seventies and consumption in 1978-79 was 2,420 MU. Assuming a higher annual growth rate of 11 per cent, the demand in 1983-84 would be 4,000 MU, which is well within the current potential (the draft report was written late in 1981) maximum generation of 5,200 MU. Even so, the report cautions that there are no major schemes to meet the likely substantial deficit around 1989-90. Sooner, rather than later, Kerala's hydel capacity will be exhausted and the state will have to turn to thermal energy. Apart from the difficulty of obtaining coal, this form of power generation is extremely polluting, which is why the KSSP has suggested offshore generating stations. The technology does not exist for curbing emissions from thermal stations. By the end of 1984, the Kerala government was itself pressing the Centre to set up a thermal unit in Cochin. Balakrishna Pillai had even staked Kerala's claim to a 1,000 MW nuclear power station, which is now raising another major environmental controversy!

When I met Thrivikraman Nair, other KSEB officials and Balakrishna Pillai in February 1982, a repeated refrain, almost Orwellian in its ominousness, was that Kerala was heading for a power "famine" by 1984. In fact, with the countrywide failure of the monsoons in 1982-83, that year was brought forward and Kerala was forced to impose power cuts for the first time since 1967 when the Sabarigiri scheme was commissioned. Surprisingly, when I paid another visit to Kerala exactly a year later in February 1983, when

\* Engineers India Ltd, the public sector consultancy firm, has recommended the building of a 2,000-km-long pipeline to carry coal, as slurry, from Orissa to Punjab and another 1,800-km-long pipeline from Orissa to Gujarat for the same purpose! In any case, the Tuticorin thermal power station in southern Tamil Nadu is delivered coal. Coal can also be transported by sea.



the state was in the throes of drought, no one in the KSEB was triumphant that its direst predictions had proved correct. The state government estimated that the drought would cause a loss of Rs 1,000 crore—including Rs 400 crore on crops lost. It was the worst water shortage in living memory: 1,341 out of a total of 1,362 villages in the state were declared affected. The KSEB finally had to resort to the drastic step of a total power cut for high tension consumers: industries which had been limping along with partial cuts came to a total standstill; shops and offices had to close by 8 pm and cinemas were allowed just one show a day. The Cochin oil refinery had to close down temporarily. Four lakh industrial workers lost their entire wages for a month, while farm labourers had to go without work for long periods because of the failure of the rains. Palghat and Kuttanad districts—the two rice bowls of Kerala — were particularly badly hit; the latter was already reeling from a severe environmental catastrophe when it was drained for cultivation and subsequently afflicted by salinity.

For the first time in the state, even common people became aware of the vital role of forests in maintaining the flow of waters in the rivers. The heavy deforestation throughout the state was held responsible for worsening the situation. According to Damodaran, the cutting of trees in the catchment areas of Kerala's major hydel projects had increased the "run-off" rate of water; with trees, water is retained in the soil and percolates steadily throughout the year into the reservoir. The impact of rain on the soil is also smothered by leaves. Damodaran put forward this calculation: in November 1981, all reservoirs in the state were full after a good monsoon that year and they were 80 per cent full in August 1982. In other words the reservoirs should have been capable of supplying Kerala's needs at least till March 1983. Besides, the siltation of the reservoirs — again thanks to deforestation—is high and the KSEB has never bothered about this so far. Despite the failure of the south-west monsoon, it continued to export power for some months in the hope that the winter rains would make up the deficit; it stood to lose a revenue of Rs 35 crore because it could not sell its power to Tamil Nadu and Karnataka. In fact, in August 1983, Kerala was buying power from Maharashtra at a cost of Rs 3.5 lakh per day. Thus, environmental neglect has been compounded by the mismanagement of water resources.

The Menon report concludes: "The energy contribution of Silent Valley (500 MU) cannot even meet one year's growth in the

state." It cites the Puyankutty hydel project, with 1,750 MU and an installed capacity of 750 MW, as well as the Perinjankutty scheme (1,600 MU and 400 MW), which can be completed within eight years of commencement, as being capable of meeting Kerala's needs to a large extent, both as regards total power and "peaking" (the variation in demand with industrial and domestic use at different times of the day). Puyankutty in Idukki district was given the go-ahead early in 1984.

What about the energy needs of Malabar specifically? The backwardness of this region can be traced to its neglect when it was part of Madras state (as against the more prosperous former princedoms of Travancore and Cochin to its south). The Menon report shows that less than one-fifth of Kerala's electricity is being consumed in this northern region. As the KSSP notes, there are socio-economic reasons for this: the Alwaye-Cochin region, in the middle of Kerala, consumes most of the power with units like the giant fertiliser factory FACT, Indian Aluminium at Alupuram (near Alwaye) and Travancore Electrochemicals (which alone gobbles 25 MW for three furnaces, employing just 500 persons). The original project report for Silent Valley in 1973, significantly enough, states categorically that the project is justified because it is being "considered mainly to meet the rapidly growing demand for power in the southern part of the southern region (of the country) which is relatively energy scarce." However within Kerala, this demand for industrial purposes can be best met by the second stage of Idukki (390 MW), and by augmenting the capacity of other large projects like Sabarigiri and Kuttiadi. Existing reservoirs can usually be made bigger. Claims the KSSP: "Obviously, it is not lack of generation of electrical energy as such that contributes to this backwardness of Kerala in general and Malabar in particular. In fact, Kerala's internal energy consumption is only half its generation. Another 20 per cent is 'lost' in transmission and distribution." This 20 per cent represents 200 MW of the total installed capacity—more than the contribution of Silent Valley. It argues that the bulk of the KSEB's resources has been spent on generation of power, ignoring transmission and distribution.\* It is as a result of the KSSP's constant criticism on this score that the KSEB now spends half its funds on transmission and distribution, as against 40 per cent previously.

\* One reason, allegedly, are the kickbacks that civil engineers can earn from the construction of a large dam, as well as their expanding promotion prospects on the completion of each such project, both of which they hotly contest.

"The problems of Malabar are only a magnified version of the situation of Kerala as a whole," says the KSSP. I took Damodaran's advice and visited a village right next to Idukki, which supplies 40 per cent of Kerala's power. Poochapara was a tribal tract just 3 km from Idukki—it still had no electricity when I visited it in 1982. The villagers had applied for an electric connection in 1978: it had been conceded "in principle" after several years. More than half the village cannot read or write: "We feel we're still living in slavery like we were under the British, despite independence," a villager asserted. "Sometimes we feel that we're not part of India, that we belong to another world." Kochukoshy was obviously sensitive to criticism regarding the Kerala government's claim that all its villages were electrified; he writes that every revenue village was connected, "not every nook and corner of Kerala". Power engineers emphasised that it was not possible to electrify every remote area because power had to be supplied to the grid, as if the very existence of the grid implied a technological imposition on the people! In effect, this means that even if a village is on the grid, a person cannot afford to connect his house to the nearest cable.

Malabar, consisting of the four revenue districts of Cannanore, Calicut, Malappuram and Palghat, occupies nearly half the area of Kerala and accounts for 40 per cent of its population. Damodaran sees the immediate solution to its power needs in the setting up to 220 kv, 110 kv and 66 kv substations, for which Rs 40 crore was sanctioned in the Fifth Plan. These will do more to improve the power position in these four districts than time-consuming and expensive hydel projects. As the Menon report recognises, if losses in transmission are reduced to 10 to 12 per cent, 400 to 500 MU will be saved—almost as much as what Silent Valley will contribute. The longer term solutions are to take up other schemes like Pandiar (70 MW), Chalipuzha (60 MW), Cholatipuzha (60 MW) and Mananthavady (240 MW). The last, to the far north of the state, is most frequently cited as an alternative to Silent Valley but the KSEB correctly points to the difficulties of implementing it because of water-sharing problems with Karnataka and Tamil Nadu. The Centre is now being pressed to clear this Rs 100 crore project. "Ever since Idukki was commissioned in 1976," the subsequent Chairman, K. Ramabhadran Nair, complained to me, "the KSEB hasn't been able to build a single storage reservoir due to various reasons—including environmental problems. All projects have got

bogged down because of inter-state disputes or forest laws." The last is a reference to the Forest Act of 1981 which has virtually put a stop to all felling by the Board without the sanction of the Forest department. The Industrial Disputes Act, in a volatile state like Kerala, is also playing havoc with the execution of projects.

Apart from energy, there is the question of irrigation—one of Silent Valley's spin-offs. The Menon report questions the basis on which the Board estimates that 10,000 hectares will be irrigated by the tailrace waters of the dam. It points out how all Kerala's major river valley irrigation projects were expected to cover 2 lakh hectares of land, while they actually serviced less than 90,000 hectares (and that too, not sufficiently and at the required time). Almost all irrigation schemes started in Kerala during the Third Five-Year Plan are still incomplete. One should add that big irrigation schemes in the country as a whole have also been planned badly; the Public Accounts Committee reported to the Lok Sabha in April 1983 that against a plan target of 60 million hectares over three decades, only 39 million hectares have been irrigated. As we have seen in the introductory chapter, D.R. Bhumbra of the Society for Promotion of Wastelands Development has also produced a deluge of statistics to show that the country has spent Rs 12,000 per hectare of irrigated land with precious little to show for it. Besides, a confidential note from an investigator on behalf of the Central Ground Water Board to the Agriculture Ministry, presumably at the request of Dr M.S. Swaminathan, clearly cautions against the possible hydrological impact of a dam like Silent Valley: "By the introduction of an artificial barrier into a natural system through the construction of a dam, the surface water is being impounded ... which not only disturbs the natural hydrological regime but also affects the ground water conditions of the area concerned. The water level in the region below the dam is lowered and thereby the soil moisture is reduced and plant and animal life directly affected." This is plainly visible below the Idukki reservoir, as well as in dams in the Ashambu or Agastyamalai hills where I spent a week trekking with Rauf Ali in March 1983.

Swaminathan in his report calls for a detailed survey of the Palghat and Malappuram districts so that the available ground and surface water can be used for irrigation as much as possible. The KSSP makes out a good case for installing 10,000 pump sets to provide lift irrigation in Malabar region and points out that,

contrary to the scepticism voiced by KSEB engineers about the possibility of tapping such resources, a Coimbatore-based organisation has successfully started two tubewells—one near Nemmara, not far from Palghat town—and sold them to the Irrigation department. Incidentally, there was a frantic search for ground water in the three southern states of Kerala, Karnataka and Tamil Nadu during the drought of 1983.

The generation of electricity is now so much a part of the mythology of economic development—witness Lenin's famous dictum: "soviets plus electrification equals socialism"—that fundamental questions regarding its costs and benefits are seldom raised. If Silent Valley was a beginning in such heresy, the exercise was carried several steps further in the Bedthi controversy in the North Kannara (renamed Uttara Kannada) district in Karnataka. While Silent Valley attracted headlines as much for its evocative name as any other factor, hardly anyone outside Karnataka has even heard of the hydroelectric project proposed on the Bedthi river, otherwise known as the Gangavali scheme. Nevertheless, it has come to be known, in environmental circles, as Karnataka's Silent Valley. "Silent Valley has done a disservice in certain ways to other areas on the western ghats with equally good forests," grumbles Fr Saldanha, who runs a centre for taxonomy at St. Joseph's College in Bangalore. He mentions dams across the Varahi and Kali rivers in Karnataka where virgin forest has been destroyed. "Bedthi is different: to produce 210 MW of power, 10,000 hectares of prime forest will be inundated. The Karnataka Power Corporation (KPC) is given a mandate to improve the power position. Given its narrow vision, it has looked at every source of hydel power and all other issues are secondary." Karnataka was the first state in India to exploit hydel power, way back in 1902, and its potential is now over 6,200 MW—half that of the southern region as a whole. Work on the first stage of the Rs 140 crore Bedthi project began in 1977 and Rs 5 crore had already been spent on it in four years when it was halted because of objections raised by Bangalore environmentalists and a fierce campaign against it by rich cultivators known as *totgars* in the nearest taluka town of Sirsi. These politically powerful *totgars* were able to organise an impressive seminar in Sirsi on the implications of hydel projects in Uttara Kannada in January 1981, where the costs and benefits were meticulously analysed. The papers have now been published in a book titled *Major Dams—A Second Look*.<sup>15</sup> This

was followed up a couple of months later with a memorandum to K.C. Reddy, Chairman of the KPC, signed among others, by Zafar Futehally, Madhav Gadgil and D.K. Subramanian from the School of Automation in the Indian Institute of Science (the latter served briefly as Additional Secretary in the newly-created DoE in the State) and Vijay Paranjpye, formerly of the Gokhale Institute of Politics and Economics, Pune. They point out that the loss of the net annual yield from the 10,000 hectares of forest—estimated at Rs 3 crore by the Forest department—has not been taken into account; neither has that from 2,500 hectares of agricultural land, valued at Rs 25 lakh a year. Similarly, if losses on fuelwood and grazing, and the cost of rehabilitation are added, the benefit-cost ratio comes to 0.86, which is far less than the minimum of 1.5 prescribed by the Planning Commission for approving any project.

These "environmental planners", for lack of a better word, were guided by Paranjpye, who has presented a detailed economic analysis in his paper called "The Woes of Gangavali". They draw attention to other anomalies, which are contrary to the national planning objectives: the benefits of the hydel scheme will flow to the urban elite and the direct and indirect costs will be borne by the rural poor. A very large and important natural resource, forests, will be irretrievably lost; since the detailed project report was made in 1977, inflation will raise the cost of generation from 14 paise per unit of electricity to 25 paise. They cite various environmental consequences as well, like the siltation of reservoirs (they mention how the actual sedimentation rate in 17 reservoirs in India is 2.17 times the expected rate, according to the Irrigation Ministry), which shortens the life of a reservoir considerably and makes it less attractive, economics-wise.

But the most incisive argument relates to how the project will disrupt the area's economic balance. Taking the country as a whole, Paranjpye shows how in the last three decades, India's per capita income had risen from Rs 235 in 1951 to Rs 341 in 1975, taking 1961 prices as the base, but this had not prevented 40 per cent of the population from staying below the poverty line. "What is happening at the national level is also being reflected in the states," he asserts. "In Karnataka, for example, the per capita expenditure at constant prices has actually gone down in rural areas." By 1976, a villager in that state spent only Rs 16 on food a month and Rs 5 on all other items, as against Rs 18 and Rs 8 respectively in 1951. His expendi-

ture on energy (or rather fuel, consisting of firewood, gas, electricity, kerosene and cowdung) also declined from Rs 1.66 to Rs 1.23 per month in the same period, even though Karnataka dramatically increased its electricity output ten-fold, from 439 million kWh to 5,380 million kWh during that time. Industry, incidentally, has grown at twice the rate of agriculture; the KPC—like its southern counterpart, the KSEB—is loathe to go in for rural electrification. Astonishingly, two units in the state—Indian Aluminium in Belgaum and the Bhadravathi iron and steel works founded by Visvesvaraya—consume a quarter of the total power. And one reason for locating the energy-intensive project at Belgaum is to assuage the feelings of local people who have long been plagued by border problems with Maharashtra. This “sop” to local sentiment is a familiar refrain in big development projects, as we shall see in Thal-Vaishet as well.

What are the alternatives to schemes such as Silent Valley or Bedthi? Paranjpye suggests run-of-the-river and micro-hydel plants with small generating stations along the initial course of the Bedthi with capacities ranging from 12 kW to 1,500 kW, which would require small bunds or tanks to store monsoon water as well. These tanks would be used for irrigation and the power would be employed for developing local resources, creating employment. “It is interesting to note,” says Paranjpye, “that in China, 86,400 mini-plants are presently in operation, generating 10,000 gigawatt hours (1 gWh = 1 million kWh) of electricity.” The KPC has itself identified a micro hydropotential of 750 MW from irrigation canals in the state, while the KSEB believes the mini and micro potential in Kerala is 300 MW. Besides, thermal power can be supplied from the station that the KPC is contemplating at Raichur, using coal from some 600 km away in Andhra Pradesh.

The KPC asked the Administrative Staff College of Hyderabad to prepare an environmental impact assessment and claims that it has okayed the Bedthi scheme. But it will not get off the ground so long as the present Chief Minister, Ramakrishna Hegde, of the Janata Party, remains in power: he comes from the area—the Hegdes are influential Brahmins—and was asked to intervene when he was in the opposition by a local Janata leader. “The *totgars* feel that their whole way of life is threatened,” says Saldanha. “They have made out that they will be the biggest losers whereas investigation reveals that it will be the Forest department.”

### **Boon for whom?**

If Silent Valley and Bedthi pose the energy dilemma in different terms, they also throw up many questions about what energy is supposed to promote—economic development. Comparisons between Silent Valley and similar big development projects elsewhere in the world are inevitably made. They are seen as a bane or boon, depending on the viewer; a choice between preservation or progress. Thus the KSSP refers glowingly to how the US Supreme Court in 1978 ordered the dismantling of the \$116 million Tellico dam across the Little Tennessee river to save the tiny snail darter fish, which was threatened in the reservoir. The Tennessee Valley Authority was given the go-ahead later, only after it had shifted the tiny fish to a safe habitat: the case is often cited in the West as an example where environmentalists get blinded to economic realities by their excessive zeal. Even groups like the Sierra Club are not sure whether it did good or harm to their cause. Similarly in 1967, two dams across the Colorado river in the Grand Canyon, Arizona, were halted because of their threat to wildlife, as was the Rampart dam across the Yukon in Alaska. In Thailand, environmentalists are fighting against the Nam Choan hydel project because it will dam some 14,000 hectares of "one of South-East Asia's last *primaeval* forests" to produce power. Indian newspapers have already headlined the story "Thailand's Silent Valley" and quote the British WWF Chairman as saying: "How can a few people with bulldozers tear up what belongs to future generations? In terms of cost-benefit, the dam is unjustifiable." Interestingly, the Thai electricity authorities are asking whether they have to choose between animals or human beings, while an environmentalist points out how countries such as India, Indonesia and Malaysia are having second thoughts about major dam projects and seeking alternative, less destructive energy sources.

On the other hand, Balanandan, the former CPM MP from Kerala, quotes the well-known writer on environment, Asit K. Biswas, on the Aswan High Dam: "A discussion of the environmental effects of the Aswan High dam is not meant to be a total condemnation of the structure, nor does it imply that it should never have been built. The benefits of the dam are many, and as in any other project, the benefits and costs should be compared." Several of the undesirable consequences of the Aswan dam were in fact predicted and on balance, it has brought a great deal of



prosperity to a poor region. Much of the analysis of these big multi-purpose projects centres around how a compromise can be struck between the apparently conflicting demands of environment and development. Very seldom are the postulates of development itself questioned.

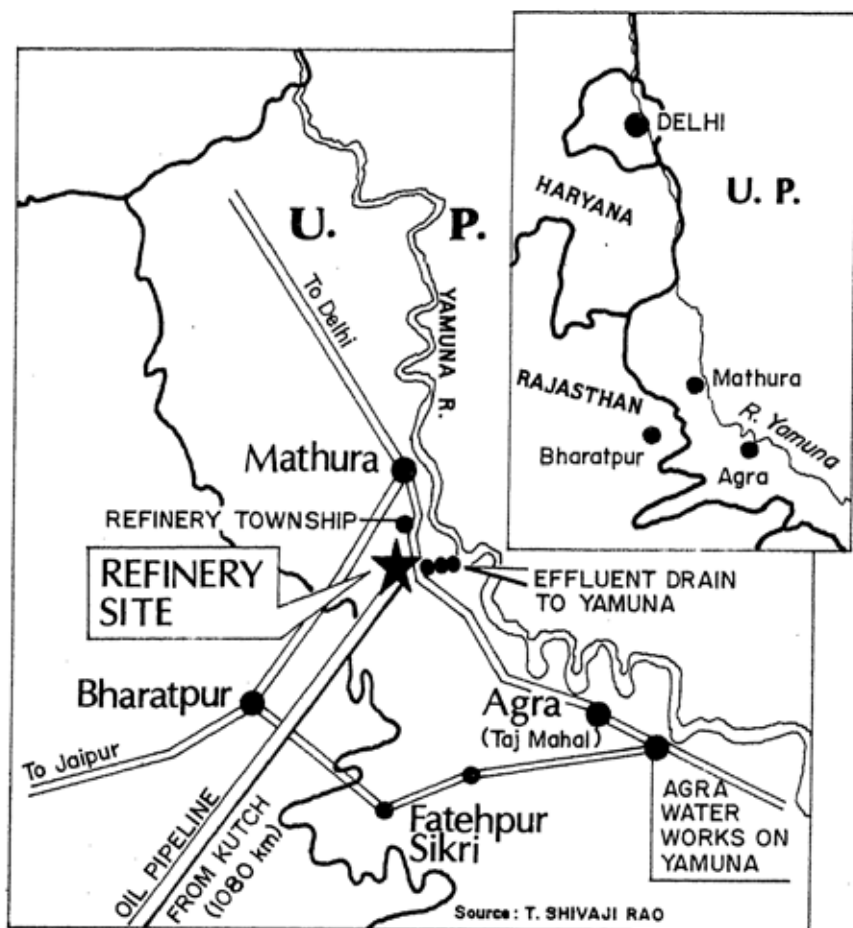
In Kerala, Govinda Pillai, once editor of *Deshabhimani*, puts it well: "There was a lot of cheap rhetoric about Silent Valley: trees or human beings, monkeys or men. Kerala moans about industrialisation at any cost, any attempt to deprive the state of its legitimate rights. If everyone, including scientists and the KSSP, woke up to the dangers of the Silent Valley project too late, how can political activists, who are so worried about Kerala's development, be blamed? In a speech, I made a funny analogy: I said if a minister offers to start a factory to manufacture gallows, any Keralite will not only jump at the idea but demand that it be located in his village!" The problem is that development is seen as synonymous with industrialisation and electricity as the essential ingredient in such a blueprint for advancement. And yet, as the Menon committee points out, there is the paradox that a district like Idukki produces 75 per cent of the state's electricity but has the lowest industrial growth, measured in terms of the number of industrial units and employment.

Kerala's situation is such, as we have seen earlier, that over 70 per cent of its power is consumed by industries all located in the Alwaye-Cochin belt, in the centre of the state, which makes for serious regional imbalance (a phenomenon that is much more acute in Maharashtra, as Thal-Vaishet underlines). This, in spite of the fact that Kerala enjoys a curious "rural-urban" mix where one never knows when a village merges into a town and vice-versa. Given its very high population density of 1,127 people per sq km and 66 per cent literacy, as also the tremendous emancipation of women, all of which make the state a leading exporter of labour to the rest of India, the Gulf and even the West (as nurses), it is puzzling that it has not developed faster industrially. Power, a major obstacle in other states, was till recently at any rate in plentiful supply. One reason is that with social and political progress, such as is not visible anywhere else in India, workers' expectations have risen very high and no industrialist wants to invest in a state where he will be constantly plagued by strife. This is the effect, rather than the cause: Kerala would not be racked by such strife if its highly

conscious population had ample employment opportunities within its home state.

Alternative paths are the only option left to the state. As a joint study<sup>16</sup> by the highly respected Centre for Development Studies in Trivandrum suggests, there is need for a shift in the present pattern of energy consumption where large enterprises enjoy access to high voltage transmission at a rate of just 19 paise per unit—the cheapest industrial hydel power in the world!—as against 31 paise for domestic consumers. Till today, nearly one-third of the total development expenditure in Kerala's state plans has been on one sector alone—power. The study makes a good case for decentralising industries which, by very definition, will have to be small-scale and therefore less energy-consuming. This means that very many more people will be employed on a regular basis. Kerala, as its name implies, is the land where coconut thrives, along with other cash crops such as cashew. With proper organisation, there is a vast scope for agro-based industries and processing units based on such plantations. Being a narrow state with a coastline that runs down its length, fisheries are another untapped industry. And for the thousands of well-educated men and women who are now compelled to seek employment outside, electronics and other highly-skilled assembly units are an obvious choice. In other words, Kerala's unique resources—a literate work force, cash crops and last but not least, abundant electric power—could be put to much better use than they now are.

Such a decentralised approach is bound to be viewed as starry-eyed, if not downright reactionary, a return to "small is beautiful" economics. But one has only to study the experience of large multi-purpose projects in Kerala like Idukki, where the environment has been devastated by the building of a new township as the headquarters of an entirely unnecessary new district, or the fate of the massive Birla-owned Gwalior Rayon<sup>17</sup> pulp unit in Mavoor, near Calicut, which has been repeatedly shut down because of protests against the indiscriminate disposal of its toxic effluent into the Chaliyar river, to realise not only that big is often ugly but illusory as far as benefits to local people are concerned. Silent Valley, now happily protected, has provoked a major debate on these issues, and on this count alone the protracted controversy can be said to have served a very vital purpose in a country where people repose so much faith in big development schemes.



The Mughal emperor Aurangzeb wrote a letter to his renowned father, Shah Jahan, whom he had incarcerated in the Agra fort, detailing what he had observed on a Friday when he made a pilgrimage to the “illustrious sepulchres and gained the blessing of paying homage to that holy shrine”—the Taj Mahal. “The dome is leaking in two places, from the arches and galleries. The buildings in the sacred enclosure stand exactly as they were completed in your Majesty’s august presence,” he reported, “except that the master builders state that if the roof of the second storey is opened out and treated with concrete, over which half a yard of mortar grout is laid, it is probable that the semi-domed arches, the galleries and the smaller domes will be set right, but they confess their inability to prescribe any corrective measures in respect of the main dome.

“My revered guide and benefactor,” intoned the heartless Aurangzeb, “may you live long! This great edifice has curiously sustained some injuries but it is believed that if the pious disposition of the Emperor inclines to its repairs, the defects will forthwith be set right.” Such solicitude would have appeared touching were it not for the knowledge that Aurangzeb—sickened, among other things, by the tremendous expense (estimated at as much as six crore rupees in those days), incurred by his father on his beloved wife Mumtaz Mahal’s mausoleum—had imprisoned Shah Jahan for eight years till the latter died in 1666. Shah Jahan had built the “miracle in marble” to keep alive his memory of Mumtaz, who died giving birth to their fourteenth child in 1631; the Taj Mahal was completed over 22 years, with the labour of 20,000 men.

Three and a half centuries later, the Taj Mahal still draws sighs of ecstasy from those who behold the magnificent monument. But, just as Aurangzeb drew Shah Jahan’s attention to defects which threatened to disfigure the marble structure only a few years after it

was completed in 1654, the Taj has been imperilled on certain occasions. After a century had lapsed, the Jats captured Agra and sacked Agra Fort. They camped in the Taj Mahal itself and burnt hay within the mausoleum to keep themselves warm; they carried away its finest gems and silver gates.

A more gentlemanly but nonetheless sinister threat came from the British. By the nineteenth century, the grounds of the Taj Mahal were used for open-air "frolics". Outdoor balls were held on the marble terrace in front of the main door; the mosques on either side of the Taj were rented out to honeymooning couples! "At an earlier date, when picnic parties were held in the garden of Taj," recalled Lord Curzon early this century, "it was not an uncommon thing for the revellers to arm themselves with hammer and chisel, with which they whiled away the afternoon by chipping out fragments of agate and carnelian from the cenotaphs of the Emperor and his lamented Queen."

One of Curzon's predecessors, however, very nearly presided over the liquidation of this noble edifice in the 1830s. Lord William Bentinck, the first Governor General of India, announced his intention to demolish the best Mughal monuments in Agra and Delhi and remove the marble facades. The idea was to ship them to London, where they would be sold in fragments. Writes David Carroll,<sup>1</sup> "Several of Shah Jahan's pavilions in the Red Fort at Delhi were indeed stripped to the brick and the marble was shipped off to England (part of this shipment included pieces for King George IV himself). Plans were then made to dismantle the Taj Mahal and wrecking machinery was moved into the garden grounds. Just as the demolition crew was setting to work, word came from London that the first auction had been a failure and that all further sales were cancelled—it would not be worth the money to tear down the Taj Mahal." Incidentally, the Earl of Moira—otherwise known as Warren Hastings—did dismantle the marble bath in Shah Jahan's palace and ship it to his sovereign in England.

The most recent threat to the Taj is far more serious. It surfaced, unobtrusively, in the shape of what Nehru would certainly have considered one of the temples of modern-day India—an oil refinery at the town of Mathura, 40 km as the crow flies from Agra and 160 km from Delhi. Although no one in the Central government or the public sector petroleum industry had the slightest inkling at the time, the location of the refinery so close to the Taj poses a danger

to it. Fumes emitted by its smoke stacks may easily traverse this distance and descend on the monument; over a period of time, these can stain the marble facade. The dilemma was well summed up by Salim Ali, who wrote in August 1977 to the Indian Oil Corporation (IOC), which has erected the 6 million tonne refinery (India's largest) at Mathura: "Considering the supreme gravity of the hazards involved, many of us would like to be convinced that it is really so vitally essential to site the refinery at Mathura only, and that nowhere else in the whole of the northern region will do. Granting that an element of every possible precaution is scrupulously taken, there still remains incalculable risk since neither the expert committee (which went into the impact of the refinery) nor we ornithologists are prophets or crystal gazers. Under the circumstances, would it perhaps not be advisable to make a second more thoroughgoing effort to find a less risky site for the refinery and thus allay the not unreasonable doubt and anxiety of the vast number of people like myself to whom such things are of more vital concern than any economic consideration whatsoever?" Salim Ali, it must be clarified, was equally concerned about the repercussions on the world-famous Bharatpur bird sanctuary, which roughly forms an equidistant triangle with Mathura and Agra, each 40 km away.

"The need for an oil refinery in the north-west of the country was talked about since 1964," says S.K. Nayak, who was General Manager of the Mathura refinery right through the controversy over its location till 1982; it was fully commissioned in May 1983. It had been officially recommended by a government committee in 1966 and endorsed by another which had to determine the additional refining capacity in the country. The IOC submitted a feasibility report in 1971, suggesting that it be located around Delhi—Shakur Basti on the outskirts was cited—so that existing oil depots and other facilities could be used. Ultimately, it was decided to move the refinery out of Delhi for military and strategic reasons: if the capital was bombed, the oil refinery would be an obvious target. The Centre asked the experts to choose another location between Delhi and Agra. After considering other sites, including Hissar, Sawai Madhopur, Aligarh, Etawah and *Agra itself*—as well as the possibility of another state, Madhya Pradesh—the experts opted for Mathura. Obviously, the authorities were blissfully ignorant of the possible pollution, considering that Agra was a tentative location. Mathura was located "centrally within the demand area"

for petroleum products in the north-west; moreover, it enjoyed access to both broad and metre gauge railway lines and was on a national highway (the old Grand Trunk Road, dating back to Mughal times, which today takes tourists from Delhi to Agra).

As the feasibility report noted, the demand for petroleum products established beyond doubt that a fairly large refinery should be built in the region as early as possible. Any delay would lead to an enormous loss of foreign exchange on imports of these products and curtail the economic growth of these states. The difference between the import price of 6 million tonnes of crude and an equivalent amount of petroleum products would give an idea of the quantum of exchange involved. The north-west, it must be recalled, was where the so-called Green Revolution, based on new high-yielding varieties of wheat, had taken off since the mid-'sixties. The new agricultural techniques called for new inputs; the land had to be irrigated, so that pumps run on diesel had to be installed; the land had to be fertilised, which meant that fertiliser based on fuel oil or naphtha, one of the heavy distillates from an oil refinery, was required. Punjab, Haryana and western UP were where these products were most in demand. Instead of obtaining supplies of products by train or truck from refineries on the west coast in Baroda and Bombay, crude oil would be unloaded from tankers in the Gulf of Kutch at Salaya in Gujarat and transported by pipeline 1,080 km to Mathura.

IOC received the green signal from the Central Government to go ahead with the refinery in August 1973; it was to cost Rs 97 crore and process 6 million tonnes of crude a year initially, to be expanded to 10 million tonnes eventually. In the normal course of things, it should have been completed, as scheduled, in 1978. But the oil price hike by OPEC countries caught the government napping. It had suddenly to pay a whopping import bill for crude oil and the demand for petroleum products within the country dropped sharply when prices were raised. Faced with this "negative demand" and a general shortage of funds, the government kept its decision on the Mathura refinery pending.

Just before world events caught up with the project, Mrs Gandhi laid the foundation stone in October 1973. But rumblings against the likely pollution that the refinery would cause were already beginning to be heard: one of the first to raise the issue in the press was a naturalist, Asad Rafi Rahmani, who wrote protest letters to

newspapers in Lucknow, the state capital. Questions were raised in parliament and the government denied that it was going to do any damage. However, this was an instinctive response since there was no empirical data at that stage to support either point of view.

It was Prof J.M. Dave, presently Dean of the School of Environmental Sciences at the prestigious Jawaharlal Nehru University (JNU) in New Delhi, who first raised grave doubts about the impact of the Mathura refinery. He claims that as far back as in 1969, when he was an environmental adviser to the Central government, he wrote a note to Uma Shankar Dikshit, who was Works, Housing & Health Minister, asking him not to go ahead with a petrochemical complex at Mathura.\* A man not known for his modesty, Dave believes he was solely responsible for raising the Taj issue. Dave headed the Air Pollution Division of what was later renamed the National Environmental Engineering Research Institute (NEERI) in Nagpur; at the time, it was known as the Central Public Health Engineering Research Institute, more commonly by its ungainly acronym, CPHERI. In fact, Dave was later acting Director of NEERI and was in the running for the post, but his outspokenness, among other factors, cost him the job. In fairness to him, it must be said that he was better qualified than anyone else to head the organisation.

Before the foundation stone of the refinery was laid, Dave wrote to the Prime Minister, expressing his fears. Her office asked the Petroleum Ministry to look into it. The ministry, in consultation with the NCEPC, had formed an informal committee for this purpose: it consisted of M. Kurien, the Adviser to the ministry, Ashok Khosla and Dr C.K. Varshney (Associate Professor of Environment at JNU) from the NCEPC, Dr A.K. Ganguly from the Bhabha Atomic Research Centre (BARC) and Dr P.K. Das from the Indian Meteorological Department (IMD). Dave was informally consulted too. The committee realised that it had first to find out how to estimate the quantum of sulphur dioxide or SO<sub>2</sub> that would reach Agra from the refinery 40 km away. Das, in consultation with Khosla, worked out a theoretical model to ascertain this.

Apprehensions were growing about the safety of the Taj Mahal and other monuments in Agra — notably the Agra Fort, Itmad-ud-

\*According to Dave, the minister agreed not to. However there is considerable scepticism in the DoE and IOC about the existence of such a note.



Daulah's tomb and Akbar's tomb at Sikandra, on the outskirts of the town—as well as in Fatehpur Sikri (which lies along the way to Bharatpur). Questions were being asked in parliament and letters published in the press. According to the late S.N. Chib, Vice-President of the Indian Heritage Society (IHS), which was formed later to save the Taj, among other sites, questions were asked at least six times in the Rajya Sabha by Khurshid Alam Khan, later Union Minister of Tourism. Petroleum Minister D.K. Barooah called a meeting in September where officials from the NCEPC, BARC, and IOC were present. The consensus was that technology for keeping the emissions of gases within desirable limits for the preservation of monuments was available. Barooah directed IOC to “take the necessary precautionary measures to ensure that the effluents discharged into the atmosphere will not have any adverse effect on the monuments at Mathura and Agra.” Many people, especially devout Hindus, were equally concerned about the well-being of temples in Mathura—Vrindavan, the birthplace of Krishna, is revered by thousands throughout the country.

Meanwhile, the Archaeological Society of India (ASI), founded in 1861 and a venerable institution in its own right, also began taking note of the threat to the Taj. R. Sengupta, later Director of Conservation in the organisation, was most deeply involved. To dispel its own fears, ASI commissioned NEERI to do a survey of air pollution near Agra's monuments. The main fear was of  $\text{SO}_2$ ; its source was fuel burnt for distillation—crude oil is heated to yield a range of petroleum products, from liquefied petroleum gas “at the top of the barrel” to heavy distillates like diesel. An additional source of  $\text{SO}_2$  was the power plant at the refinery, where coal could be burnt to generate steam.

It took quite some months for NEERI “to get its act together” and the survey was conducted only in December 1974. The findings were officially released six months later. It was all too brief and inadequate, extending over 15 days at the height of winter. This is the worst season of the year for air pollution, since winds are very low; by contrast, summer winds are much more gusty and can therefore disperse pollutants. In the monsoons, on the other hand, the danger is least because rains help noxious gases to precipitate quickly before they can travel. Once  $\text{SO}_2$  is air-borne, it can convert to sulphurous acid ( $\text{H}_2\text{SO}_3$ ) on contact with moisture; with yet more vapour, it turns into the highly corrosive sulphuric acid ( $\text{H}_2\text{SO}_4$ ). If this descends on stone like marble, which is calcium carbonate, it

can form calcium sulphate or gypsum, rendering what was once bright and translucent — indeed the Taj is luminous on moonlit nights—into a dull, opaque surface. What if the monument lost its lustre?

### **Expert committee**

With concern about the possible damage to the Taj mounting month by month, the government felt compelled to appoint an expert committee to examine the issue. The committee was constituted in July 1974. Its terms of reference were not to see whether the refinery should be shifted, as environmentalists and other public-spirited citizens were demanding, but “to advise the project authorities on the measures to be taken for keeping the pollution effect (sic) to the absolute minimum.” Thus the intention of the government was clear: having spent a great deal of time and energy on choosing a suitable site and preparing a feasibility report, it was in no mood to consider going through the whole exercise at another location. At that stage, only Rs 1.5 crore had been spent on engineering works etc at the project, according to IOC.

The committee was to be headed by Dr S. Varadarajan, then Chairman of the Indian Petrochemicals Corporation Ltd (IPCL)—a giant public sector concern linked to the Baroda oil refinery and one of the biggest such complexes in Asia. Apart from Kurien from the Petroleum Ministry, it had representatives from NEERI, NCEPC, the Indian Institute of Petroleum (IIP), IMD and UP government. Nayak was to act as the member secretary. On the face of it, given the terms of reference of the committee and the loyalties of its members, its impartiality was highly suspect. Long after the Varadarajan committee submitted its report three years later in 1977 (it was only published by the government in 1978), I wrote editorials in *The Times of India* and the *Indian Express*, questioning how someone in such a key position in India's petrochemical industry could be asked to prescribe pollution control measures in a refinery, the interests of which he was committed to promoting as a leading oil technocrat in the country.\* My image of him, at the time, was of a hard-headed, no-nonsense executive, intent on

\*He later became the head of Engineers India Ltd, the huge public sector consultancy firm in addition. Subsequently, he served as the Secretary of the Department of Science & Technology and is now Director General of the Council for Scientific and Industrial Research. He was responsible for supervising the neutralisation of the killer gas in the Union Carbide factory in Bhopal.

dismissing allegations against the Mathura refinery as so much nonsense, obstructing the path to progress and prosperity. *The Hindu* pointed out that half the members of the committee, including the Chairman and Secretary, represented oil interests; the representative of the UP government, too, could hardly be considered neutral since the state authorities—as indeed the entire citizenry of Agra and Mathura—were determined to see the smoke stack of the refinery raised at the site chosen. To add insult to injury, the ASI was excluded altogether and only as an afterthought was a representative inducted more than a year later, in November 1975! This could only strengthen the suspicion that the committee was more interested in seeing the refinery come up than the age-old monuments protected.

One of these misgivings immediately turned out to be unwarranted: the *bona fides* of Varadarajan himself. When I did meet him finally, to interview him for this book, it was apparent that he was no insensitive technocrat. On the contrary, he was as concerned as, if not more than, other members of the committee who had no stake in the oil industry to ensure that the Taj remained intact for posterity. It was he who first educated me about the very structure of the monument itself: contrary to what I (and most people I have spoken to) believed, the edifice is made of brick and mortar—the marble is only the outer facing of the structure as well as in the cenotaph itself. He spared no effort—one would hesitate to say “left no stone unturned” in relation to the Taj!—in seeing to it that the rest of the members observed every facet of the indescribably beautiful monument—the same over which the wife of W. Sleeman of the Bengal army, who fulfilled a life-long dream when they visited the tomb in 1836, sighed: “I cannot tell you what I think, for I know not how to criticise such a building. But I can tell you what I feel. I would die tomorrow to have such another over me.” Varadarajan roused members from their slumber at 5 am when they officially met in Agra in May 1976 and entreated them to witness the glory of the Taj as the dew on the surrounding gardens began to evaporate. He also took them on a somewhat slippery tour of the inside dome, armed only with a lamp.

When the Varadarajan committee met for the first time in August 1974, it heard how D.K. Barooah had happened to pay a visit to Italy where he was impressed by the precautions taken against pollution from a refinery near Venice, which has a large

number of very old monuments and can therefore be said to be somewhat similar to Agra. One of the plants to control pollution was especially built by an Italian firm called Tecneco, a subsidiary of the state-owned oil conglomerate, ENI. That very month, Nayak journeyed to Rome and met with Tecneco, to establish whether it could help out at Agra. He reported that they had no commercially proven process for the removal of  $\text{SO}_2$ ; that they preferred to limit  $\text{SO}_2$  concentrations at different points by raising stack heights. Though the capital cost of doing this was high, it was better than "scrubbing"  $\text{SO}_2$  from flue (chimney) gases. Tecneco responded to Nayak's query by asking for certain data: meteorological data for the last 20 years, every hour of the day; temperature, humidity, wind velocities and direction in tabulated form; the type of monuments, materials of construction, chemical composition and other details such as surfaces, dimensions and locations of monuments; types of atmospheric pollutants and the refinery plan. No Indian participation was necessary, Tecneco told Nayak, to determine the permissible levels of  $\text{SO}_2$  under different meteorological conditions—only for deciding on control measures.

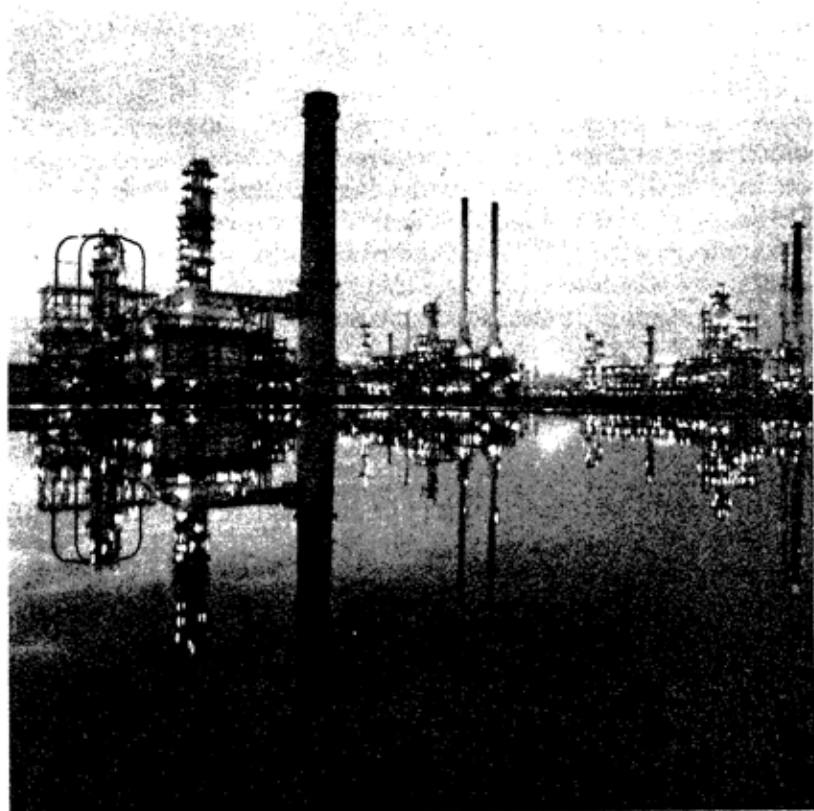
At the second meeting of the Varadarajan committee in October, it was decided to send an IOC team to follow up on discussions with Tecneco in Rome. R.N. Bhatnagar, the Managing Director of IOC, led the team. Tecneco told them that it was possible to recover between 25 per cent and 60 per cent of its consultancy fee from the Italian government, if the application was submitted within just ten days of the team reaching Rome. Otherwise, it warned, they would have to wait till April 1975 for the funds. It even had the temerity to suggest that IOC should present it a letter of intent before the team left Rome! Tecneco announced that its fee would be 185 million lire, the equivalent of Rs 22 lakh. There is no doubt whatsoever that it did its damndest to hustle the IOC representatives into signing on the dotted line: there was no possibility whatsoever of a subsidy from the Italian government. At the committee meeting, Tecneco's services were sought to be hired on the ground that although substantial efforts had been made in identifying pollution problems by NCEPC, IMD and NEERI, it was necessary to obtain a second opinion from a reputed and experienced foreign concern. Apart from the urgency of hiring a firm like Tecneco, the detailed project report would be ready by January 1975, and the plant design would have to be finalised by

taking into account the pollution control equipment recommended. Committee members appreciated this but wondered if it was really necessary to hire Tecneco: indigenous expertise in this field ought to have been checked first. Following Bhatnagar's discussions in Rome, it was agreed that Tecneco should depute a team of specialists to Agra. On October 31, a team of three Italian archaeologists visited the Taj and other monuments; they were accompanied by Sengupta and J.C. Nagpal, who headed the chemistry branch of the ASI. A week later, Tecneco made its final offer.

In the meantime, apprehensions about the refinery continued to grow. Perhaps the best indication of this was a confidential note by S.M.H. Burney, Additional Secretary in the Prime Minister's staff, in September. It was sent on to the Varadarajan committee by Kurien from the Petroleum Ministry. "In the cabinet meeting today," it said, "the Prime Minister expressed her concern over the problem of pollution to be created by the Mathura refinery. It was mentioned that the International Pollution Control Centre is now located at Nairobi and that we should depute experts to Nairobi to find out the latest technological developments for the control of SO<sub>2</sub> discharge." Ashok Khosla, however, reported that he had been in touch with the Centre in Nairobi and it did not have the facilities required. While this concern demonstrated Mrs Gandhi's genuine concern for the environment, it also betrayed a slavish mentality in believing that an unheard-of organisation, merely because it carried the tag "international", should have the answers to a specific situation in India.\*

For most of 1975, the Varadarajan committee was engaged in trying to find out whether the studies on the impact of the refinery could be conducted by Indian scientific institutions, instead of hiring a foreign consultant. Khosla had discussions with the acclaimed "alternative technologist", Dr Amulya Reddy from ASTRA in Bangalore, as well as with the National Aeronautical Laboratory in the same city. Khosla felt that such studies "were more an art than a science" and that it might not be easy to get concrete results to take a "yes/no decision". Events proved how prophetic his assessment turned out to be. It was realised at the time

\*Khosla played a role in setting up the Infoterra division of UNEP in Nairobi, while he was with the NCEPC, and subsequently joined it.



Bright lights at the 6-million-tonne-a-year Mathura oil refinery

that however desirable, an independent survey would require setting up a separate organisation, since no existing Indian agency could undertake the task. There were also procedural problems hampering Indian research, notably the procuring of equipment from abroad (nine months was considered an average waiting period). Nevertheless, as a measure of its good intentions, the committee hired Dr B.B. Lal, the former head of the ASI's chemistry branch in Dehra Dun, to travel throughout the country and report on the facilities available in scientific institutions.

Dave questioned whether the flue gas desulphurisation process, on which IOC had presented a technical note, would be able to limit the emissions of  $\text{SO}_2$  to 1 tonne per hour (tph), as the latter

claimed. He believed that such claims should be examined more minutely, in the light of the latest technology available in the West. With typical self-assurance he wrote: "We (NEERI) can undertake special work for reducing flue gases with any of the available processes *or develop a new one*" (my italics). Such technology, it should be mentioned, is so expensive that it is only in commercial use in America and Japan. At the third meeting, in January 1975, Varadarajan replied that 90 per cent of the  $\text{SO}_2$  could be eliminated by desulphurisation; if Dave knew of any other methods, he should inform the committee of it. He also regretted that NEERI had not informed them of its study, commissioned by the ASI. Khosla had written to IOC that Dave had found that the long term  $\text{SO}_2$  levels were higher than imagined: 10-15 micrograms per cubic metre ( $\mu\text{g}/\text{m}^3$ ) might be closer to the mark and "he also appears to have seen some damage to the quality of the stone which he feels is due to corrosion from atmospheric pollution."

In its interim report, NEERI found that of five locations it examined, the Taj had the highest concentration of  $\text{SO}_2$ : the daily or short term average was  $107 \mu\text{g}/\text{m}^3$ ; by contrast, Agra Fort had only  $38 \mu\text{g}/\text{m}^3$ , and Itmad-ud-Daulah's tomb, Sikandra and Fatehpur Sikri  $35 \mu\text{g}/\text{m}^3$ , or less. There is another index of atmospheric pollution—dust or what environmentalists term "suspended particulate matter" (SPM) levels.\* Dave's report placed the SPM levels in Agra at  $300 \mu\text{g}/\text{m}^3$ , which is high. His conclusions were that "significant" pollution levels prevail in the vicinity of the Taj but were comparatively lower elsewhere in Agra, that the prevailing winds carried pollution from other city sources towards the mausoleum. Considering that this was the first on-site survey, the results alarmed a great many people, not least its sponsors, the ASI. It reached the Prime Minister's ears and at the fourth meeting of the Varadarajan committee, in October 1975, it was reported that NEERI's findings had "caused her a lot of concern and she directed that no efforts should be spared in order to ensure the preservation of priceless monuments, especially the Taj Mahal." Subsequently,

\*This is particularly important for the preservation of monuments in north India, which is subject to *loos* or dust storms which bear desert sand, containing chlorides and other particles. Apart from any chemical action on marble or sandstone—the other building material used in all Mughal structures—these winds tend to pit the surface of buildings because of the force with which they blow and can also form the nuclei for molecules of acid-bearing vapour.

however, there was a great deal of scepticism about NEERI's findings. "Although I didn't see what equipment it used or the mode of calculations," B.B. Lal (the committee's consultant) revealed, "I was shocked but didn't believe it. The study was conducted with just Rs 5,000. These very high values were alarming but later proved incorrect with NEERI's own later surveys." Lal, in the course of his quest for Indian consultants, looked up Dave. When he mentioned the Taj, Dave retorted: "The Taj is already destroyed!" Lal was amazed at this response: "When a scientist arrives at such a conclusion, there is no room for discussion," he recalls bitterly. "I said that you had better see the monument for yourself."

An even stronger assessment was made by Thomas Mathew, who was with the NCEPC and replaced Khosla on the Varadarajan committee. "There are so few scientists who have the support and wherewithal or even the experience to conduct studies here that the practice of fabricating data goes unchecked, unlike in the US," he said "Dave's was the word of God in many situations." There was certainly no doubt in Dave's own mind about the impact of the refinery. "Having been surveying Agra since 1973," he maintained, "I have sometimes found that  $400 \mu\text{g}/\text{m}^3$  of  $\text{SO}_2$  are due to the power stations (two old thermal units). Even without these stations, there will on occasion be  $26\text{--}40 \mu\text{g}/\text{m}^3$ . The refinery on certain days will contribute  $26\text{--}30 \mu\text{g}/\text{m}^3$ —no one can deny that the existing level is bound to increase." There is undoubtedly logic in his last statement: whatever the disagreement about the actual contribution to Agra's air pollution by the refinery, it could only add to it.

The findings of another study—on the "Dispersal of Pollutants from a Refinery Stack" by Dr P.K. Das and two other scientists from the IMD—were also made available at this stage. This theoretical exercise was to prove highly controversial in that some experts contested the alleged jugglery with certain mathematical values in it. Basically, such a technique employs the Gaussian plume model, a statistical device, to estimate how much  $\text{SO}_2$  emitted from a source will reach a distant spot, given the prevailing winds. In other words, this is a purely abstract mathematical model—unlike the monitoring of actual pollution levels done by NEERI. IMD reported that the maximum long-term concentration of  $\text{SO}_2$  at a distance of 2 km from the refinery would be  $28.1 \mu\text{g}/\text{m}^3$ ; at 40 km downwind, for a stack 80 metres high, it would be a mere  $0.44 \mu\text{g}/\text{m}^3$ . These figures



pertained to winds in January, when they would be lowest, and there would thus be the greatest chance for emissions being wafted to the Taj. Helpfully, the IMD prepared a table to show the tolerable limits of  $\text{SO}_2$  pollution, based arbitrarily on half the level at which steel is corroded:

#### PERMISSIBLE LEVELS OF SULPHUR DIOXIDE POLLUTION

	Concentration in $\mu\text{g}/\text{m}^3$	
	One-hour (short term)	Annual (long term)
1) Vegetation	1,320	26
2) Human beings	1,056	26
3) Building material		26

Paradoxical though it may seem, humans have a higher tolerance to air pollution than many buildings: their bodies are able to adjust and counteract these impurities in the air, whereas marble or stone is inert and the damage to stone is cumulative rather than self-correcting. In fact, experts are agreed on one thing pertaining to the controversy over the Mathura refinery and the Taj—that no one knows what are the permissible  $\text{SO}_2$  limits for monuments!

Confusingly, IMD had done a study<sup>4</sup> in 1973 (after discussions with Khosla) where the results were much higher. In the short-term or one-hour period, the peak concentration of  $\text{SO}_2$  would be as high as  $482 \mu\text{g}/\text{m}^3$  under strong inversions (the pollution phenomenon that takes place in winter when pollutants are not allowed to rise and are hemmed down by cooler layers of air above them) and light winds. The 24-hour peak concentration would be  $284 \mu\text{g}/\text{m}^3$  and the worst affected area would be 10–20 km from the stack. A long-term level of  $40 \mu\text{g}/\text{m}^3$  could be expected “under the worst meteorological conditions” in the winter and pre-monsoon season. The report noted that if the height of the refinery stack was doubled to 80 metres, the long-term levels would drop. At this stage, IMD was under the impression that the refinery would be releasing 5 tonnes per hour (tph) of  $\text{SO}_2$ —whereas IOC later undertook to reduce it to 1 tph, which meant that IMD’s figures had to be divided by five to give a long-term concentration at Agra at  $8 \mu\text{g}/\text{m}^3$ , which is very low.

The Varadarajan committee still had to decide about Tecneco's proposal. The feedback from Dr B.B. Lal, as we shall see in the next chapter, was that Indian institutions were competent to conduct the studies but since it was a novel subject, it required a multi-disciplinary approach and the co-operation of several institutions. "This was discussed at Bangalore and other places but the scientists wanted time," said Sengupta of the ASI. "IOC was in a hurry: it didn't want to set up a lab. to do simulation experiments and so on." Hence Tecneco was signed on. Tecneco's brief was three-fold: to determine the typical meteorological conditions in the Mathura region and calculate the long-term ground level concentration of effluents (particularly SO<sub>2</sub>) at Agra on account of emissions from the refinery; to determine the existing level of pollutants in and around Agra, and finally, the present status of preservation of monuments, as well as the maximum pollution which these could be exposed to. As far as the first requirement was concerned—atmospheric diffusion—this once again involved the use of mathematical models on the lines of the IMD study. The second task was quite straightforward, simple monitoring of pollution levels of the kind that NEERI was equipped to do. The third concerned corrosion damage. It was realised that the extreme weather in north India, coupled with the poor preservation of stone itself, were responsible for the deterioration of monuments rather than pollutants. However their presence in the atmosphere could accelerate the damage. Tecneco agreed that "there is no exact or straightforward method of conducting laboratory tests and indicating how to arrive at the rate of corrosion. This was essentially due to the fact that the corrosion is not a gradual process but can easily accelerate and also that the deterioration of the monuments could be and is generally due to diverse factors such as weathering, humidity, quality of stone, pollution of the atmosphere etc. It would also not be possible to accurately simulate in the laboratory exact conditions which monuments are subject to." But the Indian experts realised that if they knew the present condition of the monuments, they could tell whether deterioration had taken place after a few years. Tecneco admitted that "there is no direct method of fixing the maximum permissible level safe for monuments." The studies were thus to be indicative, more than anything else.

## Opposition

It was a brief news item in October 1975, announcing that Tecneco had been appointed, that caught the attention of Prof T. Shivaji Rao, Professor of Civil Engineering at the Andhra University College of Engineering (now its Principal) at Waltair (Visakhapatnam). "I had been interested in different aspects of the environment since returning from the US in the early '60s, where I obtained a Masters in environmental engineering," he remembered. "Those were the early days, when the subject was first coming up; I visited oil refineries in Texas. When I examined the Taj issue a bit more, I realised that there was going to be 5 tph of  $\text{SO}_2$  since IOC was going to use high-sulphur crude from Iraq. I soon realised that this was a prestigious project for Mrs Gandhi and since it was the emergency, I might be put in jail if I protested against it . . . I told my wife to be prepared for this." Shivaji Rao obviously had an exaggerated notion of his own nuisance value but he nevertheless became the most strident campaigner against the Mathura refinery. If nothing else, one should admire his tenacity. The very next month he wrote to the President, Fakhruddin Ali Ahmed, with a copy to Mrs Gandhi, and sent them a "general note" on the problem. "In the over-enthusiasm to make available short-term gains of industrial development to one area, one cannot ignore the long-term adverse side effects and inflict more damage and environmental harassment (sic) over the whole region," he warned. He pointed out that the area was prone to inversions during winter and dust storms in summer: "These processes must surely accelerate the tarnishing, abrasion and deterioration of the Taj Mahal and other monuments, which earn a lot of foreign exchange by attracting tourists from all over the world." Quite correctly, he noted how most modern pollution control techniques did not function at they were supposed to do because of human, electrical and mechanical failure: this was the experience in Barauni, Rourkela, Durgapur and Bombay. He made a plea for the shifting of the refinery to another site: "If the nation is to profit from the mistakes committed by other industrialised nations, such mistakes . . . should not be repeated." Always a man with an eye for the main chance when it came to publicity, Shivaji Rao used an exhibition on "Economic Growth Without Environmental Pollution" at the Indian Science Congress in Visakhapatnam in January 1976 to

buttonhole Mrs Gandhi and the Education Minister, Prof S. Nurul Hasan, and acquaint them with the threat to the Taj.

Towards the end of 1975, the government realised that it had to act to silence the growing number of critics of the Mathura refinery, after finally giving the project the go-ahead in September—a delay of two years. It was now slated for completion by mid-1980. The Petroleum Ministry announced that it had decided to meet half Mathura's crude requirements of 6 million tonnes a year from the Bombay High offshore field, following the discovery of low sulphur crude there at that time; the rest would come from Iraq, as originally planned. This would limit the emissions of  $\text{SO}_2$  to only 1 tph or 24 tonnes a day. The Varadarajan committee also okayed two proposals—one from the IMD to establish two first class observatories at Mathura and Agra so that they could make up deficiencies in data used in the previous calculations and another from NEERI to continuously monitor pollution levels for 15 months. These would be paid for by IOC.

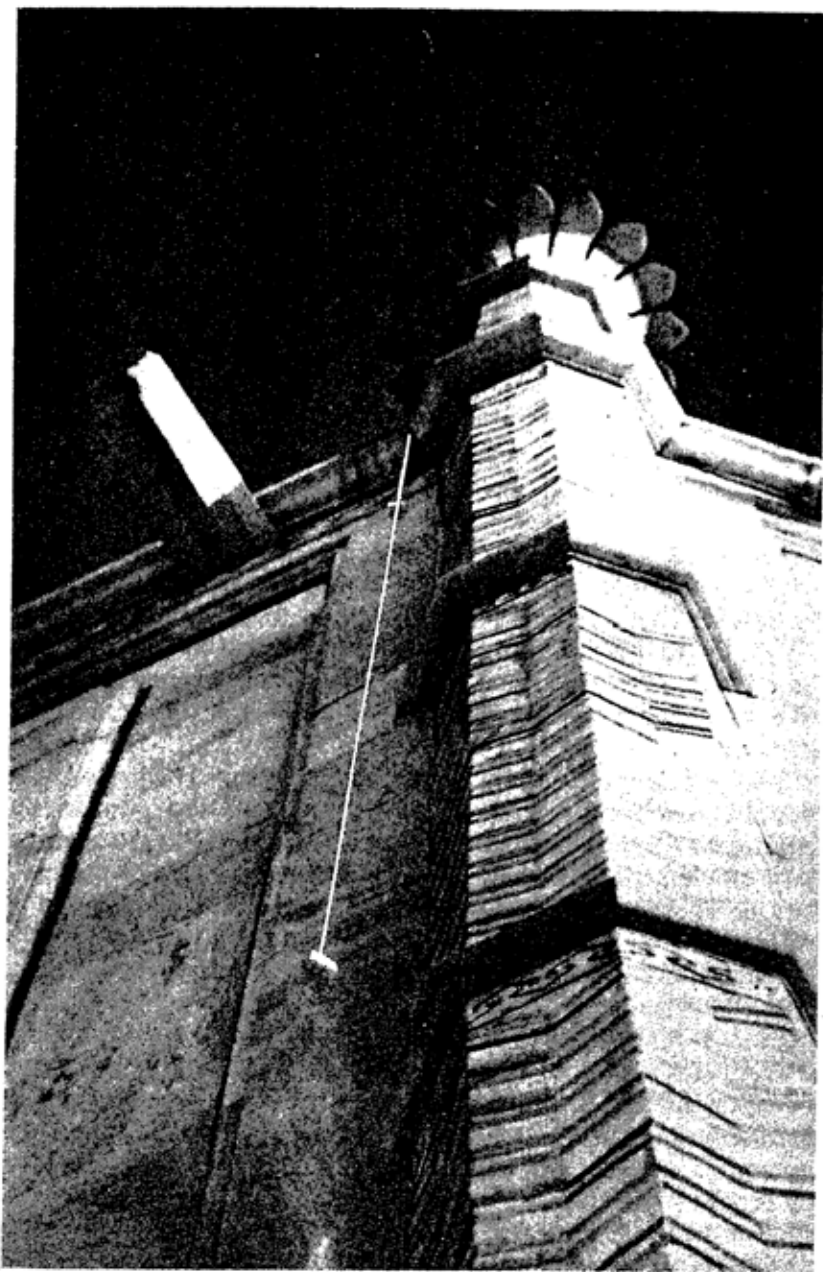
Another environmental threat was discovered at this stage; to the world-famous Bharatpur bird sanctuary, a little more than 40 km west of Agra. The Keoladeo Ghana sanctuary, to give it its proper name, had seen literally hundreds of birds shot by the Maharaja and his hunting parties till this was banned a couple of decades ago. Salim Ali raised the spectre of this magnificent 30 sq km expanse, the home of some 2,50,000 mainly migratory birds, being contaminated by fumes from the refinery. Like the lion-tailed macaque of Silent Valley, the threatened species in this case was the rare Siberian Crane. He wrote to the President of India, in his capacity as head of the BNHS, and at Bharatpur in February 1976, asked for scientific studies to be carried out there to ensure that the birds' habitat was not spoiled. He also deputed Dr A.N.D. Nanavati from the BNHS to visit the sites; Nanavati cleared the refinery. According to Nayak, Salim Ali's view was that the "Taj Mahal can be built again, but birds from Siberia can't"! Because of the immense worldwide prestige of the ornithologist (who won the \$ 50,000 Paul Getty award a couple of years ago for his diligent and dedicated studies), the Varadarajan committee wrote to the Royal Society for the Protection of Birds and the Nature Conservancy Council in Britain to seek their opinion. Both considered the risk of contamination of the water courses 40 km away minimal and the latter even suggested that "a case can be made out for sulphur as a

benefit to water birds ... sulphur dioxide emissions ... when neutralised act as a significant fertiliser.”\*

In reply to a question in parliament, Z.R. Ansari, the Deputy Petroleum Minister, detailed the steps that IOC would take to reduce the contamination of the Yamuna river, where the effluent would be released downstream of Mathura. The “surface discharge” would be treated waste water, containing oil, phenol and sulphides. The treatment would ensure that the contaminants would be reduced below the Indian Standards Institution limits for inland river water. According to V.S. More, who heads IOC’s Pollution Control cell, the total water to be discharged was 3 million gallons a day; the Yamuna was 6 km from the refinery and for 15 to 20 km downstream there was no habitation. Varadarajan emphasised: “We have a permanent obligation: we can’t let the water get bad even for a day.” The danger, of course, was that the town of Agra, with 8 lakh people, lay 40 km down the river and this was the source of its drinking water. Nayak took me on a tour of the refinery, which was partly functioning when I visited it early in 1982. He showed me the physical, biological and chemical facilities to rid the effluent of oil and other impurities and vowed that a large fish pond would be placed at the last stage: if a single fish died, the plant would be closed down till the leak was repaired. Both Varadarajan and he also disclosed how a 5-km-long effluent channel from IOC’s Koyali refinery in Gujarat to the sea was being used “illegally” for the past 12 years by farmers for irrigation with no untoward result. As regards atmospheric pollution, Ansari stated that the flue gases would be scrubbed to rid them of sulphur and the height of the stack doubled from 40 to 80 metres.

During most of 1976, Tecneco, NEERI and IMD were busy completing the studies they had undertaken. The Varadarajan committee met just once, in May. This was at Agra itself, where it became apparent after NEERI’s first quarterly “baseline” air quality survey of the town that more than by the refinery, the Taj was threatened by SO<sub>2</sub> sources within the town itself. Three main culprits were identified. The most serious were the two 10 MW thermal power stations: a decrepit one near Agra Fort and another at Itmad-ud-Daulah’s tomb. The railway yard, which is cheek by jowl with the

\*A similar point was made about the effluent from the Thal-Vaishet plant but it was by no means scientifically proven.



Blocks of marble suspended from Taj Mahal to measure pollution

Fort, was also using coal for its locomotives, and this added to the smoke, as did some 250 iron foundries which are the main industry in the small town. The meeting was attended by Salman Haider, Director in the Prime Minister's Secretariat—the same gentleman who was instrumental in getting Futehally to acquaint Mrs Gandhi with the problems of the western ghats—who asked whether the committee had arrived at any definite conclusion as to the necessity or otherwise of shifting the refinery. Varadarajan explained that with the pollution control facilities, less than 1 tph of  $\text{SO}_2$  would be released and even under the most adverse meteorological conditions, the long term levels at Agra would not exceed  $0.4\text{--}1.0\text{ }\mu\text{g}/\text{m}^3$ . "This is such a low level that the committee is of the opinion that there is no need to shift the Mathura refinery." This response was in sharp contrast to what Varadarajan told Shivaji Rao, when he attended the ninth meeting in November 1977 as an invitee of the ASI: the Chairman claimed that the terms of reference were very specific and these were to examine ways of mitigating the damage of the refinery, not whether it should be shifted altogether. In July 1977, to compound the confusion, H.N. Bahuguna, who was appointed Petroleum Minister in the Janata regime, told Nurul Hasan, then only a Rajya Sabha MP, that the question of shifting would have to be considered by the Union cabinet if the expert committee opined that the refinery was likely to damage the historical monuments in the area!

It was evident that the government was indulging in doublespeak because towards the end of 1976, IOC finally approved of the contractor for the construction of the refinery—itsself a comment on how efficiently things move in the public sector!—and work on it began. There was thus no doubt in the authorities' mind that they were going ahead with the refinery—even a year before the Varadarajan committee completed its report. "I argued many times with the committee," complained Dave, "but they kept saying that points I was raising were outside the terms of reference. Since I was a scientist, I continued to be there because I felt it my moral duty to bring the facts and figures to its notice." When the expert committee met in January 1977, Varadarajan called for the first draft of the committee's report—he felt Mrs Gandhi was keen to see it—even as Tecneco's first findings were presented to it.

Tecneco calculated that the maximum 24-hour average  $\text{SO}_2$  level at the Taj, in the long-term, would be  $7\text{ }\mu\text{g}/\text{m}^3$  in December, with a

low of  $0.8 \mu\text{g}/\text{m}^3$  in July. For winter as a whole, it was  $3 \mu\text{g}/\text{m}^3$  and for the entire year, just  $1.7 \mu\text{g}/\text{m}^3$ . By the time IMD did its sums again, using meteorological data collected at the observatory it had set up in Mathura (the first studies used Delhi and Agra wind speeds), the results were even lower:  $1.3 \mu\text{g}/\text{m}^3$  in winter. V.S. More of IOC confirmed that "we didn't learn much from Tecneco; the first part, relating to the calculation of long-term ground concentrations, as well as the determination of the existing level of pollution in Agra, we already knew about from IMD and NEERI. IMD's findings were roughly of the same magnitude as Tecneco's: it was in no way inferior. It was only regarding the third part, the present status of the monument, that it had a genuine contribution to make. That too, was mainly thanks to the devotion of experts from the Institute Centrale del Restauro in Rome whom Tecneco brought into advise them."

Tecneco found that the actual daily level of concentrations of  $\text{SO}_2$ —as distinct from the theoretical calculation—was "usually only a few  $\mu\text{g}/\text{m}^3$ . Only on some days did it reach values of  $10\text{--}20 \mu\text{g}/\text{m}^3$  and in very exceptional cases higher values ( $60 \mu\text{g}/\text{m}^3$ ). NEERI came to similar conclusions: an annual average mean of  $10\text{--}20 \mu\text{g}/\text{m}^3$ . Tecneco concluded from the surveys carried out at the Taj between January and July 1976, that "the Agra zone has a very low index of atmospheric pollution." It substantiated this by citing international  $\text{SO}_2$  standards (beyond which levels should not reach). Thus the Environmental Protection Agency (EPA) in the US prescribes an annual average of  $80 \mu\text{g}/\text{m}^3$ , while various European nations observe  $100 \mu\text{g}/\text{m}^3$ . The World Health Organisation (WHO) lays down  $60 \mu\text{g}/\text{m}^3$ . By contrast, Tecneco reported how annual levels in some other cities in recent years were very much higher: Milan reported  $600 \mu\text{g}/\text{m}^3$ , London 250, New York 110. With the theoretical annual concentrations it had calculated earlier, it affirmed, in its very stilted Italian-English, that "the atmospheric pollution caused by the refinery does not constitute, except for very improbable high levels of concentrations due to exceptionally bad meteorological conditions, a modifying element of the atmospheric situation of Agra because of its extremely low levels of concentrations which it could add to the already existing low levels."

It then turned to the state of the monuments and found that the marble was still in good condition and even the worst samples analysed were only slightly altered as compared to similar marble



obtained from Makrana in Rajasthan, from where Shah Jahan obtained his supplies. Sandstone, on the other hand, was not in good shape, with evidence of "peeling and scaling." Some areas were marked by white efflorescence caused by chloride and nitrates, which could only have been deposited there by sandstorms. Its measurements of air temperatures and humidity near the monuments indicated that the likelihood of condensation of gases was small—one has to remember that  $\text{SO}_2$  in the air is harmless: it only does damage when it dissolves in moisture to form sulphuric acid and can precipitate on stone.

The Petroleum Ministry towards the end of 1977 was anxious to have the Varadarajan report finalised as soon as possible. But the otherwise smooth functioning was disturbed by an unseemly squabble between different experts represented on it. This began at the ninth meeting, in November (attended by Shivaji Rao, who fulfilled a lifelong desire on this occasion of seeing the Taj). Dr B.B. Sundaresan, who had taken over as the Director of NEERI, warned that in case  $\text{SO}_2$  emissions exceeded 1 tph, it would lead to a "serious situation" (Sundaresan is, with Dave, a leading expert on air pollution) and asked that the short-term and long-term levels when the emissions were 5 tph should also be ascertained. "NEERI would like to keep on record its concern about the preservation of the environmental quality around the world famous monuments and particularly of the highway linking Delhi and the Taj Mahal," he said, making out a case for restrictions on industrial activity and traffic. He stressed that short-term concentrations should also be considered a threat, since the greater their frequency, the more likely the chances of damage.

The ASI also had its misgivings. Sengupta cited the high short-term peak concentrations arrived at by NEERI in its 1975 winter survey and pointed out that these were much higher than Tecneco found. Like NEERI itself, he sought to clear the ASI of any suspicion that it was absolving the Mathura refinery of blame. "Though the Survey is not yet in a position to record its own figures of the present level of pollution, from the actual deterioration that has occurred on the marble of Moti Masjid inside the Agra Fort and on the red sandstone of the Taj Mahal, considered in the context of the divergent views of other organisations and scientists, the Survey cannot fail to express its deep concern ... about the possible continued detrimental effect. In Delhi, where pollutant levels have

been determined by NEERI, the decay of the marble and standstone structures of the Red Fort is very evident . . . . As for the Taj Mahal, many of the stones on the structures have decayed under the present environmental conditions. The decayed stones have been periodically replaced (by the British, Sengupta forgot to mention!) and the monument is kept in a state of continuous maintenance and repair. He cited how Dr Giorgio Torraca, Deputy Director of the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) in Rome, had told him that "there is no base level of safe tolerance in respect of marble." Sengupta had met Torraca at an international symposium in Iran in March 1976 and discussed the Taj with him.

### **Absolutely sure?**

Nayak immediately queried Torraca and received a prompt reply. Torraca clarified that he never acted as a consultant to Tecneco though he cooperated with its team in setting up the guidelines for the study; ICCROM was bound to give free advice if requested by a government. "While we gave substantial advice at the beginning of the study, we were not called officially to examine the results and to discuss the conclusions," he said, adding that he subsequently was given a copy of the report. "It is a very good document. It is the first of its kind that is prepared for the protection of a monument. All people involved deserve great praise for this, but we must face the fact that exactly for the reason of its novelty it cannot be expected to give a 100 per cent sure answer. Besides the novelty of the whole problem of pollution, forecast at 40 km distance, the uncertainty limit is due, in my opinion, to the difficulty of applying the mathematical model at low wind speeds (below 6 km/hour) and the insufficient knowledge of the half-life time of sulphur dioxide in the atmosphere (data in the literature vary between 12 hours and 4 days.) This does not allow one to be absolutely sure that no sulphur dioxide can travel the distance in winter at very low wind speed (but mainly directed towards Agra) when the concentration of pollutants is high."

Significantly, Torraca stated that after reading the report he felt that it "should be submitted for review to a small panel of internationally recognised air pollution experts in order to ascertain if the uncertainty that I feel to exist (however I am no expert on meteorology and air pollution) is real and warrants the preparation

of efficient counter measures or even a revision of the project. I repeat that even a 1 per cent risk is far too high for an object like the Taj Mahal (the reliability level required for the electronics in missile systems is often around 99.99 per cent)." Needless to add, Torraca's views do not get even a mention in the Varadarajan committee report. However, Varadarajan did say that the question of referring the Tecneco report to another committee did not arise because they were not relying solely on its conclusions but also on a number of other studies. He also referred to how the use of low-sulphur crude, instead of coal, in the refinery's power plant would reduce the emissions of  $\text{SO}_2$  to just 0.8 tph. In case a flue gas desulphurisation plant was installed later, if technology and funds permitted, the rate would be halved: the design of the refinery permitted this but the cost was exorbitant.

Tecneco sent a reply to the committee, pointing out that "neither Tecneco nor anybody else could give a '100 per cent' sure answer to the problem . . . mainly because any quantitative relationship between pollution and deterioration levels are still unknown." It admitted the uncertainty in the theoretical determination of ground level concentrations caused by the impossibility of using the mathematical model for very low wind speeds (below 6 km/h): "Of course nobody can be absolutely sure that no sulphur dioxide can travel the distance between Mathura and Agra at very low wind speeds. Because of the distance and the persistence of wind speed and direction for many hours, we suppose that such an event should be rather rare and, in any case, it should concern, if it occurs, only an increase in short-term concentrations . . . It is obvious that from a purely theoretical point of view, any increase in air pollution, even with only  $1 \mu\text{g}/\text{m}^3$ , is not good for the conservation of stones. The problem is to evaluate how dangerous it is in comparison with other causes of deterioration, including the natural ageing of stones."

On December 6, 1977, the Varadarajan committee met for the last time and finalised its report.<sup>6</sup> It concluded that there was substantial pollution—with  $\text{SO}_2$  and SPM—in the Agra region and that effective steps needed to be taken quickly to reduce this. It therefore recommended the closing down of the two thermal power stations, replacing coal with diesel in the railway marshalling yard and shifting the existing small industries, particularly the foundries, to an area south-east of Agra beyond the Taj so that their emissions would not blow over the monument. Similarly, no new industry

should be located north-west of the Taj or petrochemical or fertiliser industries within the region. Any large project, for that matter, should first be examined from its environmental impact. It suggested the creation of an appropriate authority to monitor emissions as well as the air quality in the town and suggested that the ASI should have a cell to keep an eye on the state of monuments. Yet another precaution was the establishment of a green belt between Agra and Mathura. The use of coal in the refinery's power plant should be deferred till technology permitted its desulphurisation. Finally, it advocated that facilities and expertise in this area of environmental research should be built up within the country. The report also detailed how much the pollution control measures cost IOC. As far as air pollution is concerned, the biggest cost was Rs 3 crore for a scrubber and sulphur recovery unit; ESPs to remove coal dust cost another Rs 50 lakh (these would not be used, eventually). To keep the liquid effluent within tolerable limits, a little over Rs 2 crore would be spent. The cost of handling the ash would be nearly another Rs 1 crore. The breakdown of costs of various studies undertaken by the committee was as follows:

STUDIES	COST (Rs lakh)
1) IMD	18
2) NEERI	6
3) TECNECO	20
4) Miscellaneous	5
Total Rs 49 lakh	

These were the most exhaustive studies conducted on the impact or pollutants on a monument *anywhere in the world*. On equipment and instruments for monitoring pollution levels, IOC spent Rs 12 lakh. This gave a total cost, on all measures including studies, of Rs 7.5 crore. Since the refinery at that stage was estimated to cost Rs 195 crore, the expense to be incurred on pollution control came to roughly 4 per cent of the project cost. Ultimately, when the refinery went on stream in 1983, this rose to Rs 10 crore but out of a total of Rs 250 crore.

Only a few days after the final meeting, the members were summoned to the chamber of the Petroleum, Chemicals and Fertilisers Secretary, S. Krishnaswamy, along with UP Government officials. In response to a query, Krishnaswamy (who played a

major role in the Thal-Vaishet controversy) reiterated that there was no proposal to shift the refinery from Mathura. The terms of reference of the committee only related to the identification of measures for the reduction of pollution to the absolute minimum. He then went on to make a telling assessment of the problem: he said that it was clear from the report of the committee that there was no conclusive evidence that the emission of  $\text{SO}_2$  and SPM would have an effect on the monument. Equally, however, there was no evidence that these would not. It was apparent that there would be some contribution from the refinery, but more from the railway shunting yard and the use of coal as a domestic fuel in *chulhas*. "With a view to restore confidence in the public (mind) and in people interested in environmental cleanliness", several key decisions were made. Most important of all, the thermal stations were to be closed down within a period to be agreed upon, which the UP government consented to do. No new industries, including small units, were to be located north-west of the Taj and existing foundries were to be shifted to an area south-east of Agra. If a situation arose where low-sulphur crude was not available domestically—from Bombay High, Koyali or Barauni—the Petroleum Ministry would arrange for imports. To ensure that the emissions from the refinery and the dispersal of fumes were in accordance with IOC's assurances, three monitoring stations were to be set up 10 km from the refinery in the direction of Agra at suitable intervals. These had to be operated well before the commissioning of the refinery so that baseline data was easily available "to ensure no controversy afterwards". NEERI would manage these, at IOC's cost. IOC would set up its own monitoring station at Bharatpur as well.

Presumably because the Central government was waiting to implement some of the Varadarajan committee's recommendations and decisions taken at this subsequent meeting, its report was only tabled in both houses of parliament in August 1978. Bahuguna said that the report was still being examined in consultation with the departments involved and as soon as the government's views were finalised, it would be made public. Several of the recommendations were disclosed then and in several subsequent revelations to the press but the Centre persisted in behaving as if the findings were highly confidential. This is a recurring pattern in all the three environment controversies dealt with in this book: in both Thal-Vaishet and Silent Valley, the state governments concerned sought



Marble slab at Red Fort, Delhi, blackened by sulphur dioxide from Indraprastha power plant

to capitalise on the fact that the committee reports were not revealed to the public by distorting the findings. "Such an attitude is born out of a lack of confidence," believes Thomas Mathew. "It's high time that these reports were no longer treated as secret."

Meanwhile, Shivaji Rao persisted in his efforts to raise the Mathura refinery issue whenever an opportunity presented itself. For sheer doggedness, especially since he was unknown and in a remote corner of the country till this controversy arose, he was hard to beat (even if one includes all the campaigners embroiled in the other two cases in this book). He addressed seminars in his home town and Hyderabad and adroitly manipulated his contacts with the local press to gain the maximum mileage for himself out of the most inconsequential events. In August 1978 and October 1979, he co-authored two articles<sup>7</sup> on the air pollution threat to the Taj in *Chemical Age*, Bombay. While the authors found that the annual level of  $\text{SO}_2$  concentration was not high, they claimed that the subsequent short-term figures were alarming. They concluded that "the 24-hour and shorter (1-10 hour) term averages of  $\text{SO}_2$  ground level concentrations due to the refinery indicate that the refinery's pollution potential is much more than the monthly and annual predictions made earlier" (in the first article). Shivaji Rao was able to inveigle a local correspondent into publishing Torraca's commendation: "I am particularly impressed," the Italian expert wrote to him, "by your short-term mode which appears to define more precisely the dangers arising in particular combinations of meteorological conditions. It is exactly to such conditions that we refer when we speak of the insufficient reliability of the long term calculations."

Dave also harps on short-term figures. "Even with insufficient data, the long term annual mean will be 80 per cent reliable," he says. "But short-term figures require local coefficients (a mathematical term). Here arbitrary constants have been usurped from the west; no work has been done on these in India except by myself. With short-term figures, the reliability is only 50 per cent. Thus if you get  $5 \mu\text{g}/\text{m}^3$ , it may actually be  $7.5 \mu\text{g}/\text{m}^3$  or  $2.5 \mu\text{g}/\text{m}^3$  .... Even if it is  $1.5 \mu\text{g}/\text{m}^3$  in the short-term, marble can be damaged if the humidity exceeds 60 per cent, since the acidity will also increase. They are cheating the people with wrong figures. I told them to give me 5 to 7 years to do proper tests, but they said that I would have to accept their findings. I fought tooth and nail, went all the way to the PM." He and Shivaji Rao liken short-term findings to the actual

depths of a stream: whereas the average depth of the water may be low, it is possible for a person to drown at one particularly deep spot.

The Varadarajan report, however, makes short shrift of the short-term threat. "The short-term maximum peak concentration (1 hour) is estimated to be about  $65 \mu\text{g}/\text{m}^3$  at Agra and Bharatpur (based on IMD calculations, obtained from data from IMD's own meteorological stations set up for this purpose). However, such concentrations are likely to occur only during stable atmospheric conditions. From an analysis of the meteorological data available, IMD have indicated that frequency of the atmosphere to be stable towards Agra is in the region of 4 per cent ...." As Dr B. Padmanabhamurthy of IMD explains, under such conditions,  $\text{SO}_2$  will travel straight towards Agra as a plume, instead of being diffused by winds. The chance of winds blowing towards Agra are highest in February, but then too, it is only 28 per cent or less than one-third of the days in that month. The "life" of  $\text{SO}_2$  in the atmosphere, besides, is believed to be only five or six hours and it gets deposited on the way. "Even if we had taken no steps to control the  $\text{SO}_2$  emissions," believes Nayak, "the emissions from the refinery would have been 3 tph, which would have given a yearly average in Agra of  $3\text{--}4 \mu\text{g}/\text{m}^3$ . Western countries told us that we were over-reacting to a problem that doesn't exist. Even if there is a 50 per cent increase in these annual means, it makes no difference." Thus, even if the refinery expands to process 10 million tonnes per annum, it still poses no danger. In one sense, the investigations carried out at the behest of the Varadarajan committee exceeded its terms of reference: most recommendations related to pollution sources other than the refinery itself.

The voices raised against the Mathura refinery grew yet more strident, nevertheless. At a two-day seminar organised in Agra by the Indian Environmental Society, Shivaji Rao made the headlines when he cited other instances, around the world, of environmental damage to monuments: the Acropolis in Athens, Cleopatra's Needle in New York and Cologne Cathedral in West Germany. In the summer of 1979, S.N. Chib, the former Director General of Tourism, called a meeting in Delhi of prominent people like Romila Thapar, D. Chattopadhyaya and Rajeshwar Dayal, to see what they could do about the deterioration of the Taj. They set up the Indian Heritage Society (IHS) in October and set about trying to save the



Taj in right earnest. They saw Mrs Gandhi for the first time in September 1980, held press conferences and a one-day seminar on "Industrial Development or Environment." They also went to see Prof M.G.K. Menon, Secretary of the Department of Science and Technology (under whose purview Environment then fell), but they prudently did not take Dave with them. At one stage, the IHS contemplated suing the government and even had the well-known advocate F.S. Nariman prepare a brief. But they thought twice about it because they did not want to antagonise the Prime Minister and the time had passed for such drastic action. Somewhat immodestly and incorrectly, Chib claimed that the IHS was responsible for closing down the power stations in Agra in 1982.

The active members of the IHS were a different breed from conventional environmentalists: men like G. Naqshband, who was a top executive in Sita Travels, a leading agency in Connaught Place, from where the organisation was run. S.K. Roy, a former diplomat, devotes himself to several environmental causes in and around the capital. Ram Niwas Mirdha, the President, was a Rajya Sabha MP at the time and later the Union Irrigation Minister. These were all top professionals in their respective spheres, suave and influential; Roy once confided to me that the daily allowance he earned on various government environment committees just about met his liquor bills for the days he was out of town! A useful contribution of the IHS was to arrange for a professional photographer to take colour slides of the Taj, showing the deterioration of the marble and sandstone; these were widely circulated and even formed the basis of a slide show, with a commentary by Shivaji Rao.

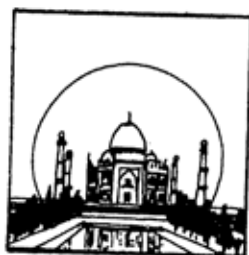
In September 1979, a High Power Committee of Secretaries of various departments, under the chairmanship of Prof Menon, was set up to supervise the measures being taken to protect the Taj. This was one of the last decisions of Morarji Desai's cabinet, at which meeting the Varadarajan committee's recommendations were officially accepted. The committee was formally wound up only in April 1980. By March 1982, the Menon committee was able to report that, thanks to the closing of the power station near Itmad-ud-Daulah's tomb and the dieselisation of the railway yard by May the previous year, SO<sub>2</sub> levels had been substantially reduced. According to NEERI, there has been a 75 per cent drop in SO<sub>2</sub> pollution in Agra as a result. The UP government also announced the creation of a Rs 35 lakh green belt around the Taj to protect it from fumes.

The progress on the refinery remained painfully slow. After being plagued by strikes, floods, disputes with contractors and power cuts (imposed when Charan Singh, as Prime Minister, switched electricity to agriculture), the commissioning of the project kept getting postponed from the middle of 1980 to October 1981 to April 1982. Then technical snags delayed the opening further, although it was partly functioning, causing the Public Accounts committee of the Lok Sabha to pass strictures against IOC for allowing the cost to escalate from Rs 97 crore in 1973 to Rs 235 crore in 1981 (it eventually cost Rs 15 crore more). The country's 12th refinery at Mathura was finally commissioned in May 1983, a full decade after the foundation stone was laid and in twice the time it should have taken.

The nagging doubt remains: will fumes from the Mathura refinery definitely not corrode the "miracle in marble"? From all the possible evidence, it appears to be ruled out. In the long run, especially as long as low-sulphur crude is being processed there, the danger does not exist. However, Torracca, who wrote to me from Rome, still has doubts whether low-sulphur crude will always be used: "it is easy to see that the use of a lower quality crude might be imposed, some day, for economic reasons," he said. Even in the short-term, despite the cautionary cries of Messrs Dave, Sengupta, Shivaji Rao and Torracca, the possibility of a conjunction of adverse factors—very low winds coupled with high humidity—is too remote. As for mishaps, which can cause a sudden release of a large quantity of  $\text{SO}_2$ —rather like the RCF's notorious fertiliser plant in Chembur, Bombay, which has overnight defoliated trees on occasion—these do not happen in oil refineries: if there is an accident, it is shut down immediately. The only lingering uncertainty is the effect of  $\text{SO}_2$  on marble which is over 300 years old. But here too, it is clear that since the emissions of  $\text{SO}_2$  from within Agra itself were—and still are—much greater than from the refinery, the Taj and other monuments in the area are still in a very good state of preservation. The marble has yellowed somewhat but it is nothing compared with the havoc wrought by atmospheric pollution to similar structures in Delhi itself.

This is not to say that the Mathura site was by any means properly chosen. When the refinery was planned there, it was well before the public had become conscious about the hazards of industrial pollution: in fact that only happened in India after the

much-publicised UN conference on environment in Stockholm in 1972. IOC officials are the first to concede today that if they had any premonition of the destructive power of a refinery, they would never have located it so close to the Taj. Of course, they were guilty of amnesia in forgetting how wastes from the Barauni oil refinery caught fire on the Ganga in 1968. In fact, it can be revealed that they did see P.K. Dave, then Petroleum Secretary, around 1974, to ask him whether they could shift to another site to avoid the acrimony that was surrounding Mathura. Dave told them, however, that if it was moved at that stage, there would be no refinery in the north-west for another five years. The Petroleum Minister would not back IOC, he added, and the people would hold the company responsible. That put paid to the move.



“Some people seem to be unduly perturbed over the prospect of the beauty of the Taj Mahal being affected by the gaseous discharges from the proposed oil refinery at Mathura,” wrote a reader to the *Indian Express* in January 1979. “It should be remembered that the Taj is basically a mausoleum in memory of the consort of an emperor of a bygone era . . . Shah Jahan wasted crores of rupees just to satiate his fanciful desire and thereby engrave his own grandeur in the niche of history . . . Should we not care more for the downtrodden coolies who carried the stones for the Taj? Any effort to perpetuate the myth of the eternal greatness of the Taj should be considered a reflection of mediaeval and regressive psychology. All such efforts should be resisted by those interested in the progress and modernisation of the country.

“As Jawaharlal Nehru said once,” he went on, “it is the modern industrial projects which should be considered as the real temples. They are the real symbols of development and the beacons of hope for the poor people.” A glossy IOC brochure, which has a picture of the brilliantly illuminated refinery on its cover, is literally titled “A ‘Modern Temple’ in Mathura”. An even more crassly materialist and ridiculous view was expressed by Nikita Krushchev when he visited India in 1955. He declared that had the Emperor Shah Jahan been a Marxist, he would have spent the crores of rupees in the Mughal empire’s coffers on building a hospital instead! These were admittedly voices in the wilderness as far as opinion-makers were concerned: the press, in particular, had deep misgivings about the consequences of locating the refinery so close to the Taj.

It was understandable that the public at large believed that there was a conspiracy on the part of the Petroleum Ministry to impose its decision on Mathura without taking a careful look at all the consequences. As we had seen in the previous chapter, the very constitution and terms of reference of the Varadarajan committee only

strengthened this suspicion. As in Silent Valley, it was easy to get carried away by the belief that an all-powerful alliance of technocrats and politicians was prepared to ride roughshod over the sentiments of those who gave priority to preserving the monument. In a TV debate, moderated by the well-known commentator Melville de Mellow in 1979, the Petroleum Minister, Bahuguna, was grilled by Dave; Shivaji Rao appeared on it as well. Shivaji Rao's pronouncements, as we have seen, were given wide credence throughout the country: I myself published an article by him, titled "Agra Under A Cloud" in *The Times of India*, as well as another outlining his "unconventional technology" to save the mausoleum. Other articles reveal their tenor: "The Taj Mahal Is Sick", written by Sengupta; "Should We Kill the Siberian Crane, Should We Destroy the Taj Mahal?" by the earliest campaigner, Asad Rafi Rahmani. Interestingly, senior editors were far more concerned with something "tangible" like the Taj than the preservation of Silent Valley (I was once specifically told not to take an "unscientific" view by opposing the project in the latter case.) The ripples of concern spread to politicians as well. During the Janata regime, the Education Minister, P.C. Chunder, admitted that the Taj was getting discoloured because of pollutants in the air and the issue of the refinery had placed the government in a quandary. Dr Karan Singh, the former Tourism Minister, chaired the parliamentary joint committee on the Air (Prevention and Control of Pollution) Bill,<sup>1</sup> which was passed in 1979, and summoned Dave and Shivaji Rao, among others, as witnesses. "It is one of the great monuments of mankind and it has become a symbol of threatened environmental pollution," he observed.

It was a classic confrontation between those who wanted to preserve the Taj and those who wanted to provide the north-west with the inputs for both agriculture and industry.\* Why is the preservation of ancient monuments so important? Richard L. Meier, Professor of Environmental Design at Berkeley in California, who had been consulted about the Taj, puts it well in a paper<sup>2</sup> on "Preservation—Planning for the Survival of Things." He says that the preservation of a monument "is a channel for transmitting

\* I have loosely used "environmentalists" to include those who wanted to shift the refinery, whereas a true environmentalist would be worried about the safety of the Taj irrespective of where the refinery was located.

messages from the past to the future... the images to be immortalised may stimulate intense emotions. Emblems of nationhood that generate patriotic feelings offer an almost universal example." He cites how "when a building is to be saved, it is the facade that is of paramount concern", and illustrates this with three cases: the Taj, Acropolis and Venice. Apart from "grand artifacts" such as these, there are also natural wonders and special communities and in this context he refers to the need for preserving certain habitats for their species importance and plant diversity—all of which are familiar arguments in Silent Valley. On the side of saving the Taj were ranged archaeologists, historians, representatives of the tourism trade and environmentalists. Their objectives are summed up in the charter of the IHS: "to awaken consciousness of the people in the diversity and richness of their art, architecture, culture and natural resources such as wildlife, forests, mountains, sea beaches, lakes and rivers and rare geographical formations; to improve the environment and the traditional quality of life in town and country."\*

Although detractors like the letter-writer quoted at the beginning of this chapter may seek to deny the Taj its pre-eminent position (it was only a historical accident that it is located within India's—as against Pakistan's—borders, he insinuated), there is no question that it symbolises the entire nation's cultural legacy. The Indian History Congress and many leading intellectuals made repeated appeals too. Indeed, it is significant that such preservation is often as much a political issue as protecting genetic diversity, which we dealt with in Silent Valley. Thus the famous Greek Culture Minister, the fiery actress Melina Mercouri, has raised a hornets' nest by demanding the return by Britain of the world-famous "Elgin Marbles", the collection of ancient sculptures from the Parthenon on the Acropolis, which Lord Elgin brought to Britain early last century and now reside in the British Museum. If there is a similar insistence by the respective governments on the return of antiquities in western museums to countries of their

\*Its active representative in Bombay, Cyrus Guzder, who owns a large travel agency, is also Secretary of the Save Bombay Committee (which played a subsidiary role in the Thal-Vaishet controversy). Both he and Murad Fyzee, another member who owns a travel agency in the city, have written about the need to promote cultural tourism.

origin—not least India—these museums would be practically denuded!

Surprisingly, despite the Taj being popularly considered one of the “wonders of the world”, this environment controversy did not attract much attention—or at least intervention—abroad. The concern did spread: a Dallas journal called *Energy Week*, for instance, warned its readers in 1976: “If you want to see the Taj Mahal, better go now!” *Uniterra*, brought out by UNEP, commented that it was not whether “the Mathura refinery will harm the Taj but how long it will be before the acid fumes in the atmosphere will make the damage visible.” The ever-energetic Shivaji Rao tried to lobby Dr Dillon Ripley, the internationally known ornithologist and Secretary of the Smithsonian Museum in Washington (and collaborator on books with Salim Ali). Ripley referred the matter to Chew Wee-Lek (the IUCN officer for Asia who attended one of Futehally’s task force meetings) in Morges, who passed it on to the International Council On Monuments & Sites, based in Paris. An official connected with museum programmes at the Smithsonian did reply to Shivaji Rao, mentioning that he had discussed the issue with O.P. Agarwal, head of the National Research Laboratory for Conservation of Cultural Property in Lucknow, who believed that the Mathura refinery would not cause damage. The IHS contacted counterpart organisations like the US National Trust and the Scottish Natural Trust, neither of which was able to do very much.

The message did seem to reach the far corners of the globe; when President Mitterand of France visited the Taj in 1982, he asked about the pollution threat. As a *Hindu* editorial emphasised, the safety of the Taj ought to have been considered not just a national but international responsibility, which is why India had requested UNESCO to include it (and 24 other monuments in the country) in its “World Heritage” list, which covered a hundred sites. In 1984, UNESCO agreed to do so, along with the Agra Fort, Ajanta and Ellora. Once a monument is so listed, UNESCO comes to its aid if it is in distress.\* The most famous international rescue is of the ancient temples of the Pharaohs at Abu Simbel in Egypt, for which UNESCO appealed for £36 million when the Aswan High dam

\* Because of the non-recognition of the present Cambodian government, Angkor Wat does not qualify for UNESCO assistance and Indian archaeologists have been asked to help.

threatened to swamp them. In Venice—where Tecneco had taken some pollution control measures—the amount was very much larger: when a “Save Venice” Act was passed in 1973, no less than \$550 million was sought to be raised by UNESCO and several European millionaires.

What was the opposing viewpoint of the “developmentalists”? Varadarajan sees the justification for choosing Mathura very clearly. “All refineries are situated nearest the areas of consumption because the cost of transport of petroleum products is very high,” he says. “In Europe, a refinery used to be located only 40 km away from the demand areas: now it’s around 200 km.” This is what economists call the “least cost solution”. It is obviously much less expensive to pump crude over long distances than products; apart from other considerations, some are highly inflammable. Because there was an overwhelming need to “fuel” the new high-yielding agricultural technology, a refinery had to be built in the north-west.\* Even granting that a refinery had to be situated in the north-west, it is apparent that Mathura was an extremely bad choice—a monumental mistake, everybody would agree today. The very fact that Agra itself was earlier considered as a site shows what little idea the selectors had of environmental factors. According to Varadarajan, Bharatpur was examined earlier too, but given up because it was too low-lying!

As an old resident of Mathura recalled, politicians had painted a bright picture at the time of the development of the region as a result of the Mathura refinery. At any rate, the actual employment in the refinery was only 1,100, which was hardly anything to set the

\* The Green Revolution itself, of course, has been questioned on both environmental and socio-economic grounds, as we have seen in the introductory chapter. Firstly, it needs heavy inputs: irrigation, fuel oil, fertiliser and pesticide. After spectacular crop yields initially, the returns may begin to diminish as the nutritive qualities of the soil are exhausted. Furthermore, the new varieties are extremely susceptible to pests and disease—as we have commented on, in the Silent Valley case. The socio-economic consequences are also dubious since it means that existing inequities are strengthened rather than levelled. In any case, the increase in production of food does not in itself lead to a rise in consumption of food: India has been registering such increases regularly, except when there is a drought, for the past few years, but the poorest peasants simply do not have the income to purchase the food. These are all extremely complex issues which can hardly be dealt with here. All that can be stated is that the very rationale of the new agricultural strategy is itself open to criticism.



Yamuna on fire. Dave also alleged that the site was prime agricultural land and that some Congress leaders bought plots there for Rs 3,000 per hectare and sold it to IOC at between Rs 10,000 and Rs 30,000 a hectare, which is simply not true. As anyone who visits the area can see for himself, the land is partly irrigated, the soil very saline and the groundwater brackish: the highest compensation paid to landowners at the time of acquisition was Rs 16,500 but the average was not more than Rs 10,000 per hectare. In addition, a person from each displaced family was offered a job in the refinery. "We thought there would be employment for hundreds of people," says the resident, who was once Mathura City Board's President, "but now we realise that the town's citizens have hardly benefited." Adds Dave: "Local people were misled by politicians, they even formed a citizen's group for the project." The Agra Chamber of Commerce, which entertained the site selection committee to lunch, later stated publicly that the Taj could be taken away, stone by stone; "We want the refinery!"

Of course, as we shall see in Thal-Vaishet as well, it was not the project itself that was considered job-creating, but the associated industries. The first of these in Mathura was to have been a fertilizer plant, which would be based on feedstock obtained from the refinery. However, the discovery of Bombay High gas changed the picture radically—the entire economics of fertiliser production was altered—and the government decided to use associated gas (which comes out along with crude) as feedstock instead. Padmanabhamurthy and an IMD colleague had done a study in 1977 of the dispersal of pollutants from the stack of a fertiliser plant, since National Fertilisers Ltd was contemplating shifting from Panipat to Kosi, a little east of the Mathura site, and another fertiliser plant was being contemplated adjacent to the Mathura refinery (1,600 acres were notified for the plant around 1972). Although they found that winds from Mathura and Kosi would blow directly over Agra, both the short and long term concentrations from these stacks would be well within ISI standards. "We didn't want to take any chances, even though the fertiliser plant was cleared," admitted Nayak. The project was dropped, despite pressure from the Agra Chamber of Commerce which was anxious to put the town firmly on the path towards industrialisation. It felt that Agra could become another Baroda, which had its "take-off" with petrochemicals. In

July 1982, Chief Minister Vishwanath Pratap Singh renewed the plea for another fertiliser plant, in addition to the four based on offshore gas, to use surplus naphtha from the Mathura refinery as feedstock. It will be supplying heavy feedstock-based plants at Bhatinda, Panipat and Nangal and naphtha-based plants at Kanpur, Phulpur and Kota.

The second associated project was a petrochemical complex. "All refineries are accompanied by such complexes," Dave points out. "Look at Bombay and Baroda—or Amsterdam and Tokyo. For downstream units, you save enormously by carrying products through a pipeline, avoiding the hazards of truck or train transport. Thus the Koyali refinery near Baroda can feed the Gujarat State Fertiliser Co, IPCL, around 37 small petrochemical units and Gujarat Alkali." It was believed that the same would happen at Mathura and the Varadarajan committee was in fact asked to look at the impact of ancillary and downstream units. Dave claims, as we have seen in the previous chapter, that he was responsible for convincing the government not to locate a petrochemical complex at Mathura. Aligarh and Etawah were considered as possibilities and rejected. Finally, Salimpur—about 60 km from the refinery, near Aligarh—was chosen for a Rs 450 crore complex. "The value added by the petrochemical industry is large," observes Varadarajan. "As against Rs 2,800 a tonne for naphtha, it is Rs 9,000 a tonne for petrochemicals. Because the capital costs of these projects is high, the cost of the pipeline in relation to the total cost is not much. Outside cities, other costs are also lower and the government should locate some of these industries to develop backward areas." Whether such highly capital-intensive projects help to develop depressed areas is a moot point, as we shall see in Thal. For that matter, some experts believe that it may be cheaper to import basic petrochemicals than produce them at home at a higher capital cost.

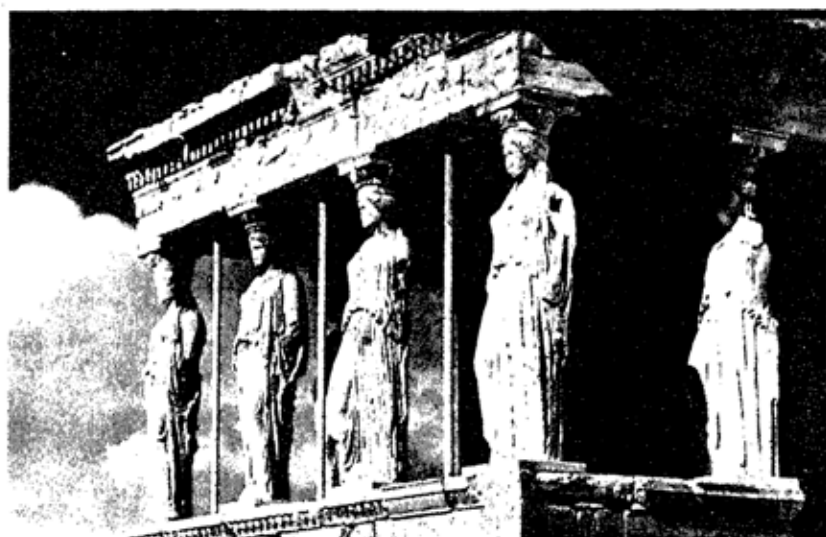
Some of the considerations which dictated the choice of Mathura for a refinery are the same for Karnal, as the site of one the two new "grassroots" refineries in the country, also with a capacity of 6 million tonnes (Mangalore is the second). "Though it's called Karnal, it's really at Panipat," said Nayak, who was asked to write the project reports for both these refineries after he relinquished charge at Mathura in 1982. Most knowledgeable officials believe that the Karnal decision was more a sop to Haryana than anything

else, which is a telling comment on how the location of so many big development projects are decided upon—supposedly on the basis of “pragmatic” economics.

### No holistic view

If, as seems clear from all the studies conducted on the impact of the Mathura refinery, the Taj will not be affected, does the voice of the “developmentalists” prevail over that of the environmentalists in this case? The reality is much more complex. It shows that if one takes an overall view—as distinct from the ad hoc, piecemeal approach adopted by official decision-makers—environment was certainly the first casualty. One is not referring to just the physical surroundings but a much broader concept: the integrated, holistic viewpoint. This is the essence of “ecology”, which, as we saw, has been described as the science of interrelationships between living organisms and their environment. In the case of the Taj Mahal and the Mathura refinery, what was at stake was no living thing but a nonetheless precious heritage. It was the inter-connectedness of factors: not just the “refinery versus the monument” but a whole string of related issues.

The most glaring demonstration of the developmentalists’ inability to see beyond their nose was quite obviously the decision to locate the refinery so close to one of the most revered monuments in the world. The original project report ignored the question of pollution altogether. It was only after the controversy that pollution control was introduced separately at the plant: till then, it was handled either as effluent treatment or water disposal. “Initially all refineries had effluent treatment plants,” said IOC’s More. “This was another aspect of quality control—we weren’t acting as a separate group. I came to Delhi to set up the Pollution Control Department in 1975. We established cells in different refineries.” Following the recognition at Mathura of the potential danger of the emissions, many measures were taken to minimise pollution which were not envisaged when the plant was designed. Thus the Central government decided to process low-sulphur crude from Bombay High for half the refinery’s capacity; this contained between 0.16 to 0.2 per cent sulphur only, as against 1.6 to 2.0 per cent for the remaining Middle East crude. Later, it moved to restrict the emissions further by using low-sulphur fuel, obtained by processing Bombay High crude or directly from Barauni or Koyali, instead of



CARYATID FACE (AFFECTED BY  
SPELCHUT. N SINCE 1946)



CARYATID FACE  
(AFTER RESTORATION)



CARYATID FACE  
(BEFORE 1946)

STONE CANCER TO MARBLE  
MONUMENTS OF ACROPOLIS. (2,400 YEARS OLD)

30 YEARS OF EXPOSURE TO AIR POLLUTANTS HAS DONE MORE DAMAGE THAN THAT  
CAUSED BY NATURE DURING 2,400 YEARS.

Acropolis in Athens: world's worst case of monument corroded by air pollution. Below: detail of damage to caryatids or maidens, now removed to museum for safe keeping (Courtesy T. Shivaji Rao)

coal in the captive power plant. This meant that the electrostatic precipitators, installed at the enormous cost of Rs 50 lakh, were a total waste. The cost of "washing" the excess gas from the refinery furnaces to remove hydrogen sulphide and make it sulphur free, as well as the sulphur recovery unit, amounted to Rs 3 crore alone. The total estimated capital cost of reducing the  $\text{SO}_2$  emissions to 1 tph amounted to Rs 3.2 crore (the actual cost was Rs 5.6 crore including the railway line and pipeline) and much of this could have been saved had IOC the prescience to site the refinery elsewhere in UP (this excludes running and maintenance expenditure). Most of the measures to control the quality of the liquid effluent, on the other hand, were unavoidable—even at an alternative site for the refinery like Etawah, which Shivaji Rao was agitating for, it would still have to be released about 150 km downstream into the Yamuna. As the Karan Singh joint committee, which drafted the air pollution bill, stated emphatically: "Mathura is one of the worst possible sites for setting up of a refinery from the archaeological, ecological and environmental points of view."

Another example of shortsightedness on the part of the authorities was their extreme reluctance to consider the possibility of shifting the site early during the controversy. It was understandable that IOC, having been caught napping by the OPEC price hike, was forced to bide its time at Mathura for exactly three years from October 1973 before beginning construction and was thus in no frame of mind to consider repeating the entire process—from site survey to sanction—all over again at another location. Since the Soviets were supplying the equipment for the refinery, any delays would have played havoc with the bureaucratic Russian contract system and its long-term planning schedules. But the government was guilty of forcing the issue by resorting to the classic bureaucratic ploy: appoint an official committee to go into the question in order to quell the protests, continue work in the meanwhile and then present the environmentalists with a *fait accompli*. In 1974, by the time the Varadarajan expert committee was appointed, only about Rs 1.5 crore had actually been spent. At that stage, it was well within IOC's powers to move elsewhere.\* It is true that since the earlier informal environmental committee, which was actively

\* Even as late as in May 1979, the Karan Singh committee observed: "The Committee have themselves seen that some of the structures of the refinery have

helped by the NCEPC, had cleared the refinery, the Petroleum Ministry was sufficiently confident that it had the situation well under control. Unofficially, I was told the government was prepared to consider shifting if the indications were that the refinery would cause damage. This was apparently an additional reason for hiring Tecneco, because it possessed the expertise to advise IOC how to shift if the need arose. However, none of this was publicly stated and on the surface, at any rate, it did look like the government was going ahead regardless.

A third omission was the possibility of losing a sizable chunk of tourist traffic as a result of polluting Agra, Fatehpur Sikri and the Bharatpur sanctuary, which form a kind of little "golden triangle" of their own in north-west India. Since around one million tourists visit India every year and at least half visit the Taj, the sizable loss in earnings would have to be taken into account, according to some campaigners. Around 40,000 people visit the Taj every day during the tourist season and a quarter as many in other months; even with 10,000 a day, the gate receipts (Rs 2 per person) alone work out to Rs 70 lakh a year. Not only do they bring in foreign exchange but there is a "multiplier effect" in that they create a demand for hotel accommodation, transport services, handicrafts and so on, which Inder Sharma of the IHS (and head of Sita Travels), estimates at four times the direct income from tourism. According to one estimate, the revenue from 30 tourists a day is equivalent to that of a factory with a turnover of Rs 1 lakh a year.\* In fact, Sharma went so

already been constructed and more are under construction. On the question of expenditure incurred so far, the Committee were informed that about Rs 100 crore—Rs 15 crore on acquisition of land, civil works etc and about Rs 85 crore on items of equipment—have already been spent. The committee are of the view that in case the site of the refinery is shifted elsewhere not too far away from Mathura, the structures already constructed can be used for storage, transport, and distribution requirements so that they are not completely wasted and most of the equipment can also be shifted and put to use at the new site. Although this would result in some infructuous expenditure, it should be kept in mind that apart from its cultural and artistic value, the Taj Mahal is a major tourist attraction and helps earn crores of rupees every year through international tourism."

\* However, just as the advantages of the Green Revolution are being challenged today, so are those of international tourism, which can have a great many detrimental social costs. Even in Agra itself, local tourism operators complain that the bulk of the profit is creamed off by agencies in Delhi and Bombay. Besides, it is a mistake to emphasise the value of the Taj Mahal alone and ignore the cultural diversity of the rest of the country as a tourist attraction.

far as to say that it was worth shifting the refinery in 1979 even if it cost Rs 100 crore because the gains from tourism would be greater; for one thing, without the Taj, many potential visitors would simply overfly India. The Karan Singh committee bought this view as well. As we have seen, the Taj stands as a symbol of the culture of the country, like Borobodur in Indonesia and Mohenjo Daro in Pakistan. It would also be interesting to idly speculate whether the Taj, which cost Rs 6 crore nearly 350 years ago, is "worth more" in terms of today's prices—rupee for rupee—than a Rs 250 crore oil refinery, given the high rates of inflation! However any cost comparison is a complicated exercise and in any case there is no certainty that the condition of the Taj is deteriorating rapidly and will therefore deter tourists. At the same time, it is true that tourism is often a casualty when a big project is built: the classic case, of course, is the Aswan dam, because of which the Abu Simbel temples had to be moved in 1966; today, the rising water table further down the Nile is threatening the 3,500-year-old Karnak temple at Luxor, only 20 metres from the river. To do cost-benefit studies of "development versus monument" cases is difficult because many factors are highly subjective. All that one can conclude is that these must be given due weight in the decision-making process as far as possible.

### Scientists' role

The lack of an ecological perspective was all too apparent in most of the studies conducted during the controversy, which did little credit either to the scientists themselves or the developmentalists and environmentalists who often used the findings to bolster their own partisan viewpoint. Objectivity was hard to establish, even if it is conceded that such research was an entirely new field in India, if not the entire world. Instead of taking a synoptic view, many scientists got bogged down in their own narrow speciality. This is well illustrated by a remark made by Dr B.P. Pal, who headed the NCEPC during the earlier phase of the Silent Valley dispute and is a reputed plant geneticist. When I asked him whether I could interview him about Silent Valley, he firmly declined, asserting: "I'm only a geneticist!" If this was the view of such a senior scientist in the New Delhi establishment, it is easy to imagine that of others in organisations like NEERI and IMD.

NEERI under an egotist like Dave was able inflate its all-too-brief

Rs 5,000 study, extending over just a fortnight in winter, 1974-75, to claim that it had evidence of alarming high  $\text{SO}_2$  levels in Agra. However its subsequent studies for the Varadarajan committee, which cost Rs 6 lakh, showed a much lower concentration of  $\text{SO}_2$  both in the short and long term. Dave was over-confident and recounted to me how he had attended a conference in Dubrovnik where Yugoslavian experts told him that they had no need for Tecneco when there was someone of his standing around! "We have very little regard for our own scientists," he complained. "Fortunately, I am more respected outside India for my contribution (to air pollution studies)." By contrast, Sundaresan, the current Director, is far too cautious and bureaucratic. Like many government-run organisations, NEERI (which is controlled by the Council for Scientific and Industrial Research), believes that any research it undertakes is the property of the agency—public or private—which funds it and will therefore not part with its findings till the sponsor gives the green signal. Such an attitude, needless to say, hardly contributes to the cut and thrust of scientific debate. "NEERI is an overworked agency," observes Varadarajan. "It requires a lot of investment before it can establish itself as an independent consultant. Otherwise, it will always agree with whoever funds it." Biswas of the DoE adds: "When CIPHERI became NEERI, public health engineers started calling themselves environmental engineers! They began to believe that everything was their concern whereas they lack a multi-disciplinary approach."

The veil of secrecy, if anything, was drawn even more firmly by the IMD over its findings. Admittedly, the task of estimating the dispersal of pollutants from a refinery stack to a destination 40 km away was a highly theoretical exercise, drawing upon the Gaussian plume model. Meteorologists using this assume that  $\text{SO}_2$  emanating from a stack will spread out as a plume, and then introduce several variables, like the stack height, wind directions and speeds and temperature, to base their calculations. However there are other "uncertainties", as P.K. Das and his colleagues somewhat disconcertingly termed them, such the empirical values of what are known in mathematics as diffusion coefficients. "There are other numerical methods for calculating  $\text{SO}_2$  levels also," said Padmanabhamurthy, who is a Director in the IMD. "But the Gaussian plume is highly sophisticated. A modeller called Shirvekar from the BARC has been using it since 1955 to estimate the diffusion from atomic power



plants. The mathematical 'constants' we used for the Taj case are available in standard text books." An earlier variant of the same technique, perfected by and known after Geomet, an American firm, was in fact used to calculate the likely effect of a fertiliser plant in the twin city of Bombay in 1972, as we shall see in the Thal-Vaishet case. Even so, IMD complicated matters by not publishing its studies—in fact they are specifically referred to as "pre-published" reports—and not openly discussing how it was making its calculations. By resorting to the use of such arcane variables as a "power law"—which is a simple way of relating the wind speed to the height above ground at which pollutants are emitted—it gave the impression to outsiders that it was deliberately trying to camouflage its findings. This suspicion was only heightened because the power law was not mentioned in its July 1975 report but introduced in its June 1976 report (which was published as an annexure by the Varadarajan committee), where IMD blithely stated that its use would halve the  $\text{SO}_2$  concentrations!

According to Shivaji Rao, since IMD came under the aegis of the Tourism and Civil Aviation Ministry, it was always doing work at the behest of one government agency or another and was never independent. My meetings with Padmanabhamurthy tend to confirm such a belief. He was extremely diffident and cautious, asking me to get permission from his Director General, P.K. Das, before he would open his mouth. Even after I did so, he would not part with copies of IMD studies. Shivaji Rao asserted, with infallible logic, that "the output of mathematical models can't be more valid than the validity of its inputs" and questioned, for instance, why IMD was using Delhi's wind data instead of Agra's (Barkat Ali's). Padmanabhamurthy had a convincing reply: "To begin with, we had to have some data. Suppose we wanted to measure levels in the middle of the ocean: we would have to take some baseline figures and then measure the actual data and compare them. Earlier we used Delhi's wind data because its observations went back a hundred years (IMD itself is about as old). After 1976, we established our own observatories at Mathura and Agra and were able to incorporate this data." Not surprisingly, IMD came in for criticism from Dave and Sundaresan, Sengupta and Shivaji Rao because its findings were so confusing and seemingly contradictory. At a Varadarajan committee meeting, Das admitted that IMD had made an "error analysis" of its dispersion models and come to the

conclusion that the selection of dispersion coefficients would affect estimates of ground level concentrations considerably for a distance very close to the source of pollution. However for distances beyond 10 km, the errors had "virtually no effect" and the Mathura data proved that the studies done with Delhi's figures were entirely consistent with each other. On another occasion, Das referred to experiments conducted in the UK and Norway. While values of 20 to 10  $\mu\text{g}/\text{m}^3$  were observed near the major source regions, these dropped to 2 to 0.5  $\mu\text{g}/\text{m}^3$  at a long distance away. "It would thus seem," he said, "that the values we have computed have received support from Tecneco... I am therefore of the view that an increase in  $\text{SO}_2$  concentration in Agra is unlikely to exceed the small values reported by IMD" (1.50  $\mu\text{g}/\text{m}^3$  in the long term, which compared favourably with Tecneco's 1.75  $\mu\text{g}/\text{m}^3$ ). The fact is that even allowing for a 50 per cent error with certain mathematical techniques, the concentrations would still be too low to cause any alarm whatsoever. Moreover, as Tecneco and IMD were at pains to emphasise, the use of the Gaussian model always yields long-term values which are higher than in practice—thus the findings would be on the safe side.

The vital studies undertaken by NEERI and IMD thus often served to cloud the issue rather than clear it and this contributed in no small measure to the confusion surrounding the Taj controversy. But this does not mean that Tecneco was in any way superior. As we saw in the previous chapter, IOC officials readily concede that Tecneco had nothing much to contribute except regarding the archaeological work done by experts from the restoration institute in Rome. Says Ashok Khosla: "Tecneco definitely didn't know anything when they first came: they wanted to earn a reputation as saviours of the Taj." Indeed, the experience of environment cases such as Silent Valley and the Taj throws light on the underutilisation of another vast national resource—scientific manpower. As is well known, India possesses the third largest number of trained personnel in the world in a wide spectrum of research institutions. Even so, they seldom display the maturity and confidence that they should, given their training and sheer numbers. Nor are they, in turn, given the respect that is their due. For instance, B.M. Chhabra, who worked on the earlier IMD studies, revealed that IOC had originally wanted to entrust these to a foreign agency. At the same time, the training scientists receive encourages over-speciali-

sation at the cost of a comprehensive assessment of any problem. The Taj case, in particular, called for a marriage of many disciplines: from chemistry to understand what gases were being emitted and what the reaction on stone would be, to mathematical models for the transmission of pollutants over distances, to archaeology to gauge what condition the endangered monuments were in. It was an entirely new line of inquiry and there were admittedly few practitioners (as Khosla put it, it was more art than science). Varadarajan, who is himself a distinguished technologist and has been president of the Indian Academy of Sciences, is a good example of a person who could fuse different kinds of expertise (though being a compulsive "workaholic", he took on more than he could do justice to—at one stage he was Chairman of EIL as well as Secretary of the Department of Science and Technology). He was correct in deciding that there was no single agency which could conduct the kind of studies that Tecneco finally was entrusted with, given that time was running short. Another very good "universalist" was B.B. Lal who, though an archaeological chemist, was able to turn his keen mind to the problem of identifying where different scientific expertise in the country existed. After discussions with key scientists in institutions such as the Physical Research Laboratory in Ahmedabad, Geological Survey of India in Calcutta and Lucknow, National Physical Laboratory in Delhi and, most importantly, the National Aeronautical Laboratory (NAL) in Bangalore, he was able to conclude by April 1976 that "almost unlimited potentialities exist in India for turning out high quality work, which may prove of great value in understanding the mechanism of weathering of the marble and red sandstone of the Taj Mahal and other architectural monuments in these stones."

A key figure in Lal's deliberations was Dr S. Ramaseshan, who then headed the Materials Science Division of NAL and was till recently Director of the Indian Institute of Science (IIS) in Bangalore. Ramaseshan was most enthused about conducting studies on the likely effect of pollution on monuments and submitted a three-year Rs 1.6 lakh project, which would combine both physical experiments (such as the use of special microscopy to examine whether marble would turn opaque as a result of exposure to pollutants) and chemical analysis. When I met Ramaseshan in his elegant IIS bungalow, he informed me that NAL could also have examined weathering effects: just as the laboratory measured the

impact on helicopter blades when aircraft landed in a desert, it could study how the dust-laden winds of north India pitted the smooth surface of the Taj. Although NAL was ruled out at the time, quite rightly, its services should surely have been requisitioned on a permanent basis to establish Indian expertise in this field. Ramaseshan, a polished and articulate man, is one of the top scientists in the country who has a grasp of larger issues. An even better example, of course, is Prof M.G.K. Menon: when I asked him why an ornithologist like Salim Ali was making pronouncements on an environmental problem like the Taj, he replied that anyone with as much diligence and dedication to making painstaking observations was bound to have the *intuition* to comprehend the issues involved.

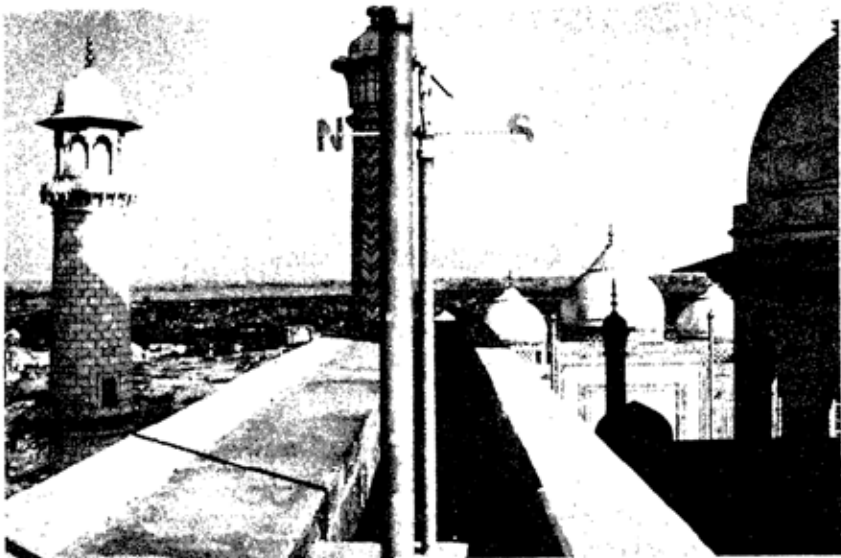
As Lal reported, Ramaseshan's study could also have been used to check Tecneco's findings because of the interdisciplinary nature of the work. It could "also go beyond their diagnostic studies and produce a more comprehensive picture of the pathology of the monument and in the process, build up a sound method of environmental studies in the country. By proper co-ordination and orientation of data from different disciplines, it was possible to reach a meaningful interpretation which would enable us to say unequivocally as to what is really happening to the marble and other architectural stone monuments under the ambient environmental conditions and how the stones would react to increasing atmospheric pollution."\*

The Varadarajan committee, taking its cue from Lal's report, listed 11 scientific institutes which had facilities to follow up Tecneco's studies. The ASI should have coordinated such a task: after all, it was hardly as if the investigations on the Taj were a one-shot affair for this monument itself, let alone the know-how that could have been gained for other sites in the country. "ASI should have deputed personnel to work along with Tecneco, as Varadarajan and Nayak wanted it to," recalls Lal. If any organisation could be accused of being stuffy and bureaucratic, it is the ASI. One has only to visit its decrepit headquarters beside the National Museum in Delhi, to realise how neglected this organisation has

\* Quite accidentally, the DoE learned only in 1982 of a Birla Archaeological & Cultural Research Institute at Purani Haveli in Hyderabad, which has been conducting experiments<sup>3</sup> on the effect of SO<sub>2</sub> on marble! This shows how arbitrary such research is even today.<sup>4</sup>

been. Instead of learning from the mistakes of omission and commission made by Tecneco, it chose to maintain a mandarin-like silence and only spoke out later. Sengupta asserted, feelingly: "Posterity can't accuse us as scientists and historians of neglecting our duty; we owe something to our cultural heritage." This debt appears to have been taken lightly. Dr B.N. Tandon, present Director of the Chemistry branch in Dehra Dun (why it is based there, no one knows!), mentioned that one of his officials did work with Tecneco to learn about monitoring SO<sub>2</sub> emissions in Agra but admitted that he had not even seen their report when it was first submitted. It is possible that internal squabbles between various departments of the ASI ensured that copies were not circulated. "Since 1978, we have been doing independent work," said Tandon. "Our conditions are quite different from Italy. Monuments there are located in one climatic condition whereas here physical deterioration occurs because of three seasons." Much of the damage to European buildings is caused by frost: moisture can permeate cracks and when it freezes, cause fissures.

Tandon, an energetic scientist, described four main measures that the ASI was taking to protect the Taj: the measurement of sulphation (which makes marble opaque), use of an accelerated testing chamber to test the physical changes in marble as a result of exposure to SO<sub>2</sub> (like reflectance, porosity and impedance), preservatives and cleaning. One of his assistants, N.S. Venkateswaran, was sent to Europe for a month in 1980 to study monuments in Rome, Venice and Athens (he only saw the Tecneco report in Italy!). "Most monuments there are much older than the Taj," Venkateswaran points out. "Five important sites in Rome are 1,500 years old. The marble Arch of Constantine, for instance, has turned completely yellow because of industrial and vehicular pollution." As he asserted, many Indian archaeologists are every bit as competent—though probably not as knowledgeable—as their European counterparts. Sengupta and Lal, after all, were among the Indians who very successfully restored the gigantic Buddha at Bamiyan in Afghanistan; others will very likely be going to Angkor Wat. However, the lack of a professional work culture makes Indian experts unsure of themselves, which is why they have an ambivalent attitude towards foreign specialists: alternately critical and deferential, ready to scorn their advice and on other occasions, anxious for their accolades. This is not the spirit which fosters an independent scientific attitude.



Meteorological instruments on top of the Taj Mahal.

In Athens, Venkateswaran met the famous conservation expert, Prof Theodore Skoulikidis, who checked first, that he did not believe in UN experts; second, in blindly applying preservatives, and only then agreed to discuss things with him! Like in many other fields of national endeavour, archaeological sites in India too have also suffered at the hands of foreign experts. The most notorious example concerns the famous frescoes of Ajanta, where Italians summoned by the Nizam of Hyderabad in the 1930s applied shellac, one of the few known preservatives at the time. In time, this turned yellow and now the problem is how to remove the shellac! "It's better not to do something wrong just because it's done in Venice or Athens," Venkateswaran points out. The danger with preservatives is that they may in fact trap moisture within the stone and not allow it to "breathe";\* alternately, the effect of the preservative may be irreversible. Lal believed that the very fact that Tecneco was able to carry away such a large number of samples of marble to Rome—a

\*There is also a fierce debate among archaeologists—particularly regarding the restoration of paintings—whether the application of preservatives tampers with the antiquity of objects.

40 kg package—amounted to an unpardonable surrender on the part of the authorities in Delhi. “We offer presents in the Indian tradition: these were samples from the monument itself. Can any Indian archaeologist obtain samples of marble from the White House if he goes to Washington?” he questioned, rhetorically. At the same time, archaeologists like Sengupta, Tandon and Venkateswaran repeatedly emphasise that many UNESCO, Italian and other experts are full of praise for ASI’s restoration work.

### **Conservation of sites**

India has the largest number of archaeological sites in the world, though this is seldom realised even within the country itself. Out of some 15,000 monuments listed in 1966, 3,500 were under the ASI; now the number stands at 5,000. The ASI is plainly too weighed down by a severe shortage of funds and facilities to able to cope with a task of this magnitude. Its various departments keep vying with each other for a larger share of the organisation’s meagre resources and officials scramble to get promotions. One statistic sums up its pathetic state: it has spent Rs 7.5 crore out of its total annual budget of Rs 9 crore on salaries: what is left for conservation and restoration can be well imagined. While the Taj itself, being a prize monument, is relatively well looked after by 70 attendants (although some place lighted candles directly on the marble tombs, which are inlaid with the most exquisite flowers made up of semi-precious stones, in the hope of attracting cash offerings from the faithful!), the rest are in a state of utter neglect. There is no better illustration of the sheer inability of the ASI to protect the monuments under its charge than the severe damage done right under its very nose in Delhi itself—the havoc caused to the marble monuments in the Red Fort and, to a much lesser extent, Humayun’s Tomb by atmospheric pollutants. The location of the Indraprastha thermal power station, just a few hundred metres from the Red Fort, once again demonstrates the paucity of vision of the planners, who were so intent on ridding the capital of its chronic power shortages that they completely forgot about the health of some of the country’s most treasured historical sites. (Of course, no one was aware of environmental problems two decades ago.) “Delhi would have been ideal for the study of pollutants on monuments,” said Nayak. The Indraprastha station had been spewing out SO<sub>2</sub> and SPM (fly ash) ever since it was set up over two decades ago and no one

even today seems at all perturbed about the damage it is doing.\* The ASI also has other monuments on its hands which are endangered by the environment, apart from Ajanta: Konarak, which has been battered by salt spray from the sea and the Bagh caves in Madhya Pradesh, where extensive leaks are threatening the ancient frescoes. But it is blissfully ignorant—as the former Director General, Dr B.K. Thapar, admitted to the Karan Singh committee—of the possible threat, for instance, to the Elephanta caves from Bombay's oil refineries, which are exceedingly close, as well as to the marble of the Victoria and Albert Memorial in Calcutta.

The conservation of archaeological sites by the ASI is thus a hit-and-miss affair. In addition to the ASI's list of 5,000 monuments, another 2,000 are looked after by museums, state governments and civic authorities, which means that half the identified sites in the country are unattended. The law protecting them does not help much either. The Ancient Monuments and Archaeological Sites and Remains Act of 1958, is based on the original passed by Lord Curzon in 1904. According to the IHS, which contemplated taking legal action to stay the construction of the refinery, the actual title was the only provision in the entire Act which could help them to present their case. Thus many sites are threatened simply by default.

I came across one case that came to the attention of the authorities almost accidentally. A small company was going to build a 50 tonne a day (tpd) sulphuric acid plant at a village just 5 km from the famous stupas of Sanchi. The Director of Archaeology of Madhya Pradesh and some experts from Bhopal university got wind of it and objected to the location. NEERI was consulted and confirmed that the SO<sub>2</sub> emissions could corrode the stone. As a general guideline, it suggested that no such industry should be located within 50 km of Sanchi. The company shifted to another site and also undertook to instal mist eliminators and to raise the height of its stacks to disperse pollutants. For every one such case, there is

\*In fact, another power plant was proposed in Delhi at Narela which, according to Dave, would have polluted a 280 sq km area, releasing 300 tonnes per day of SO<sub>2</sub> and 200 tpd of fly ash; fortunately, it was scuttled for environmental reasons. An Energy Ministry committee has now suggested Muradnagar in UP as the site for a 1,000 MW thermal station for Delhi.



no telling how many escape the notice of the authorities. Yet another unpredictable environmental hazard is the lack of proper building restrictions near sites. Varadarajan complained, for example, how the Clarke Shiraz hotel was given permission to come up so close to the Taj that every occupant could see the monument from his window, but marred the landscape around the monument. Similarly, Humayun's Tomb, which was visible from the Mathura Road till 1955, is now surrounded by buildings and described as "a lost case" by the Delhi Urban Arts Commission.

By way of contrast, one has only to study what has been done at the 2,400-year-old Acropolis in Greece to realise what concerted action by everybody involved—from city planners to restorers—can achieve. Indeed, it is surprising that more attention was not paid to the work of Greek experts at the time of the Taj controversy, since the Acropolis is easily the worst case of discoloration of marble by  $\text{SO}_2$ . The Italian experience, especially at Venice, was different, as we have seen. The devastation caused at Athens has now been etched in the public mind by the pictures of the disfigured statues of the caryatids or maidens in the Erechtheum. Five faces now bear a "leprous" appearance after being eaten away by acid from the atmosphere and resemble decaying lumps of stone. Athens, in fact, has earned itself the unenviable reputation of becoming the worst polluted city in Europe, thanks to the use of high-sulphur fuel for heating homes, automobile emissions and a large oil-fired power plant at the port only 10 km away. The modern capital of Athens, sprawling around the ancient Acropolis which is perched on a hillock, was designed for 1.5 lakh people; today, it has over 40 lakh! In 1977, 2 million visitors tramped through the Acropolis, wearing away the rock base; now none are allowed inside the ruined Parthenon. Apart from preservatives, Greek experts are removing the caryatids and keeping them in the safety of the Acropolis museum, replacing the originals with copies made from cement and marble dust.

But the long-term measures include an attempt to heat all houses in the vicinity of the monument with solar power and ban the use of all internal combustion-powered vehicles in the area. The present socialist government has already ordered a lowering of the sulphur content of fuel, a 20 per cent cut in production by polluting industries and the shifting of the power station and a 150-year-old municipal gas works. An even more far-reaching move is the

decentralisation plan, which has reduced the flow of people coming into the capital. Among the other notable cases in Europe where restorers are working overtime are cathedrals and abbeys like Cologne, Chartres, Reims, Notre Dame, St Paul's, Westminster, Canterbury and York Minster, apart from Italian monuments in Venice, Florence and Rome. There is also the celebrated example of Cleopatra's Needle, a large stone obelisk moved from Alexandria to London, which has suffered more deterioration in the damp and smoky atmosphere of that city in the last 80 years than in the preceding 3,000 years of its history. As Shivaji Rao's slides show, its surface is now totally defaced.

The lesson that could be drawn for the preservation of the Taj from the work of experts like Skoulikidis in Athens and the famous British restorer, Kenneth Hempel, is that eternal vigilance is the price of safety. To begin with, the "anatomy" of the monument has to be studied in far greater detail. The last such survey of the Taj, it is ironical to note, was conducted by those same arch plunderers of art treasures, the British! In 1942, an Advisory Committee on the Restoration and Conservation of the Taj Mahal conducted detailed investigations<sup>5</sup> into the condition of the structure by researching old records. It reported that there was "no systematic record of damages that had occurred: it is not known whether cracks seen in the vaults, drum and dome occurred after the first earthquake or the more recent one in 1934 or because of age, weather and temperature variations." The earliest reference, as we have seen, is the concern shown by Aurangzeb, who consulted experts but they admitted their inability to stop the leaks in the internal and external domes.

The first detailed repairs were conducted by the British in 1814, 1822 and 1864. In 1936, the Archaeological Department estimated that it would cost about Rs 53,000 to repair the cracks and leaks, which were causing "serious concern in the public mind" and this led to the comprehensive survey in 1942. It was this study that brought to light several defects, such as leakage, decay of marble and sandstone, development of cracks in marble slabs, bulging and displacement of stones, flaking of plaster, salt efflorescence, accumulation of rain water, rusting of iron clamps and dowels (pins which keep stone in place) and deterioration of the lime mortar in the brick masonry. In fact, one of the major sources of disfigurement of the marble surface of the Taj today is the corrosion of these

iron clamps. In the Acropolis, similar damage was unwittingly done when a famous restorer named N. Balanos inserted iron pins in the marble of the Parthenon to reinforce the structure between 1902 and 1908; the ancient originals were cased in lead which saved the pins from the environment and allowed them to contract or expand! As long ago as in 1964, Skoulikidis warned about the danger of corrosion but officials paid no heed; the pins are now being painstakingly replaced. Whereas Tecneco may not have been required to conduct such a detailed examination of the physical structure of the Taj, this was surely the responsibility of the ASI. Whether the Mathura refinery was built or not, it was essential to establish what the current state of the monument was—whether the occasional flooding of the Yamuna, for instance, harmed the foundations. Once this was done, it would be possible to make extensive repairs and then permit the “final solution”—washing wherever possible (as long as marble retains its sheen, it is impervious to moisture) and using preservatives on certain surfaces of the monument.

But one would have to go further still, as was done for the Acropolis, and see what could be done in Agra to curb continuing emissions of  $\text{SO}_2$ . With the closure of the two antediluvian power stations (which consumed 1,100 tpd of coal) and the switch to diesel in the railway marshalling yard (50 tpd of coal previously), the only remaining problem were the iron foundries (Agra's industry as a whole consumes up to 3,000 tpd). As we saw in the previous chapter,  $\text{SO}_2$  levels in Agra are now down by 75 per cent. Mathura is one of the largest centres in the country for the manufacture of low-grade castings, with some 250 units (of which 50 are big). In 1976, during the emergency, Sanjay Gandhi made one of his infamous “beautification” attempts by clearing the immediate environs of the Taj of people and creating “Foundry Nagar” where these units would be shifted. It was situated just 10 km away on a 150-acre plot *north-west* of the Taj—which meant the monument would have directly received all its emissions! Only four or five foundry owners moved—and retained their original plots. The high-power committee appointed in 1979 under Prof M.G.K. Menon attempted to devise incentives to coax the owners to move to another site, south-east of the Taj. Understandably, they were most reluctant to do so and the possibility of their ever leaving Agra seems remote. The committee devoted some attention to devising new technology for

the cupolas used in the foundries to minimise the emission of  $\text{SO}_2$ . Yet another classic example of the right hand of the authorities not knowing what the left was doing was the UP government's plan to locate two industrial colonies right in Agra! State government officials pointed to the difficulty of imposing a blanket ban on industries coming up in the town and believed that it was better to stipulate the toleration limits of emissions and define parameters for distance, quality of fuel etc. A ban would certainly cause both political and socio-economic problems, but is essential for protecting the monuments.

Perhaps the single biggest act of shortsightedness on the part of the Varadarajan and Menon committees was to treat the establishment of the Mathura refinery as an immediate problem and not see what it would do to the region as a whole. According to IOC, in fact only one-fifth of the refinery's products will go to agriculture—the rest will fuel industry. "They should have examined the total environmental impact," believes Dave. "What would be the industrial development between Mathura and Agra? How would the huge increase in heavy truck transport services alter the pattern of growth? Jaipur, for instance, was once a tourist haven but today has been overrun by trucks and *dhabas*." The development of secondary industries in and around Mathura would lead to a change in land use in the area from agriculture to small industry and partial urbanisation. Till the early 'seventies, the main highway was infested by dacoits, as is still the case between Agra and Bharatpur. Indeed, the configuration of the entire National Capital Region around Delhi would certainly be altered not only with the refinery at Mathura but the petrochemical complex at Salimpur and the second refinery in the north-west at Karnal. This might trigger off the kind of development (albeit on a smaller scale) that has accompanied the growth of the petrochemical industry at Thane-Belapur in Bombay: as we shall see in the Thal-Vaishet case, this was—after heavy engineering—the second biggest factor responsible for the city's growth. With the already rapid industrialisation of Delhi's environs (particularly the Faridabad complex on the Mathura Road), it is not inconceivable that the entire stretch between the capital and Mathura will become choked with factories like in the Bombay-Pune belt. When that happens, the city of Delhi is bound to face all the familiar symptoms of urban sickness: relentless migration and the spread of shanty colonies. These are all chain

reactions triggered off by the Mathura refinery that no planner has given any thought to. A sub-committee appointed by Prof Menon and headed by Dr Nilay Chaudhuri, head of the Central Board for the Prevention of Water Pollution, has instead been indulging in an elegant exercise in geometry—he has devised a trapezium, with Agra in the centre, within which no industry should be located. The logic of this move appears dubious and it seems to illustrate, almost literally, the stunted vision of planners—the exact antithesis of an integrated viewpoint.

This is not to suggest, as must be clear from the previous chapter, that the outlook of the environmentalists involved in this controversy was any better. Indeed, out of the three cases in this book, the role of those who opposed the Mathura refinery tooth and nail was dubious, to say the least. While members of the IHS always maintained a dignified—if elitist—aloofness without muddying their feet in anything unsavoury, the two other antagonists, Dave and Shivaji Rao, certainly did not conduct themselves in a manner which advanced the cause of environment. Dave was an intelligent man with a ready grasp of air pollution issues, but he let his self-esteem warp his sense of judgement. He accused the Varadarajan committee of cheating with figures. On the other hand, Thomas Mathew recalled how Dave would claim that the Environmental Protection Agency of the US was using equipment that he had designed 30 years ago in that country! "There were a microscopic number of scientists who understood the issues," says Mathew. "Less than a handful of them took the trouble to pursue it—the others just jumped on the bandwagon of ritual breastbeating. This will repeat itself in many environmental conflicts, like Silent Valley." Nayak adds, with barely disguised sarcasm, "It was quite enlightening for a layman like me to hobnob with so-called experts!"

Shivaji Rao was a different species altogether. He plainly saw in the Taj issue an opportunity to catapult himself as an environmentalist at the national level and escape from the obscurity that he was otherwise doomed to in Visakhapatnam. On the strength of the exhibition he had organised at the time of the Indian Science Congress, he obtained an invitation to Stockholm to attend a conference of the Royal Swedish Academy of Sciences in 1976. The Taj was, as Mathew put it, his "sole claim to fame" and he was determined to extract the last ounce of publicity, which he certainly succeeded in

doing. He complained that the scientists who did the studies for the Taj "didn't have a holistic approach: they had depth of knowledge but no width. Like the blind men looking at the elephant!" But his own contribution showed little evidence of such holism. The most telling example of this was the "exotic technology to save Taj and the people of Braj" which he proposed in a booklet he published himself in 1978 and continued to propound, even when the refinery was partly functioning in early 1982. "The only way to save the Taj Mahal is to adopt a highly sophisticated technology of transporting the corrosive gases from the refinery stacks through separate sets of anticorrosive pipelines, bypassing Agra, to a safe place like Etawah, downwind of the Taj Mahal," he wrote! Shivaji Rao also advocated that the liquid effluents from the refinery should be transported through a network of pipelines, bypassing the Agra water supply system, to a safe place like Shikohbad, downstream of Agra, where they could be treated and discharged into the Yamuna. He believed that even if this was going to cost Rs 20 crore, it need not have deterred the planners. If they could spend Rs 200 crore on the refinery and about the same on the 1,000 km long crude pipeline from the Gulf of Kutch to Mathura, this was a small price to pay for environmental bliss. In the booklet he said that if it was not possible to shift the refinery *in toto*, "at least the more polluting units can be shifted to Etawah region and the present structures can still be used for storage, transport and distribution." Because environmental expertise was such a scarce commodity, the Karan Singh committee pursued this line of enquiry and grilled Nayak, in Shivaji Rao's presence, about such a possibility. The IHS also toyed with this alternative and raised it when they met Mrs Gandhi in September 1980.

Only those who were totally innocent of the technology of an oil refinery could have suggested a separation of facilities—such as storage in Mathura and refining at Etawah; all the facilities have to be centralised to give the management the flexibility of operation to switch to different products according to demand and various other factors. Any piecemeal fragmentation was therefore totally out of the question. Even Chib of the IHS had to pull up Shivaji Rao later for reiterating that the shifting of the site was still feasible and would only cost Rs 25 to Rs 30 crore: "It is completely unrealistic," he wrote to him, "to believe that it can be shifted . . . it could mean a loss of more than Rs 100 crore . . . The country needs more oil and

LPG and this is going to be the largest refinery." Such is the nuisance value of agitators like Shivaji Rao that as late as in September 1984, the Supreme Court issued notice to the IOC management and the Central government on a writ petition accusing them of destroying the Taj Mahal by the unchecked emission of pollutants from the refinery, as well as the iron foundries at Agra. The petitioner, M.C. Mehta, referred to as a "social worker", quoted Shivaji Rao's report in claiming that sulphuric acid, in the form of acid rain, was destroying the Taj Mahal and also affecting the people, flora and fauna of the surrounding areas. Another indication of Shivaji Rao's muddle-headedness was his assertion that the green belt around the Taj would do more harm than good because the trees would give off carbon dioxide at night and this would affect the marble structure! This is why Shivaji Rao raised the hackles of environmentalists like Mathew, who castigated him for not referring to sources of pollution in Agra, and attributed it to "rank ignorance", pointing out that the Mathura refinery at that stage was "Rs 130 crore worth of reality." He wrote to him in July 1978: "All my training and education and experience and sensitivity rebels against my getting blinkered and bogged down by any one or the other symbolic environmental crusade, howsoever important."

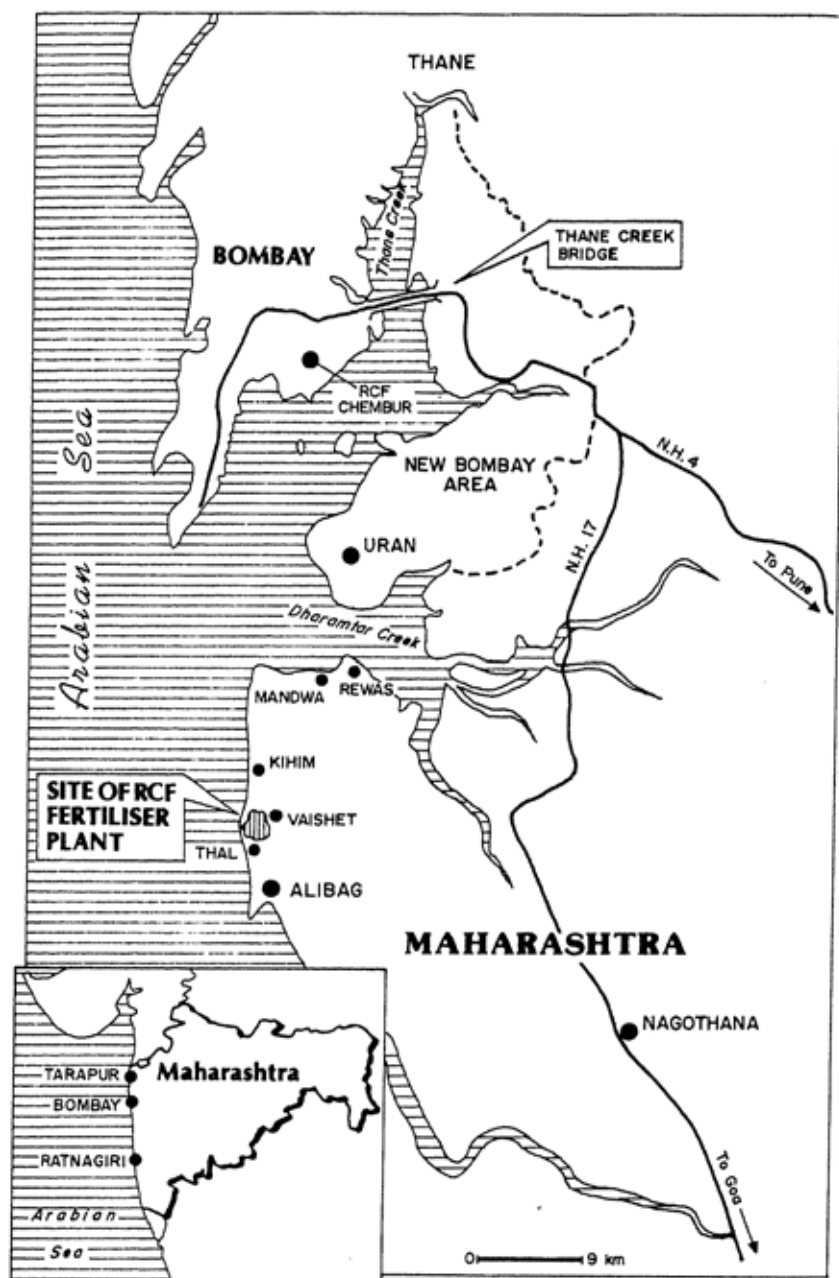
Today, if you obtain special permission to climb the dimly-lit stairs to reach the base of the Taj Mahal's wondrous onion-shaped dome, you will be greeted by an odd spectacle: safely out of sight of the thousands who mill around on the milk-white marble slabs a few hundred feet beneath, are ugly meteorological instruments keeping a constant vigil at the monument. Small blocks of marble are also suspended from the base of the dome to measure the effect of air pollution. This seems to symbolise the entire controversy between the preservation of this architectural wonder and the location of the Mathura oil refinery. It was only as an afterthought that planners and technocrats awoke to the potential dangers of the project. That it turned out to be safe was in a sense purely fortuitous and hardly a matter for self-congratulation. If all the effort and expense that went into estimating what damage it was likely to cause are not to be wasted, the controversy should be treated as an educative process for planners as well as scientists, to avoid similar mistakes in future and to take far more comprehensive measures to protect the country's cultural heritage. One cannot lightly dismiss the charge that several IOC officials make today, that "the best thing that

could have happened to the Taj is the Mathura refinery!" Had it not been for the wrangling, it is certain that the Taj and other monuments would have continued to remain neglected.

Forty kilometres to the north-west, the Mathura refinery is functioning to full capacity, a bright yellow flare forking out of its high chimney stack. Visibly, it does not appear to be contaminating the atmosphere, though the acrid smell of sulphur faintly envelops the immediate environs. But its real impact is palpable all round: apart from the bustling highway, the landscape is barren and uninviting. Hence the very presence of this massive project seems a mirage, making the promises it held out for the betterment of the lives of thousands of people in the region look illusory. The wasteland around the refinery only seems to emphasise the vast gulf between what is proffered as "the temples of today" and the grim reality.







## 6 Furore over a Fertiliser Factory

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**R**alli Jacob, a former Bombay adman, first heard rumours of a massive fertiliser “factory” being set up around Mandwa—on the mainland just across the Gateway of India in Bombay—in the summer of 1977. He had settled in a village called Dhokavade in the area the previous year. With his family, he had decided to get away from the big city and move to rustic surroundings, close enough to Bombay to sell the ceramics that they would both produce. He had spent much time in obtaining permission from the Maharashtra government to set up his kiln, which would use high-voltage electricity, in an area which was out of bounds for industry. Hardly had he obtained clearance, when word spread that the villages in the area would be swallowed by a giant fertiliser plant.

Local villagers around Mandwa-Rewas, who grew paddy, vegetables and fruit or were fisherfolk, were equally agitated that their land and occupations would be threatened by this new and unforeseen development. Jacob collected as much information as he could and took a ferry to Bombay where he hoped to mobilise public opinion against the scheme. He met Navroz Mody, who had been active in the Committee for Protection of Democratic Rights. Mody was intrigued by what he heard and spent a couple of days in the area across the harbour. “I introduced him to everyone and he was quite convinced of the merits of our case,” recalls Jacob today. “He asked me to return to Bombay where he said he could take me to the Save Bombay Committee.”

This committee had been formed in 1972—I was associated with it in the initial stages—in response to the growing congestion of the city, due mainly to the greed of real estate developers, and one of its Secretaries was Shyam Chainani, who had been to the same school as Mody. Jacob remembers that the initial response of Chainani and Kisan Mehta, the President, was to ask how the people of Bombay were concerned if some poor farmers living in Alibag taluka, 12 km

as the crow flies from Bombay but about 80 km by road, were displaced by a fertiliser plant. At any rate, Mody and Chainani were asked to find out all the facts; an architect, S.K. Das, was also roped in soon after.

Around the ferry port of Rewas, between which and Mandwa the plant was meant to be situated, villagers began to mobilise. Jacob sought the guidance of the former local MLA, Datta Patil. Patil suggested that the affected residents form themselves into a *zamin bachao* (save our land) movement. But Jacob pointed out that this had many connotations and a *shetkari bachao andolan* (save the peasants movement) would be preferable. This is how the "14 Villages Shetkari Bachao Andolan Samiti" was formed, with Datta Patil as President. In August, some seven thousand farmers and fisherfolk marched to Alibag, the taluka headquarters—the entire area falls within Kulaba district (now renamed Raigad) in the coastal region of the Konkan—to protest against the siting of a factory about which they knew precious little apart from the fact that it would swallow their precious land. Such was the sentiment aroused that the taluka panchayat samiti and the gram panchayats of all 14 villages—claiming a total strength of 24,000 farmers and fisherfolk—passed unanimous resolutions against the project.

The Union Petroleum, Chemicals and Fertilisers Ministry soon made its intentions clear. The mammoth project would be put up by the Fertiliser Corporation of India (FCI) at Rewas. Two plants would produce 1,350 tonnes per day of ammonia each and three plants would turn out 1,500 tpd of urea each. The entire project would cost Rs 580 crore, of which the foreign exchange component would be as much as Rs 330 crore. The "feedstock" would be associated gas (which is yielded when crude oil is pumped up from offshore fields) from Bombay High, 200 km away from the city. The gas would be piped under the sea to the Oil and Natural Gas Commission's (ONGC) terminal at Uran, only about 9 km north of Rewas. The project would require 500 acres of land, with another 200 acres for the township for employees, and it would be ready by 1982.\*

I published the first critical article on the proposed scheme in *The Times of India*.<sup>1</sup> It was written by Mody and Das and titled

\* Like the Mathura refinery, highly capital-intensive projects such as gas-based fertiliser plants take an average of five years to complete.

"Factory Looms Over Farm Land" (it was the first of two articles on the "Blight of Bombay": the second criticised the Tata thermal power station's new 500 MW plant in Trombay). The articles began on an emotional note, underlining the fears of the villagers. "None knew much about this monster (the fertiliser plant), or where it would first rear its head, or who would be the first to be eaten—but they understood that once the Factory got its teeth into a small part of their land, it would not take time for it to swallow the rest," warned the writers ominously. Somewhat more soberly, they went on to point out that the project would initially displace at least 5,000 farmers, most of whom owned a hectare of land; this is one of the more prosperous talukas in the Konkan. "Eventually, as ancillary industries and a proposed petrochemical complex develop, a large part of the 18,000 odd farmers from 14 villages stand to be displaced." The writers also insinuated that the plans were camouflaged in a great deal of mystery, as if the FCI was anxious to push it through in unseemly haste.

With remarkable prescience, they went over practically all the arguments against the choice of location that were to be refined and reiterated in the months to come. They questioned whether a capital-intensive plant of this nature would help develop the backward Konkan, whether displaced villagers could ever hope to find jobs in the venture. It commented that "for the local villagers, jobs at the factory at Rs 300 a month, paying near-Bombay prices for food and other commodities, are no substitute for even 2 acres of land which yield enough all year for a family of seven." They quoted the farmers as declaring, "We will not be bought, we will not be beaten!" and sarcastically questioned whether taking away agricultural lands was what the Janata government (installed amidst much euphoria early that year) meant by "priority to agriculture". If the authorities had shown scant respect for the inhabitants of Alibag, they betrayed utter disregard for the immense pollution that it was likely to cause in Bombay; no atmospheric or smoke diffusion survey had been conducted, despite the experience of the devastation caused by other fertiliser plants in the country—notably, by FCI itself in Chembur, on the eastern coast of the peninsula of Bombay.

There was a great deal of confusion over the actual amount of land that was to be "swallowed up" by the plant. A Maharashtra government spokesman clarified in November 1977 that FCI had

been "prevailed upon" to reduce its land requirements to 220 hectares (550 acres), of which 20 hectares belonged to the government and 32 hectares were *warkas* or fallow land. However, an earlier letter in July by S. Krishnaswamy, Secretary, Department of Chemicals and Fertilisers in the Petroleum, Chemicals and Fertilisers Ministry\* to K.C. Sharma, FCI Chairman, made it clear that in all some 3,000 acres were needed to accommodate the petrochemical complex that was planned along with the fertiliser plant as well. On subsequent occasions, when the location was shifted to Thal-Vaishet, FCI variously claimed that 700, 800 or a total of 1,500 acres were required. (Ultimately, 850 acres were acquired.) The state government also argued that only 29 farm houses would have to be acquired in the Mandwa-Rewas area and the total number of affected people would be just 1,600 (260 families) and not 24,000 as was being mentioned. What seems clear, even allowing for some exaggeration on the part of those opposing the project, is that FCI was referring to the actual displacement of people from their land by the factory whereas the environmentalists were estimating how many would be affected both directly and indirectly by the petrochemical complex too.

It was at this early stage that Mody, Das and Chainani decided to muster the support of Bombay-based organisations and they formed the Bombay Bachao Committee as a kind of apex body to co-ordinate this task. Among the organisations that originally banded together "for the protection and planning of Bombay region" were the Save Bombay Committee, the Bombay Natural History Society, Bombay Civic Trust, Society for Clean Environment or SOCLEEN, World Wildlife Fund, Friends of the Trees, the Committee for Protection of Democratic Rights and 14 Villages Shetkari Bachao Andolan Samiti. Dr Salim Ali—as India's best known ornithologist and conservationist, he figures prominently in all the three controversies in this book—was made the President, with Mody and Saad Ali (a relation of Salim Ali, as we saw in the Silent Valley chapter) Vice Presidents and Das the Secretary. Mody played the leading role in bringing these somewhat disparate organisations on to one platform: it was possibly his disenchantment with civil liberties campaigns which led him to look for new causes. Much

\* In September 1982, Petroleum was shifted to the Energy Ministry, leaving Chemicals and Fertiliser separate.

later, replying to a stinging attack in the *Economic & Political Weekly*, a member of Bombay Bachao—which was renamed the Bombay Environmental Action Group (BEAG) in 1979 because it was being constantly mistaken for the Save Bombay Committee—clarified that the body at the time of its formation was meant to be ad hoc, purely to combat the the effect of the giant fertiliser plants at Mandwa-Rewas, on the lines of the Save Silent Valley Committee formed in Bombay. However BEAG is still active today, thanks to the doggedness of Chainani, who was once Honorary Secretary of both BEAG and Save Bombay Committee. Mody and Das have since left the city, though the former, living in Pondicherry, continues to be Vice President of BEAG, takes an interest in its affairs and has even, for instance, represented BEAG at DoE meetings in Delhi on Tatas' proposed second 500 MW thermal plant at Trombay.

City organisations agreed to be drawn into the dispute because they feared that the fertiliser plant would spew its fumes towards Bombay, which was already reeling from the ill effects of high-rise construction and overcrowding. It would also congest the Bombay Metropolitan Region (BMR) and destroy what had been earmarked in Bombay's draft development plan as a green belt. The Trombay-Chembur belt in the mid-town suburbs, in particular, was very badly polluted; apart from FCI, there was Tata's thermal power station, the two oil refineries and a number of chemical factories, which had earned the area the unenviable epithet, "Gas Chembur". The spectre of pollution caused by the fertiliser plant was most vividly depicted in a front-page article titled "Rewas Threat to City" written by my colleague on *The Times*, Prem Shankar Jha.<sup>2</sup> "Recent studies carried out by the Colaba meteorological office indicate," he wrote, "that if the proposed giant fertiliser plant is built at Rewas-Mandwa in Alibag taluka, average air pollution levels during the winter months in south Bombay (which includes the heavily built up area from Malabar and Cumballa hills to Colaba and the Gateway of India) will rise to the levels prevailing in the Parel-Lalbaug area of central Bombay." (This is the heavily contaminated textile mill belt.) The inference was clear: unless something was done to halt the construction of the new FCI plant, the hitherto unpolluted and affluent residential and office areas of Bombay were doomed to suffer the same fate as the less fortunate mid-town precincts.

Jha cited how the sulphur dioxide level in Parel-Lalbaug was already 101 micrograms per cubic metre per day, as against a WHO ceiling of  $75 \mu\text{g}/\text{m}^3$ . He noted that "as fertiliser plants go, the proposed complex will be 'fairly clean'. This is because it will use gas as a feedstock, and electricity as its main source of power. In fact, the project authorities have taken care to replace three-quarters of the 1.2 million tonnes of coal that was called for in the original project report with electricity, leaving the annual expected consumption at no more than 300,000 tonnes." According to him, the danger arose because south Bombay had become a "heat island", with a mean night temperature of more than  $19^\circ\text{C}$ ,  $4.5^\circ\text{C}$  higher than even in Chembur. "This means that cooler air from Chembur and Trombay is even now being sucked into south Bombay, bringing with it heavy doses of pollutants from the Tata thermal power plant and the two refineries located there. The heat island phenomenon is the result of the reckless building of skyscrapers and the accompanying destruction of lawns and trees which has been allowed in the 'seventies." He also warned of the danger of thermal inversions in winter, when pollutants would be propelled downwards "on to the sleeping people of the city". At the very least, he urged that the plant should be shifted to the south-east of the Kankeshwar hills, about 16 km south of Rewas, which would form a barrier between the pollutants and Bombay.

This argument also put out by environmentalists was not correct. Mody and Das had themselves pointed out in their first article that it would have been difficult to bring down the emissions at Rewas to "acceptable" limits, as FCI claimed it would do, because the existing base level of pollutants across the harbour from Bombay was already high, thanks to emissions carried from Trombay-Chembur and the country's biggest petrochemical belt at Thane-Belapur. As an open letter issued by Bombay Bachao to the people of Kulaba district further explained, according to experts, the predominant winds were such that pollution from Bombay and New Bombay—the twin city being planned on the mainland north of Mandwa-Rewas—would be carried to Alibag taluka for more than half the year, and not the other way around. The source areas were exceedingly close, besides. On the other hand, emissions from Rewas would drift across to Bombay during the monsoon, when the winds would blow from the south-west, but the rain would ensure that not much of the sulphur dioxide (or dust) would reach south

Bombay. Nevertheless, it was this non-existent menace that did succeed in arousing the concern of many of Bombay's citizens who would otherwise have remained apathetic about any development on the mainland. What is more, since the beaches at Mandwa and a little further down the coast at Kihim were occupied by bungalow owners who used them to get away from Bombay for week-ends, Bombay Bachao was able to make common cause with these highly influential people. Kihim beach, in fact, is virtually the private preserve of a family belonging to a Bohra Muslim sect, which included Saad and Salim Ali, as well as Zafar Futehally, who headed the Silent Valley task force appointed by the NCEPC. They have enjoyed hereditary rights over the tiny strip for a century. Mandwa, which was directly affected by the Rewas location was a couple of hundred metres of coastline where the Bombay Sailing Association had its club house for "sailers" and leased shacks to a few privileged members. Notable among them were Naval Godrej, from the prominent family which owns the vast industrial empire of that name in Vikhroli, a north-east suburb of Bombay. His close relation, Kersi Naoroji, also has a beach bungalow which commands a panoramic view of the skyscrapers of south Bombay, 12 km away. Naoroji, in fact, became the Chairperson of Bombay Bachao and one of its most generous supporters; he is the works manager of the Vikhroli factory.

At Rewas itself the tempo of the campaign against the project reached its zenith by the end of 1977. The high point was a "boat morcha" that the fisherfolk from the area organised in December. A number of boats, gaily dressed with coloured flags, sailed into Sassoon Dock in Colaba, bearing some 2,500 villagers and their families, who then marched through the "central business district" of south Bombay, bearing placards. The novelty of the protest attracted the attention of many citizens to the happenings across the harbour. That same month, Bombay Bachao displayed its clout for the first time by carrying its campaign to Delhi—the first of several air dashes to the capital where a memorandum was handed over to Prime Minister Morarji Desai.\*

It urged him to refer the issue to the Planning Commission, which had earlier asked the Fertiliser Ministry and FCI for further details

\* Saad Ali knew Desai personally, having been in jail with him at Yerawada and Nasik during the freedom struggle.



of the project and was unhappy about the haste with which it was being pushed through. It referred to how Engineers India Ltd (EIL), the reputed public sector consultancy firm, had in 1972 suggested Ratnagiri, 380 km by road down the Konkan coast, as the site of a fertiliser plant when an environmental dispute had arisen over the proposal by a private firm, Dharamsi Morarji Chemical Co (DMCC), to locate its plant at Nhava Sheva, within Bombay's twin city area. Fertiliser Ministry officials told the environmentalists that they had no say in the selection of the site: that was purely the responsibility of the Maharashtra government and the FCI would merely construct its plant at the location the state authorities chose. This was not correct: Mandwa was chosen as the original site by the Centre.

George Fernandes, the Industries Minister, gave them a very sympathetic hearing and a categorical assurance that he would oppose granting FCI its industrial licence because he would not like to add to Bombay's pollution and there was a new policy to disperse industries away from big cities. The Janata party had in fact laid down that all new heavy industries should be prohibited within 15 to 20 km of a metropolitan city. It was clear that the decision-making process under the loose coalition Janata regime was by no means rigorous: Fernandes did not see eye to eye with the Petroleum Ministry or, for that matter, with the Maharashtra government, on this issue. Indeed, the Planning Commission and the Finance Ministry had even earlier queried how such a massive investment could be made without full details of the project being submitted. The Planning Commission, in particular, wrote to the Fertiliser Ministry that its report describing the project was "perfunctory" and had not been prepared according to the guidelines laid down by the Commission. It referred to the omission of "alternatives for sites, size and capacity of plants, possibility of manufacturing phosphate fertilisers at the same site and investments required by agencies like railways, port trust and the state government." A *Blitz* article insinuated that there was some ulterior motive in the manner in which S. Krishnaswamy and the FCI Technical Director, S.K. Mukherjee, had submitted their hastily assembled proposal to the Planning Commission and Finance Ministry after their visit to Washington in September 1977 ("Fertiliser sellout to multitis ..." was the title, sniffing of scandal.) It alleged that international tenders

had been called for putting up the plant even before the Centre had given its sanction, inferring from this that they were attempting to keep out Indian manufacturers who could have supplied 900 tpd ammonia plants for which indigenous know-how existed. Although there is no reason to suspect the *bona fides* of these two individuals, subsequent events did indicate that multinational companies were lobbying furiously to win the contract for the west coast fertiliser plant. The World Bank, in a unprecedented move, withdrew its \$250 million dollar loan after Mrs Gandhi's government, which came back to power in January 1980, dropped the US firm C.F. Braun, which was contracted to supply the two 1,350 tpd ammonia plants, and selected Haldor Topsoe, a Danish-Italian one instead.\* The Bank, however, has not displayed similar petulance over the replacement in 1984 of the American company, Kellogg, by Haldor Topsoe for the Rs 650 crore gas-based 1,350 tpd plant which will come up in Guna district, Madhya Pradesh.

In Bombay Bachao, the country was witnessing its most sophisticated environmental campaign yet. These were all young, highly skilled professionals in their respective occupations: Mody, a publisher with Oxford University Press, had been educated at Dartmouth College in the US; Das, as an architect, was passionately interested in town planning; Chainani, an executive with Tatas, had been educated at the Indian Institute of Technology in Bombay, at Cambridge and MIT. They complemented each other well and presented stiff opposition to those who wanted to set up the Rewas plant. Not only were they able to marshal all the facts—especially those that had not been made public—but had in Mody an accomplished activist. The very generous financial backing they received from their well-to-do fellow campaigners and their contacts in the press like Jha and myself made them most formidable. They first tasted blood as early as January 1978, when the Fertiliser Ministry agreed to the Planning Commission's request to consider an alternative site. In Bombay, a little later, H.N. Bahuguna referred only fleetingly to the Rewas plant, saying that location should be decided as soon as possible so that gas from Bombay High

\*This time, Mrs Gandhi's Italian daughter-in-law Sonia was conspiratorially cited as the mysterious link!

was not wasted:\* later estimates put this national loss at Rs 28 crore a year. Bahuguna, the Minister concerned, did deliver homilies in Bombay about the dangers of industrial pollution in general and the need to compensate local people—significantly, he specified farmers and fisherfolk—whenever a major industry was built on their land, as was the case at Rewas and Mathura.\*\*

He gave an assurance that the Centre would sanction the funds to reduce pollution in Trombay, for Bombay would not be allowed to suffocate: "If Bombay dies, who lives?" he asked rhetorically. This was in total contradiction to what he told Bombay Bachao earlier: he declared that Bombay could sink to the bottom of the sea—the so-called environmentalists should not treat it as if it was their father's property! While still in Bombay, he held a press conference, where he announced that the decision on the site had been postponed "in deference to the wishes of the people". He described the objections to Rewas as two-fold: pollution and population. Although the latest industrial policy of the Janata government stipulated that no industry should be located near a metropolis, he pointed out that Rewas was 14 km from Bombay as the crow flies but more than 50 km by road! This ridiculous remark was to prompt observers to ask whether pollution took the highway too...

Early in February 1978, the Fertiliser Ministry recommended to the Planning Commission that a site on the road from Rewas to Alibag—a stretch of about 15 km—should be chosen as the site because of the availability of land and infrastructure (the proximity of a jetty). This hardly amounted to an alternative, since it would face the same problems that the original location did. Furthermore,

\*Associated gas from Bombay High, which comes out automatically once crude is pumped to the surface from an offshore field, is still being flared for want of facilities to pipe it to users. In 1982, 1.8 million cubic metres was being burnt a day—estimated at Rs 10 lakh daily or Rs 36 crore a year. By January 1984, this figure had doubled to 3.5 mcm a day—Rs 20 lakh daily and Rs 72 crore a year. Natural or "free" gas fields, on the other hand, can be tapped in the ocean bed whenever the facilities exist to use it, unlike associated gas.

\*\*He added that when he was Chief Minister of UP, he had convinced the Central government that the compensation paid to the people around the Mathura refinery was sufficient to meet their needs for two decades. "Today you can go and meet any displaced person there and see for yourself if he is satisfied or not. The same guidelines can also be applied to Rewas," he boasted.

it told the Commission that Ratnagiri would cost Rs 65 crore more because of bad rail connections and the shortage of water. Bombay Bachao quickly responded to this by pointing out that the second site, like the original, was still within the Bombay Metropolitan Region (BMR). The planners had earmarked this among certain areas on the mainland for the spillover from Bombay and at one stage even considered locating a second international airport there. Bombay Bachao suggested other locations in the Konkan like Murud-Dighi, Roha (where an industrial estate has already come up), Chiplun, Jaigad and Dabhol, all of which had been earlier identified as possibilities for a west coast plant by the Maharashtra Industrial Development Corporation (MIDC). It pointed out that these sites would fall along the proposed rail link to Ratnagiri—part of the Konkan railway. In the railway budget, the Railway Minister, Madhu Dandavate, who happens to come from the Konkan, announced the construction of the first phase of this long-delayed scheme from Apta, in the hinterland about 15 km north east of Rewas, to Roha. Eventually, this would connect Maharashtra with Goa and Karnataka and thereby with Kerala and Tamil Nadu. This has been the single biggest impediment to the industrial development of the entire west coast of peninsular India. As things are, to reach Kerala from Bombay by rail requires a circuitous detour via Madras.

### **Opposition to plant**

Meanwhile, at Rewas, opposition to the plant hardened. A World Bank team, escorted by the FCI, was physically prevented by a phalanx of farmers from visiting the site and had to turn back. Unlike in the other two cases in this book, the issue polarised political parties locally. Thus Datta Patil, who had won the Alibag seat in the Maharashtra assembly in 1957 and again in 1967 for the Peasants and Workers Party (PWP, which is strong only in this coastal region in the state), fought the elections opposing the fertiliser plant as a major issue, while his Congress and Janata opponents both supported it. Datta Patil played a populist role to the hilt: he took a stand against the plant even while his brother, Prabhakar, who was the zilla parishad President, supported it. Thus the family kept both options open, while Prabhakar publicly declared his preparedness to fight his brother if the need arose! "Datta feared that his Congress rival Khanvilkar would enjoy patronage at the plant if it

did come," recalls Das, "so he didn't want to lose out." Many observers feel that another reason for Datta Patil's opposition was simply that he wanted to have the rates for compensation for land raised as a result of the local agitation, in the event of which he would get a cut. Khanvilkar fought the election on the plank: "Progress or no progress?", whereas Mody, on behalf of Shetkari Bachao, issued the open letter to the people of Kulaba (referred to earlier), questioning what was meant by progress. He pointed out that effluents from the plant would contain ammonia and raise the temperature of the sea water, thereby harming the fish. "To those farmers who own even one hectare of land, let us ask one question," he wrote. "Do you think you and your families will have a better life as casual labourers in one of the slums that will grow in the near future around the factory, than if you could work on your one hectare on which irrigation, seeds, credit and marketing co-operatives were made available? To those who ask for industrialisation we say this—yes, it is in fact the Janata government's policy to develop rural industry—not industry that has drawn blood from the lives and land of farmers, but industry which helps agriculture to grow... It is in your hands to determine your future." Datta Patil won the election with a handsome majority.

The Union Finance Minister, H.M. Patel, convened a high-level meeting, attended by Bahuguna, Fernandes, Dandavate and some key officials, where a working group of senior secretaries was set up to work out the costs of switching to another site. Bahuguna made a forceful plea for sticking to Rewas, pointing out that it was a highly capital-intensive plant (it would only create 1,500 jobs directly) and would not have any ancillary industries around it. The group reaffirmed its choice of Rewas purely as the "least cost solution", on the ground that any delay would escalate the project costs by 8 per cent per year or Rs 40 crore. However Fernandes was quite adamant about the need for going further south and Patel was unhappy about the site so close to Bombay.\* To break this impasse, it was decided to ask the NCEPC, then under the Department of Science and Technology (DST), to look into the issue. The NCEPC appointed a task force under Dr A.K. Ganguly, of the BARC in Trombay, on March 6; it was asked to submit its report very quickly

\*It was widely alleged later that Patel was also swayed by the fact that one of his daughters, Uma, ran a poultry farm in Kihim. She has now abandoned it.

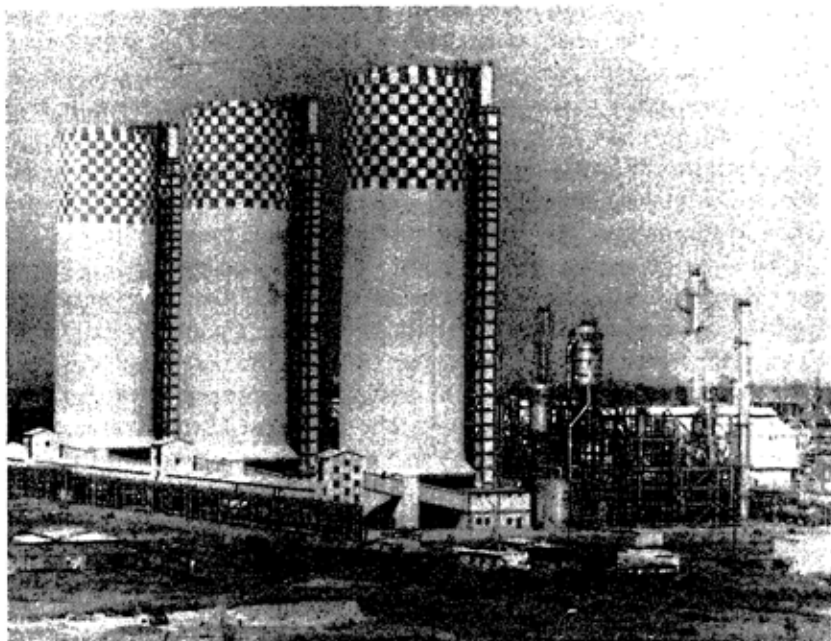
indeed—by April 15. The members included Dr Nilay Chaudhuri of the Central Board for the Prevention of Water Pollution (who invented the “no-industry” trapezium around Agra in the Taj case), Dr P.K. Das of the IMD and Zafar Futehally. Although the fertiliser industry was represented by Dr S.K. Mukherjee of FCI and Dr D.G. Rao, Adviser in the Fertiliser Ministry, no environmental groups were nominated or even given a hearing by the task force. They were asked to assess the likely impact of the fertiliser plant at Rewas and examine alternative sites if necessary. The appointment of this task force was kept a closely guarded secret.

At the first meeting, Dr Mukherjee of the FCI, who was a member, impressed upon the rest the urgency of coming to a decision soon: he pointed out that negotiations with the World Bank for a \$200 million loan were at an advanced stage and the Government was keen to finalise this deal before the end of the Bank's fiscal year on June 30. Ganguly recalls that the Maharashtra representative, P.D. Kasbekar, who was the Industries Secretary, made it clear from the outset that the task force was not going to suggest sites but only examine the suitability of those selected for it. Ganguly had been associated with the choice of locations for atomic power plants at Tarapur and Kota in Rajasthan. “Location is my professional interest,” he told me in his BARC office which commands a majestic view of the hill in Trombay that the nuclear scientists have now heavily forested. “In atomic energy site selection, there's an in-built tendency to go where nothing is growing, not to productive areas. I had a hunch that there were plenty of such sites for this fertiliser plant, but we restricted ourselves to the sites that were given us by the DST (which got them in turn from the Maharashtra government). Of the sites in Alibag taluka, none was suitable since the entire strip of coastal land from Rewas and Thal was agricultural throughout.”

The Ganguly task force<sup>1</sup> first visited Mandwa, Chanera and Tarapur. It found that Mandwa was “well known for its lush vegetation and the combination of agricultural, horticultural and fishing activities. Within 10 km of site, there is a population of 72,936 ... The area is economically viable on its own and a self-sustaining community resides here. The plant will, during the construction and later stage, result in the settlement of a large human population at a point which cannot but contribute further to the congestion of metropolitan Bombay.” As for its pollution profile, it reported that

"this area is prone to temperature inversions and calm conditions. High concentrations of  $\text{SO}_2$  have been observed in Uran during the winter months, including March. Pollution is transported from Bombay when westerly or north-westerly winds prevail and from Thane-Belapur industrial area when north and north-easterly winds prevail. Mandwa is nearer to Uran (9 km) and hence the background air pollution may be significant. Considering the high levels observed at Uran, any air pollution intensive industry in Mandwa is bound to affect additively the air of New Bombay in general and that of Uran in particular ... During the months of June to September, when southerly and south-westerly winds prevail, it is possible for pollution generated in Mandwa to travel towards Uran and some areas of New Bombay. Similarly, during the other months when north-easterly winds prevail, the pollution generated in Uran and New Bombay is likely to drift towards the proposed site of Mandwa."

The task force rejected Chanera, a few kilometres west of Roha, because it was surrounded on all sides by hills which would act as a bowl for pollutants. At Tarapur, on the other hand, the area to be acquired was only grassland and there was no farming. Besides, the City and Industrial Development Corporation (CIDCO), the autonomous agency floated by the Maharashtra government to plan the twin city of New Bombay across the harbour, had built 100 houses which were ready for occupation there. The cost of land was cheap and there were good rail and road connections, thanks to the existence of the atomic power plant and a MIDC industrial estate there. The task force ruled out Usar for largely the same reasons as Chanera and concluded: "While the Rewas site has certain technoeconomic advantages and the water pollution aspects can be made minimal if due precautionary methods are adopted, the air pollution situation, within the constraints of the data available, is of some concern during some parts of the year. A natural ecological balance exists in the profusely vegetated Alibag area. The task force has also noted that the community residing in Mandwa is self-sustaining and economically viable. Taking all the environmental facts into consideration, the task force does not recommend location of the plant at Rewas. The Tarapur site is acceptable from all environmental impact aspects. Therefore, the task force recommends unanimously that the fertiliser plant be located at Tarapur." Even Mukherjee of FCI was party to this decision.



Thal-Vaishet fertiliser plant: biggest producer of urea in the world

Before Ganguly could officially present this report on April 14, the findings were leaked to the press. Bombay Bachao and the Rewas villagers were exultant. One of the fisherfolk's leaders wrote: "If there was a river or a canal linking Bombay with the capital city, we would have sailed to Delhi in our boats to offer thanks." The Fertiliser Ministry and Maharashtra government, however, were hardly enthused. The former pointed out that a separate overland pipeline was being built from Uran, the landing point or "landfall" for Bombay High gas, to the FCI's Chembur fertiliser plant, which may have been able to carry the 3.5 million cubic metres of gas needed daily for the new plant as well if it was in Mandwa. A new overland pipeline would now have to be built to Tarapur, which would cost over \$25 million. An alternative was to lay a new submarine pipeline from the newly discovered Bassein offshore field, a little above Bombay High, to Tarapur, but that would cost twice as much. As for the state government, in



Ganguly's words, "All hell broke loose." The last thing it had expected was a shift to a site north of Bombay. It was worried about Tarapur because being close to the Gujarat border, it feared that the petrochemical complex and its downstream units—which is what it was really more interested in, because of the massive investment and number of jobs—might spill into that state. As it was, Gujarat already had a massive petrochemical complex at Baroda, of which the largest unit was IPCL, linked to the Koyali oil refinery. The Maharashtra government thus lost no time in trying its damndest to scuttle this location. It sponsored misleading press reports that Usar was being considered by the Centre as an alternative: this site would cost only Rs 15 crore as against Rs 250 crore (an outrageously inflated figure) at Tarapur. Furthermore, the west coast railway project would get a shot in the arm if the plant was built in Kulaba district, it argued. The Fertiliser Ministry aided and abetted the state authorities by dropping not-so-subtle hints that if there was further delay in selecting a site, Maharashtra might lose the plant altogether. More blatantly still, it spread the word on April 17 that the Ganguly committee had actually *cleared* Mandwa-Rewas, while one intrepid local newspaper reported that it had opted for Mandwa as distinct from Rewas!

Finally setting the record straight, Bahuguna told parliament on April 24 that the government had accepted the NCEPC task force's recommendation to site the plant at Tarapur, adding that 65 per cent of the country's chemical industries were located in Bombay and any more would only add to the pollution. The revised costs were being worked out, he stated, by Rashtriya Chemicals and Fertilisers Ltd (RCF)—as the new company looking after the Chembur and two west coast fertiliser plants was christened after the unwieldy FCI was split up into four separate companies. Significantly, the government simultaneously announced that a similar twin-unit plant was being proposed in Gujarat as well, also based on gas from Bombay High and south Bassein. This indicated that very early in the controversy—well before any investments were made on the site—the Centre was aware that there was a considerable amount of gas available at the offshore fields to produce fertiliser at another site. In fact, in February, Bahuguna had disclosed that the cabinet had approved of a new fertiliser feedstock policy, in which priority was given to natural gas, followed by coal and finally naphtha (which had become prohibitively expensive following the

oil price hikes since 1973). Ever since it was realised by 1976 that the country's first offshore field at Bombay High, in which oil was discovered in 1974, had big proven reserves of oil and gas, Maharashtra and Gujarat had begun to worry about how this invaluable natural resource would be shared between them. The possibility of it being pumped further north of these states did not ever occur to them. In fact, ten ammonia plants are now being built, of which only four are in Maharashtra and Gujarat. Immediately after the Centre announced that Tarapur was being selected, a body called Public Opinion Forum in Ahmedabad proposed that even if the west coast plant was ready at the very earliest by 1982-83, to avoid flaring the associated gas, a pipeline should be built from Bombay High to Gujarat, as Prime Minister Morarji Desai had promised in May 1977. According to the ONGC, by 1976, Bombay High was found to contain 20 mcm a day—enough for six fertiliser plants.

Unnerved at the prospect of losing out on the spin-offs of the west coast plant, politicians in Maharashtra swung into action. On April 25, Chief Minister Vasantdada Patil criticised the decision as being unilateral; the Centre has not surveyed the other sites properly and "a great injustice" had been done to the state. He implicated Morarji Desai for plugging for Tarapur and merely communicating a *fait accompli*.<sup>\*</sup> Vasantdada Patil claimed that there was sufficient gas for a plant at Tarapur, as well as another near Uran, to which a 200-km-long, Rs 400 crore pipeline had been built. Amazingly, he denied that there was any local resentment in Kulaba district against the plant, adding mischievously that according to some people, H.M. Patel's daughter owned a poultry farm near Rewas. The very next day, Sharad Pawar, then state Industries Minister, flew to Delhi to protest against Tarapur, amid speculation that he was moving to form a new Congress-Janata coalition in Maharashtra, edging out the Congress (I) led by Vasantdada Patil.

The Janata party jumped into the fray with the state unit threatening to launch an agitation if the project was located north of

<sup>\*</sup>One should realise that it was easy to arouse the erroneous suspicion that Desai was protecting Gujarat's interests; after leaving the cabinet when Mrs Gandhi split the original party in 1969, he had been a political presence only in that state. For that matter, he had been Chief Minister of undivided Bombay state before widespread agitations forced the creation of separate states in 1956. He himself, however, gave no cause for such apprehension in his public conduct.

Bombay. It urged that the neglect of the Konkan over three decades of Congress rule should be ended; no major development project had been sited there—even the public sector aluminium plant which had been promised at Ratnagiri was nowhere in sight. Dandavate, sensitive to the demands from his home region, added to the general confusion by claiming that no final decision had been made regarding the site, and that Bahuguna had permitted him to state that wishes of the people of Maharashtra would be given due consideration. It seems evident that S. Krishnaswamy was up to some mischief: Vasantdada Patil stated publicly that the Fertiliser Secretary had informed him that it was Morarji Desai's wish to shift to Tarapur.\* On May 2, the day before he went to Delhi to discuss the issue with the Prime Minister, Vasantdada Patil said he would press for Usar. He claimed that the farmers and adivasis around Tarapur had parted with their land on four previous occasions and the state government had assured them that no more would be taken. He took an all-party delegation with him to Delhi, where the crotchety old Desai was plainly annoyed that his name had been dragged into the controversy: several Marathi newspapers were openly accusing him of being anti-Maharashtrian. "What controversy can there be in a project like this?" demanded the Prime Minister, in his typical self-righteous, ostrich-like fashion. He reminded the delegation that he was on record as saying that the plant should be built south of Bombay, even as far as Ratnagiri if need be. He added that the entire cost of moving south would be borne by the Centre. The already tortuous sequence of events surrounding the site took perhaps its most bizarre twist when Desai agreed to a review of the entire question.

With uncharacteristic celerity, Krishnaswamy wrote that very day to Ganguly, asking the task force to reconvene and consider some more sites in Kulaba district, with the proviso that before coming to its conclusions, the Maharashtra government's representative should be given the chance to detail the availability of facilities at any site. Industries Secretary Kasbekar attended

\*I met Krishnaswamy twice when he subsequently became the Managing Director of the Associated Cement Co in Bombay. The first meeting, about the change of foreign consultants for the west coast plant, was off the record; the second time, in Delhi, he was more forthcoming about the decision regarding the site. He had agreed to talk in Bombay but died suddenly after a heart attack a few months later.

meetings of the task force and informed it that the state government had picked only five sites for it to choose from: Thal-Vaishet, Usar-Kune, Sogaon, Vadavali and Divi-Parangi. *All these sites were in Alibag taluka!* Kasbekar later clarified that "the only condition subject to which the state government wants to give its full support to whichever site the Government of India finally selects is that it should be in the portion of Konkan south of Bombay ... It is needless to say that the state government will consider the current phase of the task force's work as having been infructuous if it does not result in the selection of a site south of Bombay as an acceptable alternative to the earlier choice of Tarapur." Kasbekar made the Maharashtra government's stand quite clear: the site was to lie in the Konkan south of Bombay (the Konkan extends all the way to the Gujarat border); it was further narrowed down to Kulaba district; further still, to Alibag taluka and finally, only the five locations specified. Ganguly, a man of immense integrity, refused to bow down to this pressure and queried the DST, which laid down that he should examine only the five new sites proposed by the state government in addition to the earlier three—Chanera, Mandwa and Tarapur—and no others.

### Experts' choice

Again given just a month to finalise its views, the task force took the responsibility in its stride. It ruled out Thal-Vaishet, 5 km north of Alibag on the coast and 21 km from Bombay, because it was within the metropolitan region and directly upwind of Alibag. "Even during normal operational conditions, release of air pollutants will be felt at Alibag and at all the downwind direction villages up to Nandgaon, falling within 10 km, for most of the year," it reported. Some 70,000 people within 10 km of the site were directly endangered by it. In respect of all the sites in Alibag taluka—especially those north of the town—it noted their "essentially rural character" and pointed out that the location of the plant was "likely to pose a threat to the vegetative cover and may disrupt the life of the people." *Thus it came to the "inescapable" conclusion that all the sites south of Bombay were unsuitable, and that from the environmental point of view, Thal-Vaishet even less than Mandwa.* It therefore reiterated that Tarapur was the best choice, though the Maharashtra government had tried to prove that there would be a water shortage there. D.G. Rao from the Fertiliser Ministry submit-

ted a dissenting note, stating that all three sites—Tarapur, Mandwa and Thal-Vaishet could be considered. "Tarapur is unanimously indicated as the first choice," he wrote. "If for any reasons, Tarapur is considered unacceptable, the other two sites, Mandwa and Thal-Vaishet, could be considered in that order." He repeated that SO<sub>2</sub> and dust emissions could be reduced by using gas for fuel instead of coal.

The entire task force was summoned to Delhi to meet the Prime Minister. Some more people were present, including Dr B.P. Pal, Chairman of the NCEPC (the same renowned gentleman who told me that he could not speak to me about Silent Valley because he "was only a geneticist"! ). The Prime Minister delivered a long monologue. "I said nothing," recalls Ganguly, "and none of the committee members spoke. Finally the PM asked me what my objections (to a site south of Bombay) were. I excused myself and pointed out that the discussion so far was on none of the technical points that we had raised in our report." At one stage, Desai admonished the delegation: "You can recommend whatever you like; *I'm* going to decide!" Desai clearly indicated that he was not happy with the choice of Tarapur again—he was obviously prickly about the charge of being partial towards Gujarat—and asked Ganguly if he was not aware of the controversy there. Once again, Ganguly answered decorously that since these were not technical in nature, he could not evaluate their basis. Dr Pal agreed with this and the committee stuck to its guns. Ganguly believes that Desai privately agreed with the committee's selection but was extra-sensitive to any criticism of being communal. The protagonists of the Kulaba site seemed to have sensed the Prime Minister's Achilles' heel—just as those of the Silent Valley hydel project reportedly convinced him that Sanjay Gandhi had been responsible for halting it earlier!

In Alibag taluka, a strange situation was developing, with the villagers divided on whether to have the fertiliser plant or not. Shetkari Bachao renewed its agitation against the project, while other residents of Rewas and Usar were vying with themselves to invite RCF to invest in their area. Indeed, as in Mannarghat which is at the base of Silent Valley, a "save the project" committee was formed locally, called the Rewas Kath Prkalp (fertiliser factory) Bachao Samiti. A team of Maharashtra government experts, visiting sites, opted for Rewas as the "ideal location". As further

warning of its intent, the Maharashtra government categorically informed the Centre that it would not be in a position to provide water at the site in Tarapur in Thane district. The Development Corporation of Konkan, a state government undertaking, pleaded for Rewas; the "save the project" samiti staged a dharna outside the Mantralaya. The Chief Minister assured its members that the project would be situated south of Bombay and that as against the official valuation of Rs 4,000 per acre, compensation of Rs 15,000 per acre would be paid to the dispossessed.

The knowledge that the NCEPC task force had opted for Tarapur for the second time upset the Maharashtra government no end. It reacted by emphasising that it would under no circumstances accept Tarapur. It felt that the question of pollution should not be stretched too far: if Thal could harm Alibag, what about Chembur and the fertiliser complexes at Baroda? Vasantdada Patil called a meeting of all legislators on June 13 to finally decide the issue. That afternoon, I wrote a story in the *Evening News*, pointing out that the task force had not cited alternative sites in Kulaba, as misleading press reports were saying, but had unequivocally come out in favour of Tarapur a second time; furthermore, it was mischievous to refer to Mandwa as an alternative to Rewas. The Maharashtra government was using D.G. Rao's dissenting note to convey the impression that this was the majority view. It circulated a note to all legislators, stating that the task force had *cleared* Thal. Sharad Pawar moved the resolution in both houses of the Maharashtra legislature, urging that the plant be located in Thal-Vaishet or its vicinity. He said that the expert's choice was confined to three—Tarapur, Mandwa and Thal. While the state government had consistently opposed the first, Thal was preferable because it had 115 acres of barren land and as many of irrigated land, as against 52 and 168 acres in Mandwa respectively. Members in both houses referred to the choice of Tarapur as indicative of the Centre's "step-motherly attitude" towards Maharashtra and one openly spoke of the "grudge" that Desai bore against the state. Datta Patil performed a remarkable *volte face* in the assembly: in a long, meandering and largely tangential speech, he came around to supporting the resolution! He defended himself from criticism that he was a "repressor of progress" and that the opposition in Mandwa had been launched by five or six bungalow owners. The movement was triggered off instead by farmers: "We had never seen the faces of these owners,"

he emphatically declared. "I first saw them when our (boat) morcha arrived at Azad Maidan (in Bombay). These bungalow-wallahs realised that the movement had an impetus and that is why they joined us." He revealed his hand by making an impassioned plea for higher compensation for the farmers who were to be displaced. Another speaker mentioned the dangers of the project being located at Tarapur and likened it to the mythological tree which rested in one courtyard but bestowed its flowers on the adjoining one. The resolution was carried unanimously in both houses, on the basis of patently false information about the verdict of the task force.

Ten days later, I wrote a lengthy front-page report<sup>4</sup> in *The Times*, revealing for the first time what the task force had actually concluded. I also pointed out that the least cost solution—siting the plant nearest to Uran—might not appear so attractive in the long term: the gas would run out in 15 years and then RCF would be forced to switch to conventional feedstock like naphtha or fuel oil, which yields a great deal of  $\text{SO}_2$ . I referred to how the efficiency which RCF was claiming on behalf of the electrostatic precipitators—as much as 99.5 per cent—would not prove as high in practice, as SOCLEEN had long accused the Tatas when they were putting up their first 500 MW power plant in Trombay. Bombay Bachao, which had come so close to victory and had then seen it snatched away rudely, did not give up. It filed a petition on behalf of six residents of Bombay, in the High Court, contending that the levels of pollution in the metropolis already exceeded permissible limits and the fertiliser plant would make things worse. It sought to contend that the move was contrary to the spirit of several town planning acts, as well as violative of the Janata government's new industrial dispersal policy. It was such attempts to portray the pollution threat to Bombay as the main issue which betray the urban bias of the organisations which constituted Bombay Bachao, rather than the vulgar charge that it represented the interests of the bungalow owners who were its big benefactors and beneficiaries. The judge refused to admit the petition on the ground that it was premature. In December, another petition, this time on behalf of local residents—farmers and fisherfolk—was resubmitted but rejected again. The Save Bombay Committee independently alleged that Vasantdada Patil had struck a deal with Bahuguna, accepting the proposed expansion of RCF's Chembur plant (its fifth phase) in

return for siting the west coast plant at Thal. The Bombay Municipal Corporation had withheld permission for this phase so far. The late Piloo Mody questioned Bahuguna, "This can only mean that if one plant produces pollution, the other can absorb it?" He also wrote to the Prime Minister and received a terse reply: "I have satisfied myself that neither of the two places (Tarapur and Thal-Vaishet) would affect the ecological health of the Bombay metropolitan region."

Following the meeting that the Prime Minister had with Ganguly and his committee in July, the Centre announced that it would consult the state government. By this time, Sharad Pawar had replaced Vasantdada Patil as the new Chief Minister, presiding over a Congress-Janata coalition. Bahuguna, inaugurating the oil and gas pipeline from Bombay High to Trombay, observed that the ball was now in the Maharashtra government's court, adding with unconscious irony that projects like fertiliser plants were in the national interest and therefore should not be dictated by parochial considerations. Pawar told the assembly that he was once more requesting the Centre to decide on Thal; a letter he had received from Bahuguna had, however, emphasised the need to locate the petrochemical complex much further south. On July 28, 1978 Bahuguna formally endorsed Thal, putting an end to a controversy that raged for nearly 18 months. By October, land acquisition proceedings were set in motion there.

The environmentalists then turned their attention to the World Bank, whose appraisal missions were to visit the site. Ashok Advani, former Secretary of Save Bombay and publisher of *Business India*, prevailed on one of his American contemporaries at Oxford, then working in a US government agency in Washington, to lobby environmental organisations in that country to put pressure on the Bank. The official wrote to the Council of Environmental Quality in Washington, after a visit to India: "This is a milestone project in the development of the sort of independent, effective, professional environmental movement upon which ultimately almost all environmental progress there as here must ultimately rest. A group of first class professionals have volunteered great portions of their time over the last year to analyse the problem (which is much harder than here where the government, quite unused to such opposition, has proceeded in a secretive manner and where other sources of information we take for granted here are not available),



to form a broad citizen alliance, and to press their case steadily in forum after forum . . . Their effort has received considerable attention and whether or not such an investment has an impact will, I believe, importantly affect how quickly India develops an environmental constituency and therefore policy. The development of such independent constituencies is as important to the strengthening of Indian democracy as it is to the development of an environmental movement here." But all negotiations were futile because the Bank remained convinced that RCF was taking adequate precautions to protect the environment—both the atmosphere and coastal water—around Thal. In 1983, I met Ann Hamilton, who was about to relinquish charge of "India" at the Bank, in Washington. She told me, quite candidly, that she had sympathy for both points of view, but that it was not the Bank's job choose alternate sites.

Her attitude might have appeared more convincing were it not for the Bank's own declaration (to an American environmental law expert who wrote to it about the fertiliser plant) that its "appraisals of all projects considered for lending take into full account the potential impact of the project on the environment and the health and the well-being of the people directly affected by its presence and/or operations." The Sierra Club also wrote to Robert McNamara, then President of the Bank, after receiving documents from Bombay Bachao. It reminded him that "it would be tragic for the World Bank to approve financing of either the Rewas or Thal sites in the Alibag region. These locations are extremely undesirable from an environmental point of view; they do not conform to the overall siting guidelines and policies of the Indian government; they will not maximise the economic and social benefits to India of this major project. It appears that partisan political considerations and competition between districts and states are behind the resistance of the Maharashtra government to sites more desirable than Rewas or Thal." It noted that the Bank's refusal to examine all the complex political issues would mean that "the argument that poor nations cannot afford development strategies which take environmental and social values into account will go unchallenged, and will make a mockery of the effort of international development agencies to target their resources to the areas of maximum benefit." A few days later, in May 1979, the Sierra Club—which is the third largest but most powerful environmental organisation in the US—passed a resolution, urging "that the US government carefully and

independently review the World Bank's environmental assessment of the Thal-Vaishet fertiliser plant loan application and urges further that US and World Bank foreign assistance programmes should be sensitive to, and co-ordinated with, the views of environmental and conservationist organisations in India which have studied this plant siting." Despite such unequivocal intervention, the Bank remained impervious to any form of pressure—from within the US or from India. Unlike in the Silent Valley case, the passing of this resolution had little impact.

### **Work begins**

On January 17, 1979—after a delay of nearly two years because of the controversy over the location—the first sod of earth was turned at the factory site by a farmer of Thal village, who was said to be a hundred years old. Duleep Singh, the Chairman of RCF, assured the villagers at the opening ceremony that a member from each family which was displaced would be employed in the plant. While work on levelling the site and other facilities continued for the whole of 1979, the Centre was locked in the delicate task of choosing a foreign consultant who would set up the fertiliser plant. As early as in October 1977, a committee under Lavraj Kumar, then in the Planning Commission and former Petroleum Secretary, shortlisted six multinational companies which included C.F. Braun, a US firm, and Haldor Topsoe, a Danish subsidiary of the Italian firm, Snam-progetti. Each of these made bids by August 1978. After the offers were evaluated by experts, the government decided to award the contracts for all four 1,350 tpd ammonia plants (two in Maharashtra and two in Gujarat) to Braun. Draft agreements were initialled by RCF and Braun; similarly, the Indian Farmers' Fertiliser Co-operative did the same for its identical plant at Hajira in Gujarat. When Mrs Gandhi came back to power in January 1980, the whole question of the award of these huge contracts opened afresh. The new Petroleum Minister, P.C. Sethi, steered the decision-makers to drop Braun and awarded the Thal contracts to Haldor Topsoe and the Hajira plants to the US company, Pullman Kellogg. It was over this unprecedented reshuffle of foreign consultants that the World Bank, amidst widespread charges of hefty kick-backs received by both Janata and Congress governments from the multinationals, withdrew its \$250 million loan for Thal at the fag end of 1980. All this delayed the installation of

equipment still further: by January 1981, the cost of the Thal project had skyrocketed to Rs 918 crore. The massive plant eventually went on stream in November 1984.

Bombay Bachao, renamed Bombay Environmental Action Group (BEAG) in 1979, tried to persuade Mrs Gandhi's government to examine whether the site could still be shifted for environmental reasons. It pleaded that *both* the fertiliser plant and the petrochemical complex should be located at *one* site outside the BMR. They were ready to accept Usar as the location for both, which would have resulted in massive savings in costs of infrastructure. It also pleaded for some co-ordination between the Departments of Petroleum and Fertilisers in the same ministry. In the summer of 1980, rumours from Delhi spoke of experts examining the feasibility of shifting the location further south. Datta Patil threatened to launch an agitation if there was a shift! He and Sharad Pawar accused BEAG and other "vested interests" of using their influence to prevail upon Mrs Gandhi and sidetracking Maharashtra's interests in petrochemicals and gas after local people had sacrificed their fishing and farming for the larger benefit of the region. Marathi newspapers roundly criticised the move. Unnamed "fertiliser technologists" were quoted as saying that Gujarat was already going ahead with its plants based on Bombay High gas and the Maharashtra government had appointed a committee<sup>5</sup> headed by Dr H.N. Sethna of the BARC in 1979 to advise whether to establish a petrochemical complex with the remaining "fractions" of gas that would not be used at Thal (only methane is used to make fertiliser).

By June 1980, Maharashtra had a new Chief Minister in the controversial personage of A.R. Antulay, who happened to come from the Konkan and was most anxious to develop it. The very first thing he did after assuming office was to write to the new Petroleum, Chemicals and Fertiliser Minister, Veerendra Patil, asking him to scotch the rumours about the shift of the fertiliser factory (a subsequent act of tokenism was to rename Kulaba district Raigad). Patil confirmed that the Centre did not intend to change the location. All that remained was the site for the petrochemical complex. When Sharad Pawar moved the resolution that was passed unanimously in the Maharashtra assembly, he had agreed to locate this complex "some distance to the south" as the Centre had laid down as a sop to the environmentalists who were demanding that it

be based further down the coast. The Sethna committee chose Usar as the best site: the alternative was Taloja which was within the BMR. Usar, 13 km south-east of Alibag, was just outside. Although the site may have technically qualified on this score, it was obviously too close to Bombay for the comfort of the BEAG.

Through the Mandwa-Thal controversy, Mody and Chainani had acquired considerable notoriety in official circles and Lavraj Kumar, when he took over as Petroleum Secretary, sought to win them over by appointing Chainani as a member of the newly created environmental advisory committee attached to the Department of Petroleum in 1981. T. Saranathan of SOCLEEN and Dr Ganguly were also similarly sought to be appeased.\* The intention was obviously to avoid the kind of recrimination witnessed over Thal which led to enormous delays and added to the already massive costs of these fertiliser and petroleum projects. Chainani, however, insisted at a committee meeting that Usar did not meet the undertaking that the petrochemical complex would be located "some distance to the south" of Thal, and was backed by the other two environmentalists. Faced with the prospect of a long and tortuous controversy once again, Lavraj Kumar finally agreed to Nagothana, about 35 km south-east of Alibag; Chainani, using the government's own figures, showed in any case that it would be cheaper than Usar. Though the environmentalists were pressing for sites south of Mahad, they reluctantly agreed to accept Nagothana. By September 1984, Nagothana was finally cleared but the complex was scaled down from the Rs 1,280 crore investment originally envisaged to Rs 1,167 crore. There will be a chain of plants which will provide products like ethylene and propylene, which are the essential materials for a host of plastics and other industries. The direct employment in the complex would be 3,000 and indirectly, about 5 lakh according to the Sethna committee, which was a wild exaggeration, even assuming that half the output would be processed by small and medium scale units outside the state. By March 1985 the indirect employment was put at 60,000.

It remains to ask: what exactly was the reason for the Maharashtra government's excessive anxiety to locate the fertiliser

\*Interestingly, the Petroleum Ministry has even tried to buy the acquiescence of environmentalists by appointing them as directors of public sector corporations for a term. Thus Dr Ganguly was nominated on the board of Bharat Petroleum, Saranathan on Hindustan Petroleum and Dr Nilay Chaudhuri on IOC!

plant south of Bombay? There was a great deal of speculation among the environmentalists and scientists who helped in the NCEPC task force. The BEAG suspected that local political interests in Kulaba district stood to gain by having a huge fertiliser plant in their area because of the contracts they could land for trucking goods and so on. But this conspiratorial view of the state government's insistence was plainly incorrect. The simple reason is that the state authorities were absolutely paranoid about the possibility that their arch rival, Gujarat, should gain by exploiting a natural resource—gas from Bombay High—which they felt rightfully “belonged” to them. As it is, Gujarat has been making spectacular progress in the fertiliser and petrochemicals industry: it has four large fertiliser plants at Baroda, Kalol, Broach and shortly, Hajira, as well as the huge petrochemical complex at Baroda. The Maharashtra government therefore feared that any location north of Bombay, and especially Tarapur, which lies cheek by jowl with the Gujarat border where a flourishing industrial estate already exists at Vapi, would endanger the location of the petrochemical industries on which it had really set its sights.

Equally, MLAs and others had their own theories about the interests behind the environmentalists; during the Maharashtra assembly debate, a CPM MLA made the outlandish accusation that the Birlas, ensconced in their Zuari coastal plant in Goa, were seeking to block the entry of a public sector fertiliser giant (the world's biggest producer of urea from one site) in western India! A more moderate version was that the industrialists in general and the Godrejs in particular—who owned bungalows in Mandwa—were not happy about the erosion of their hold over Bombay, the country's industrial and commercial capital, which is equally far-fetched. A far more reasoned and scathing critique was offered by a young writer, making his debut in the *Economic & Political Weekly*<sup>6</sup>. Kannan Srinivasan, in two long articles titled “The Environmentalists: Another View”, sought to make out that they were wittingly opposing the location of the fertiliser plant on a selective basis and protecting the bungalow-owning bourgeoisie. “One important reason why the whole argument has been so conspicuously lopsided,” he asserted, “is that it has been dominated by the fervour of the propertied, who fear that their bungalows and their recreation places will not be so nice now with industry nearby. The debate has also been enriched by the analysis of their friends

and associates, articulate and intelligent, who often have areas of professional competence (journalists, lawyers, scientists, business executives) which have helped them to make the Bombay Bachao Committee's case intellectually fashionable. There is an imitative quality to these environmentalists, an uncritical application of Western environmentalists' priorities." He then went on to mention how Zafar Futehally—without naming him—belonged to the family which owned bungalows on Kihim beach and sat on the NCEPC task force as well; how Salim Ali was President of the committee and Futehally's kinsman (he was probably confusing him with Saad Ali, the Vice President, who does own a bungalow there). He concluded: "It has been pointed out, half-seriously, that the Bombay Bachao Committee is beginning to look rather like the Bombay Bungalow-Owners' Committee"! In reply, Chainani points out that none of the main BEAG activists—Mody, Das and himself—own any property in the region and the first two had never even been there earlier. Furthermore, he asserts, Naoroji has continued his support to BEAG and remained its Chairman, though he could have bowed out once the fertiliser plant was moved from Mandwa. BEAG itself has moved on to a host of other issues—involving the ONGC in Uran and Nhava-Sheva, the Tatas with their proposed second 500 MW thermal power unit in Trombay and even real estate developers in Bombay and Pune and surrounding hill stations.

Srinivasan was being too self-righteous about the activism of these environmentalists. It is certainly true that they were backed by the might of the bungalow owners, without which they would have found it impossible to mount the kind of high-pressure, Western-style environmental campaign which they did. This is quite distinct from the grassroots support that the KSSP in Kerala, for instance, enjoys. They must have flown to Delhi perhaps a dozen times, which was probably the single biggest expense incurred; this enabled them to intervene at the very highest level of political and bureaucratic decision-making. They were able to see Morarji Desai on two occasions, not to mention other cabinet ministers and Secretaries. However, this does not mean that their motivation was to further the property owners' hold over beach fronts: it so happened, in this case alone out of the three in this book, that to an extent the interests of the farmers and fisherfolk who were to be displaced coincided with those of the well-to-do. Of course, the

immediate ends of both were served when the site was moved from Mandwa; both would have dropped the struggle at that stage had it not been for the persistence of Mody, Das and Chainani. While the bungalow owners had nothing to lose but their properties, one should not forget that the local residents had to part with their farm land. Furthermore, if one considers that theirs was a largely self-sufficient community, neither the needs of development nor environment were served by siting the project in this taluka instead of barren land at Tarapur which the experts twice recommended categorically.

Having been indirectly implicated by Srinivasan for my association with the environmentalists—although many of them still doubt my *bona fides*!—I ought to end this chapter on a personal note. I was earlier involved myself in a city environmental dispute which had everything to do with self-interest and yet had a larger public goal as well. When the National Institute of Bank Management in Bombay was planning a grandiose training campus on the beach front in the suburb of Bandra, directly opposite the bungalow which I own, I launched a campaign against it on the ground that the seaside road was used by promenaders and others and the state government had no right to turn this public property to such select use. I in fact helped to found the Save Bombay Committee, headed then by Russey Karanjia, editor of *Blitz*, and we succeeded in blocking this project, which many still consider the first major blow struck against land developers, public or private, in Bombay (the victory was due, incidentally, solely to Mrs Gandhi's direct intervention). Although I have been accused, in print and otherwise, of having been "motivated" in launching this campaign, I see nothing extraordinary in such a stand since I believe that there was a convergence of private and public interest, just as there was in Mandwa.

To expect, as Srinivasan did, the bungalow owners of Mandwa to be concerned about the "real" environment of Bombay—which has to do with the miserable conditions in which the other half, consisting of 4 million slum dwellers, live—is plainly out of the question: in fact, it is they as industrialists who are responsible for creating conditions in which slums proliferate in the first place! The BEAG—unlike the Save Bombay Committee, which was party to a suit which the Bombay Municipal Corporation took out to enforce its legal right to evict pavement dwellers—at least maintained a

studious silence about the raging controversy triggered off after 1981 over attempts to clear slums. As a matter of fact, there appears to be some change of heart and mind on the part of Bombay's environmental organisations and they are slowly coming round to the view that the only way to deal with slums is to improve—not remove—them. On the fertiliser plant site, therefore, whatever the motivations of the bungalow owners, those who proposed that it would have been in everybody's interest—from the nation's to the local villagers'—to have the site either north of Bombay or much further south were definitely fighting a just cause. There can hardly be any dispute that a location within the Bombay metropolitan region was outrageous.







A publicity handout issued by RCF indulges in the following hyperbole: "From the time immemorable, waves in Arabian sea are washing the west coast of India. These waves, too familiar with the green coconut trees adorning the shores, tiny villages hidden in the green veils, simple half-naked natives ferrying country boat loads of sea catches, are now a little bewildered at Thal... Instead, they are finding massive steel and concrete structures... This changing sea shore scenario and skyline at Thal is RCF's prestigious fertiliser project." I cite the passage not to condemn the grammar but to highlight the sentiments expressed: that the massive coastal fertiliser factory was ushering in a new era of change, of progress and prosperity, in an idyllic, rustic area. To be sure, the thrust of the government's policy to grow more food by producing more fertiliser is one of the basic assumptions of the five-year development plans. The Green Revolution—whose benefits we questioned in the Taj case—is fuelled by fertiliser. Twenty years of research went into producing new hybrid strains of wheat and rice which could absorb 55 kg of nitrogen per acre; traditional varieties would "lodge" or fall over with more than 40 kg. Official agencies deplore the fact that though the fertiliser industry in India—public and private—is now the fourth largest in the world, the actual use of its products is woefully low. In 1982-83, for example, the country used only 35 kg per hectare, a little more than half the Asian average of 66 kg and well below the 220 kg in Europe. When the Petroleum Ministry discovered to its delight in 1976 that it had sizable quantities of oil and gas in its offshore field at Bombay High, the logical conclusion was to set up fertiliser plants based on this valuable resource.

What "development" did Thal-Vaishet promise? The Petroleum Ministry, after consultation with the State Industrial & Investment Corporation of Maharashtra (SIICOM), asked a group of experts in

the petroleum and fertiliser industries to identify areas near Mandwa for a fertiliser plant and other industrial complexes. The first techno-economic feasibility report submitted by FCI in September 1977 spelled out the national benefits of locating the plant there. It pointed out the Kulaba was one of the most under-developed regions of the state and that the plant would create 1,500 jobs, plus another 8,000 in ancillary occupations. Besides, the annual savings in not importing an equivalent amount of fertiliser per year would be nearly Rs 200 crore. The conversion of Bombay High associated gas to fertiliser was the best use to which it could be put—the highest value added; by contrast, using gas as fuel for generating power, as Tata thermal and the Maharashtra State Electricity Board are now doing—is extremely wasteful.

A central argument in the controversy over the location of the west coast plant was that Mandwa and later Thal would help to industrialise the backward Konkan. In Kulaba district—now Raigad—both the original site, which was finally rejected, and Thal lie within the BMR and these could hardly be described as falling in the Konkan proper. However the Maharashtra government paid lip-service to the objective of siting the plant in Alibag taluka so as to develop this depressed area. It is easy to understand why Konkanis have felt deprived and neglected for years. It has no industry whatsoever and there has been a steady migration of able-bodied men to Bombay in search of jobs. According to the 1971 census, for example, one-third of the migrants to Bombay were from Ratnagiri, though the percentage is steadily declining. In 1978, at the height of the furore over the fertiliser plant, these migrants were estimated to form as much as 27 per cent of the entire city's population. Perhaps the most telling index of its backwardness is the abysmal lack of transport: it has no railway and remains virtually cut off from the rest of the country. The dream of a 900-km-long Konkan railway from Apta, just south of Bombay, to Mangalore had been nurtured for a long time. But no Central government was prepared to sink an investment of over Rs 200 crore on building a line through this narrow coastal belt, fringed by the western ghats, because it would be highly "uneconomic". During the controversy over the site, therefore, Maharashtra's politicians claimed that the location in Alibag taluka would be the "gateway to the Konkan" and for three decades of Congress rule, there had not been a single major investment there. With Madhu Dandavate as Railway

Minister during the Janata regime, Konkanis saw the best opportunity so far to press for the rail link. The fertiliser project was seen as the single biggest justification for pressing ahead with the railway and many politicians warned that the railway would never come unless a decision was first made regarding the plant.

The deep resentment felt by the people of the Konkan (which is a typical "money order economy", with its men folk remitting postal money orders from Bombay), can also be explained by the manner in which the major industrial project previously promised to them has had an "on-again, off-again" existence. This was a Rs 80 crore aluminium plant to be put up at Ratnagiri, which is the headquarters of the district bearing the same name, about 380 km by road south of Bombay. To be handled by the public sector Bharat Aluminium Co (BALCO), the project was included in the Fifth Five-Year Plan, as Sharad Pawar mentioned in the Maharashtra assembly debate on the fertiliser plant site. As much as Rs 16 crore has already been spent on its infrastructure. However nothing further has been done to exploit the reserves of bauxite that are available in the ghats near Ratnagiri. It now looks as if the BALCO plant has expired peacefully.

For the Petroleum Ministry, the "least cost solution" was to site the plant as close to the gas terminal at Uran, about 10 km east of the southern tip of the peninsula of Bombay. The ONGC, under the prodding of its aggressive Chairman N.B. Prasad, had completed the laying of the 200 km submarine from Bombay High to Uran by early 1978; indeed, it was a little ahead of schedule. As S. Venkataraman, former Adviser for fertilisers in the ministry and now working with the World Bank in Washington, explained, a pipeline was being laid from Bombay High to Uran for crude oil, so that it could be sent to the two oil refineries at Trombay to be processed. At first glance, it seemed logical to place a gas pipeline alongside this, which would save enormously on surveying and other costs. Technically, however, nothing prevented the ONGC from taking the gas pipeline to Gujarat. No one thought of two things: the possible environmental impact of locating the plant within the Bombay metropolitan region and even as importantly, what would be the end use of the gas, apart from fertiliser?

As we have seen in the previous chapter, the real employment potential was not the gas-based fertiliser plant but the petrochemical complex that would follow in its wake. Contrary to what

the BEAG sought to convey, there is no technological link of any kind between the fertiliser plant and such a complex: they are not "associated" in any direct process. Thus against an investment of Rs 918 crore to create 1,560 jobs in the fertiliser plant—a colossal investment of Rs 58 lakh per job, comparable with the most capital intensive plants anywhere in the West—the petrochemical complex would cost Rs 1,167 crore and hire 3,000 directly. What is more, there are virtually no ancillary activities in a highly mechanised fertiliser plant, whereas with the downstream units associated with the gas cracker, as many as 60,000 people can be indirectly employed.

Undeniably, RCF has brought in some prosperity at the local level. At the factory, which was commissioned by the end of 1984, the looming chimney stack—at 150 metres, the highest in India—has already cast its shadow around Thal-Vaishet. RCF has metalled roads in Thal and the adjoining fishing village of Naogaon and installed street lights. It has also guaranteed that a person from each displaced family will be employed in the plant, as was the case in the Mathura refinery as well, if he possesses the qualifications. Those employed as drivers, technicians, stenographers etc are being trained on the job. Out of a total of 1,560, the "non-supervisory" staff comprises 500, and 98 per cent of these are local people. RCF had encouraged local villagers to take out contracts for minor works during the construction of the plant like the building of walls and drains, which has proved quite a successful scheme. All this has cost it a total of Rs 70 lakhs. Contrary to popular belief, the public sector is more sensitive to people around its projects than the private sector.

The immediate beneficiaries—those whose land was acquired; 850 acres were required for the factory—would certainly be pleased at the prospect that the plant has been located in their area, provided they had somebody employable in it. Even in Alibag town, certain sections have stood to gain by the coming of the factory. Local councillor Sayed Latif, for instance, ran a thriving business, renting rooms in a hostelry for newcomers to the city—mainly small contractors who had flocked there during the construction of the factory. An electrician who repairs equipment for households and small units reported how his income had quadrupled to Rs 4,000 a month today after work on the factory began in 1981. The supply of electricity and water to the town has visibly improved. A notice-

able change on the road from Mandwa to Alibag is the number of new shops and a couple of garages. Indeed, the ultimate irony is that many farmers from Mandwa-Rewas are disappointed to discover that they have been deprived of these spin-offs from the fertiliser plant! Some curse Ralli Jacob and Datta Patil for spearheading the campaign which was responsible for having it shifted. Presumably, if the plant had been moved much further south to Ratnagiri, out of sight and mind, their reaction would not have been nearly so fierce. With such proximity, they feel that they had might as well have allowed it to come near their villages. Although the actual employment in the plant is minimal, the very thought that someone with no training can land a job for around Rs 1,000 a month with all its fringe benefits—much more than most of those who work in Bombay can ever hope to earn—is enough to make people in surrounding villages green with envy.

This, then, is what "development" in the shape of a multi-crore fertiliser plant can bring to a backward taluka like Alibag. What are the conflicting environmental issues? As we have seen in the previous chapter, to raise the spectre of the pollution threat to Bombay's seven million people, as Bombay Bachao so successfully did at the time, was utterly misleading. Since the plant will use gas as feedstock, it will be far "cleaner" than RCF's notorious Chembur complex: gas and crude from Bombay High, incidentally, have one of the lowest sulphur contents in the world. The plant will limit the emissions to less than 18 tpd of  $\text{SO}_2$  (lower than the Mathura refinery) and 8 tpd of particulates, as laid down by the Maharashtra Prevention of Water Pollution Board (MPWPB), when coal is used in the boilers. In winter, when there is the danger of inversions, RCF will be free to use gas. As for controlling the release of particulates, electrostatic precipitators are being installed along with boilers. The company is also monitoring air pollution levels around the factory, with initial help from IMD in Delhi. However the proximity of Alibag, with a present population of 15,000, alters things drastically. As the Ganguly task force reported, directly in the path of the prevailing winds live some 45,000 people, whose health could be jeopardised if there is "any inadvertent release of ammonia or any other gas . . . If dust is released from the prilling tower (where urea is made into small pellets), it will give significant fallout all the way up to Alibag and the cloud may be visible even beyond. Release of air pollutants from the site could affect the vegetation . . . skirting

the western boundary of the site." In December 1984, following the catastrophe at the Union Carbide pesticide plant in Bhopal, people fled from Thal in panic after rumours that a sudden release of ammonia had enveloped the environs and killed a four-year-old boy. Subsequent reports, however, seem to indicate that there was no major discharge, as the RCF management was at pains to emphasise, and that the boy had been ailing previously. Given the charged atmosphere in the country after the Bhopal disaster, not many people were prepared to take RCF's denial at face value, especially after the Deputy General of Police for the Konkan confirmed that the child had been suffocated by ammonia (he claimed that traces of ammonia had been found in the boy's viscera by the official chemical analyser). It appears to have been a false alarm; when the ammonia plants went into full commercial operation in December, there was bound to be some release, but well within limits. However the effluents, according to the MPWPB, were well above its limits temporarily—RCF was over-hasty in commissioning the plants.

It is pertinent to point out that there have been "episodial discharges" from the Chembur site which have, on occasion, overnight defoliated trees in the neighbourhood. A major culprit at Chembur is the nitrophosphate plant; by contrast, urea employs a "clean" process. It is significant that RCF, after 15 years of persistent pressure from SOCLEEN, has reportedly agreed to modify its nitrophosphate plant at Chembur, the particulate matter from which would year after year cause extensive damage to the vegetation in the area. RCF is apparently going to introduce the latest pollution controls in its new plant, which has prompted SOCLEEN to welcome it and wish that it was introduced very much earlier. Several members of SOCLEEN will be the first to admit today that RCF, in response only to relentless harassment from environmentalists, has belatedly awoken to the need to curb the emissions of pollutants from Chembur, which has earlier played havoc with the health of thousands of residents. The use of gas as feedstock has worked wonders. A new "double conversion, double absorption" system has been installed to replace the old troublesome sulphuric acid plant; low sulphur fuel oil has replaced the regular fuel oil which has a great deal of sulphur. A brink mist eliminator has reduced emissions from the sulphuric acid plant from  $300 \mu\text{g}/\text{m}^3$  to  $30 \mu\text{g}/\text{m}^3$ , while scrubbers have brought down dust emissions. In contrast to private sector fertiliser plants—of which Birlas' Zuari unit in Goa

has been the most notorious—public sector organisations like RCF have shown greater concern for taking environmental safeguards, however belatedly. To date, it has spent over Rs 9 crore on pollution control in Chembur. The total expenditure on environmental controls in Thal comes to Rs 25 crore, which includes the planting of thousands of trees around the site. IOC has displayed similar awareness in Mathura. According to SOCLEEN, the Tata thermal station in Trombay (near Chembur) is potentially more dangerous than RCF if it switches to coal from Bombay High gas.

What about Thal's liquid effluents? The original techno-economic feasibility report in September 1977 was very sketchy about treatment facilities—the same blissful ignorance about environmental impact is demonstrated in original project reports in all three cases in this book. As an RCF engineer admitted, "The first report only thought of in-plant purification before releasing it into the sea. For that matter, there wasn't even a mention of air pollution: perhaps it was thought that such a sophisticated plant couldn't pollute." The revised report a year later stated: "We are now required to provide a marine outfall system in to the deep sea, a storage pond for holding 15 days' discharge of about 120 million gallons and other necessary effluent treatment facilities." This pipeline extends 4 km into the sea—twice as long as at Birlas' Zuari plant in Goa originally—at a cost of Rs 6 crore. The effluent pond will cost another Rs 2.5 crore and the treatment facilities Rs 4 crore. In all, some 20 million gallons of water will be used at Thal every day. As in the Mathura refinery, there will be a fish pond at the last stage to check the cleanliness of the water. The most concerned about the release of effluent into the sea, of course, were fisherfolk. Bhai Bandarkar, the powerful fisherfolk's leader who is based in Bombay, repeatedly protested against the location of the west coast plant.

The damage that a coastal fertiliser plant, without proper controls, can wreak was vividly demonstrated by Zuari Agro Chemicals Ltd at the mouth of the river in Goa with that name. When it was opened on June 5, 1973 (ironically, the very first World Environment Day!), Goans welcomed it as the first major step towards the industrialisation of this tiny union territory. The Managing Director spoke of how effluent from the plant would be treated "with well-equipped treatment machinery by using an elaborate system equipped with automatic control instruments."



Within six months, however, the plant began to destroy the livelihood of local residents. Fish began to die along the coast by the hundreds; coconut and fruit trees began to wither with the airborne pollutants. Even a few cattle which had drunk the water, contaminated with deadly arsenic, perished. By 1975, villagers began to protest against the management, which refused to acknowledge that it was in any way to blame.\* A Citizen's Anti-Pollution Committee was formed and morchas were taken out. In April that year, a district magistrate finally ordered the plant to be shut down till a proper effluent treatment system was installed. The plant was built with the collaboration of US Steel and Toyo (of Japan), with aid from the World Bank, to produce ammonia, urea and phosphates.

Meanwhile, the Central Board for the Prevention of Water Pollution had come into existence in Delhi in 1974 and instructed the company to take control measures. Till then, the effluent was stored in a pond, from where it began to seep into the earth. Under this assurance, Zuari was temporarily allowed to restart later in 1975. The following year, the Board insisted that the treated effluent should be carried by a 2-km-long pipeline into the sea. Despite the installation of treatment facilities and the pipeline, fish continued to die and it was found that the seepage into the ground continued, as did leakage of effluent from the pipeline. Once more, villagers protested vigorously and the Goa administration decided to appoint officials to monitor the effluents daily. When it was found that the factory could not keep its discharges within the prescribed limits, the company went in for a drastic overhaul of its production and discharge system, including the ammonia stripper, under the advice of US Steel. The Pollution Board also recommended that it build a 70-metre-long steel pipeline with a diffuser at the ocean outfall, which meant the 2 km pipeline was no longer necessary. This was finally done in 1982, but reports still persisted of contamination to the surrounding villages. That year, Goa's Directorate of Agriculture assessed the damage done to a coconut plantation as worth Rs 1.12 lakh. It concluded that the payment of compensation for the loss to various garden owners would solve the problem and suggested the appointment of a technical committee to

\*Today, the management recognises its mistake in not accepting responsibility for the damage.

"save all surrounding gardens for the purpose of maintenance of ecological balance." However the Goa government thought "it would not be against the public interest" to grant the Birlas permission for a Rs 25 crore expansion. Although Zuari is technologically different from the gas-based west coast plants in Maharashtra and Gujarat, it depicts what can happen when a large industrial project is allowed to come up in a "virgin" territory like Goa, famed for its dazzling beaches and tranquil villages.

Interestingly, another environmental threat posed not just to a rural area but to a Project Tiger sanctuary is the proposed gas-based fertiliser plant in Rajasthan: subsequent to the discovery of much larger oil and gas reserves in Bombay High and the adjoining north and south Bassein offshore fields, as many as six more 1,350 tpd ammonia plants are being planned all the way to UP; MP and Rajasthan will have one each, and the remaining four will go to UP, which is the most politically influential state. The Rs 500 crore plant was to be located near Sawai Madhopur and less than 7 km from the famous Ranthambhor Project Tiger national park; characteristically, neither the wildlife department nor pollution board was consulted. Rajasthan's former chief wildlife warden, K.S. Sankhala, the first Director of the WWF-aided Project Tiger and author of the well-known book, *Tiger!*, objected to it. Local people were very upset with Sankhala, decrying his attempts to halt a project which would bring prosperity to the area. Sankhala—a controversial figure who has publicly announced that he did not care if a few people were accidentally killed by tigers in the interests of preserving this dwindling species!—revealed that he informed Rajiv Gandhi (soon after his initiation into politics) about the threat and the site was shifted. Sankhala told the state Chief Minister: "All I know is that forests disappear when a big industry comes—look at the atomic power station in Kota." An all-party delegation, consisting of zilla pramukhs, MLAs and pradhans met a central study team to demand the speedy implementation of a project which they claimed could employ 15,000 people. The intelligentsia of Rajasthan also decried attempts by conservationists to place obstacles before the fertiliser plant, pointing out that the state might lose it just as it did an oil refinery earlier! Zuari Agro Chemicals has now clinched the deal for this plant, the cost of which has been raised to Rs 700 crore.

### Broader view

The Thal-Vaishet controversy illustrates very clearly the difference between those who are concerned about "pollution" and those who take a broader view of the environment. While many environmentalists were concerned about the contamination of south Bombay, the regional imbalance was a much more serious consequence. As we saw in the case of the Taj, it was easy enough to take a purely superficial view of the problem without examining the underlying socio-economic reality of the situation. Here, if anyone could be credited with a holistic approach, it was Dr A.K. Ganguly. It is worth quoting what his task force said about the original site at Mandwa in its first report: "The site is well known for its lush vegetation and the combination of agricultural, horticultural and fishing activities . . . Owing to lack of irrigation facilities and general shortage of water in the region, only one crop is harvested every year. In the remaining period, vegetables are grown in the area . . . The area is economically viable on its own and a self-sustaining community resides here. The plant will, during the construction and later stages, result in the settlement of a large population at a point which cannot but contribute further to the congestion of metropolitan Bombay." This stand has been vindicated in the draft plan <sup>1</sup> for the extended BMR, issued by the Bombay Metropolitan Regional Development Authority (BMRDA) in 1983: "The belt of lands along the coasts, specially the western belt, is an area of marked scenic beauty . . . This belt must be protected from the inroads of urbanisation. It is accordingly proposed that a 1 km wide belt along the coast on west and north be reserved as a recreational belt." As the late Dr N.L. Ramanathan from the DoE, who was Secretary of the Ganguly task force, added after a visit to the sites: "While the Rewas site has certain technoeconomic advantages and the pollution aspects can be made minimal, I am rather worried about the natural ecological balance existing in this lush green belt near the metropolitan area which is highly polluted. I was also impressed by the self-sustaining economically viable community and their reaction to the proposal to locate the fertiliser plant on their land. I feel they should be left alone and improving the quality of their lives by encouraging small cottage type industries."

When I revisited the area in May 1982, I was not very impressed myself by the environmental "worth" of this coastal belt at first

glance. At the height of summer, it looked very much like so many other villages in the Konkan, which managed to eke out an existence with a paddy crop once a year. It was true that it was very much greener, with a number of mango and coconut trees, but nothing like the profusion that one sees further down the coast in Goa and Kerala. But I was educated by Ganguly who, after a three-hour discourse in his BARC office one day, convinced me that the Konkan, properly preserved and nurtured, "could become the granary of all western India." The fact is that with the heavy deforestation of the ghats along the entire Konkan coast—and such is the devastation towards the north of this strip in Maharashtra that the hills look totally bald—the area between the ghats and the sea has become environmentally and economically impoverished. Two things, which are intimately linked to each other, as we saw in the Silent Valley case, would change this vicious circle dramatically: the afforestation of the hills and the conservation of the heavy monsoon rainfall.

Ganguly recalls that when he went around the sites, he was told that the land was not fertile and could only produce a single crop a year. And yet, this very area saw a hundred inches of rain annually. He asked the authorities where the water for the plant would come from and was shown a beautiful spot close by, a triangular gap between two hills where, if a wall was raised, as much as 35 million gallons of water could be prevented from flowing into the sea every day. "Forget about the fertiliser plant," he told them. "Why hasn't this scheme been implemented all this time for agriculture?" They replied: "Who will pay for it?" The expert remembered how when he went to Tarapur around 1960 to scout around for a site for India's first atomic power plant, he was confronted by an almost identical situation. "The earth was parched, cracked open. I asked the Maharashtra government representatives, 'How will you provide water for a nuclear plant?'" They told him that it was no problem and took him to a horseshoe-shaped site where a thin trickle of water was oozing through marshy land. "I was sceptical but was informed that I didn't know how much water flows there during the monsoon. A bund was built for Rs 45 lakh at the spot and today there is a picturesque lake there with more water than the plant can consume in three years. In other words, even if there is a drought for two successive years, the plant can function without any problem." The moral of his story? Where there was a will to provide water, there

was a way. The only catch is that there is somehow never the will to provide water for agriculture, especially on a small scale.

It was this vision of protecting a self-sufficient community, coupled with the knowledge of environmental conditions at Tarapur, that prompted Ganguly to opt for this site north of Bombay. The land to be acquired there was only covered by grass and there was no farming whatsoever. The terrain was also flat and both the cost of acquisition and levelling would be considerably cheaper. In the Konkan itself, if the rainfall was properly arrested by forests on the ghats and allowed to flow in a sustained manner to the sea throughout the year, it would be possible to grow three crops a year. In this case, it would look very much more difficult for the Petroleum or Maharashtra government to claim that it was causing no destruction by locating a big fertiliser plant and petrochemical complex in Alibag taluka. Just because the area is not properly irrigated does not mean that it does not have the potential to develop in a different direction altogether—by making agriculture much more than the subsistence occupation that it is today. As things are, the only solution to the problems of poverty that people in the area perceive is to either migrate to a job in Bombay and channel some of their earnings back to their village or—if they are fortunate enough—get employed in a major industrial complex set up in the vicinity. This option, however, is only open to a very few people, especially when the factory in question is among the most sophisticated in the world, like RCF's at Thal.

On the basis of the Ganguly committee's findings, only 464 farm households and a total number of 6,360 persons would be displaced at Thal-Vaishet. In any case, as RCF itself makes it very clear, the plant can only employ around 500 unskilled persons. Thus the direct benefit to local people of the location of the fertiliser plant is questionable. On three trips that I paid to the area, I heard innumerable complaints about the manner in which a few families from Thal suddenly found themselves clutching several thousand rupees in exchange for their lands. Krishna Ramji Mhatre in Thal village had received Rs 21,000 for his one and a half acres. He had spent practically all of it already, the bulk going towards his daughter's wedding and on buying food every day. He has two sons, only one of whom is employed at the factory. He himself has no occupation today. Asked if given the same opportunity—not that he ever had the choice—again, he replied emphatically that he

would not have sold off his land. Only a few villagers had the wisdom to invest their money in another plot of land or in some productive form; the bulk were overjoyed at the windfall and lost no time spending it. It is a familiar story wherever big industrial projects have been sited in rural areas: the complaint is not against the decision to launch such industries itself but against locations where people engaged in farming or forestry are now left to fend for themselves. It is the tragedy, for instance, surrounding the plight of the adivasis of Chhotanagpur in Bihar whose lands are being mined for their precious ores while they are left to scavenge in the dirt heaps of towns. Indeed Bihar—as Venkataraman of the World Bank pointed out—is the classic case where despite a plethora of mighty industrial projects, the condition of the people is growing from bad to worse, specially the adivasis who had access to the land for generations previously. MP too has its pockets of heavy industry surrounded by a sea of poverty like Bhilai and Korba. These anomalies are invariably shrugged off as the “growing pains” of economic progress, the price that some people have to pay for this benefit. No one ever stops to examine who is actually paying this price—it is always the poor and underprivileged in rural areas.

Although there was a lot of visible progress brought to Alibag while the plant was being constructed, much of it short-lived. Once the contractors pack up and go, for instance, the new landlords of Alibag may be left high and dry. What is more, while certain residents have undoubtedly flourished as a consequence, others with fixed incomes see the advent of the fertiliser plant as an unmitigated bane. They cannot ever hope to rent a house or even a room again; prices of daily necessities have skyrocketed. For them, much of the gains of this development project have gone to the outsiders who have flocked into the area. Vaishet, in particular, has turned into a nondescript clutch of huts on the main road, selling illicit liquor, among other things. Old-timers in Alibag also point out that while the transport trade and sundry suppliers are doing brisk business, basic amenities in the town like health services and drainage are getting from bad to worse.

The lesson to be drawn from this case is that the government lost a tremendous opportunity to locate the plant not just where it could cause the least damage, but more positively, where it could have been used to correct the regional imbalance in a state. The first alternative, as BEAG was repeatedly stressing, was to site the factory

further down the coast—perhaps, but not necessarily, as far south as Ratnagiri, which is 380 km from Bombay by road or about 250 km as the crow flies. Interestingly enough, the drama that was acted out at Thal had a full dress rehearsal with the Dharamsi Morarji Chemical Co (DMCC) proposal to put up a Rs 30 crore diammonium phosphate fertiliser plant at Nhava Sheva, where the new port across Bombay harbour was envisaged, more than a decade ago. The City and Industrial Development Corporation (CIDCO), which is in charge of developing the satellite city of New Bombay across the harbour, objected to the site in 1971 because it was planning the twin city to accommodate the spillover from Greater Bombay and heavy industry did not figure in its blueprints. CIDCO first recommended Dabhol, further down the coastline, instead but DMCC was adamant about not budging. To extricate themselves from this impasse, the two parties consulted the World Bank, which was funding the project. At the Bank's suggestion, CPHERI (now NEERI) was appointed as a consultant, with the American firm Geomet to carry out a study on the potential impact on the air quality of Nhava Sheva. While Geomet cleared the location, CPHERI questioned its findings (air pollution experts tend to differ with each other drastically, as we saw in the Taj case!) and ruled against it. In fact, its mathematical calculation with the same Gaussian plume technique of how much  $\text{SO}_2$  would reach the populace of the entirely commercial and residential twin city was four times as much as what Geomet estimated. This is why the Maharashtra government termed the proposed plant "an unacceptable health hazard". A secret memorandum from CIDCO to the Chief Minister added that "the sulphur dioxide concentration in the New Bombay area is already on certain days twice the levels of the maximum acceptable limit . . . a further addition would extend an already harmful situation into one that would be decidedly damaging to human health." The note even speculated whether "it would be possible to take over the project and construct it within the public sector", siting it in Ratnagiri. This once again underscores how state-run enterprises display greater environmental concern than most private sector companies.

The late Pitambar Pant, the dynamic first Chairman of the NCEPC, wrote to CIDCO, pointing out that the case against Nhava Sheva was even stronger because of the "creation of further



Shanty colonies have already sprung up outside the Rs 918-crore Thal plant, which employs only 1,500 people. Below: Gobar gas plant near Thal — possible alternative source of energy and fertiliser



imbalance in economic development within the state, increased attraction for additional (and unwanted) immigration into the area and restrictions on developing commercial and residential areas." It suggested Ratnagiri as an alternative, which was the headquarters of the most backward district of Maharashtra: "This district is characterised by the twin problem of low urbanisation (8.4 per cent) and low industrialisation (there were only 44 registered factories employing 2,051 workers in 1966). Even agriculture and fishing, which account for 80 per cent of the total jobs, are characterised by very low output per worker. The mass exodus of people, particularly the young, is responsible for the fact that the population rise in this district was less than 9 per cent during the decade 1961-71. This migration, together with the concentration of industries in the Bombay-Pune region, has led both to a regional imbalance in the development of the state and to a tremendous population explosion in the larger cities". The NCEPC concluded that in spite of some disadvantages, Ratnagiri would be better for the firm as well as the state, provided the latter undertook to bear the costs of infrastructure. Nevertheless DMCC surrendered its licence, rather than be browbeaten into moving south.

In October 1972, I wrote an article<sup>2</sup> on the editorial page of *The Times*, headlined: "Pollution Vs Development: First Test Case in the Country" where I noted how a state government, anxious to attract investment, can often work against the dictates of environmental wisdom. The Maharashtra Chief Minister had okayed DMCC's proposal in 1970 and it was only because a full-fledged planning authority came into the picture later that year that such a decision was questioned. I also criticised CIDCO for being concerned only with the likely pollution from the fertiliser plant and not whether the aims of sound city planning would be met by starting a highly capital-intensive factory, employing just 500 people, in an area which was meant to accommodate the commercial and residential spillover from Greater Bombay. In retrospect, it seems clear that what is called for in such cases is a *political decision* to help an industrially backward area by locating a big plant there. Otherwise, it will be impossible to break the vicious circle of poverty and absence of industries. If such a decision had been taken at Ratnagiri for DMCC in 1972, there is no question that the choice of a site for

RCF's west coast plant would have been automatically settled five years later.\*

### **Concentration of industry**

The direct environmental consequence of Thal-Vaishet will be that the existing concentration of industry in and around Bombay will be strengthened. The metropolitan region has three-quarters of the industries in Maharashtra, which is in turn the leading industrial state in the country. Already, 35 per cent of the state's population is urban—the highest in the country. According to an official survey by the Central Statistical Organisation in 1982, Maharashtra accounted for nearly one-sixth of the total factories registered in the country in 1978-79. The state also accounted one-fourth of the total value added in the manufacturing sector (Rs 2,030 crore out of an all-India total of Rs 8,126 crore), which shows how most of the country's capital-intensive industries are located there. By this index, West Bengal stood second. While the premier state had only 15 per cent of the total fixed capital, it employed nearly 17.6 per cent of the total employees in industry. The Bombay-Pune industrial belt is easily the richest in the country and is already nearly a continuous agglomeration of modern factories. This belt accounts for 70 per cent of the nation's pharmaceutical output. Within the state, it accounts for 59 per cent of the factory employment and 87 per cent of the value added by industry. In the 1950s, in the first flush of independence and industrialisation—the two seem to be made for each other—Bombay's growth was spurred by the establishment of heavy engineering industries, mainly in the northern and eastern suburbs. In the following decade, it was the turn of petrochemicals, and associated industries like synthetic fibres, chemical fertiliser and plastics. Today, out of 23 major industries in the country, including power generation, Maharashtra leads in as many as 16 of them. Given such an inordinately high concentration of industry, it is the aim of all planners to divert as much investment not only to other parts of the state but to the rest of the country as well. (Calcutta, by contrast, is declining rapidly although it was once the commercial capital.) The specific task of

\*Ironically, the Sethna committee in 1979 hired DMCC to advise on the environmental impact on different sites of the petrochemical complex near Thal!

CIDCO and later, the BMRDA, was to stop existing industries in the city from expanding any further and give them incentives to move to backward areas of the state.

In fact, Maharashtra presents a classic picture of uneven development, with the ultra-modern metropolis cheek by jowl with areas even within Greater Bombay which were till a couple of years ago not electrified. It is to this magnet that people from poverty-stricken rural areas of Maharashtra and other states migrate continually (the influx from the Konkan having dwindled of late). As many as 4.2 million of the city's 8.5 million people live in slums. It is to arrest this relentless process and the rapid deterioration of Bombay's urban environment that attempts were made by SIICOM and others to build industrial estates to act as counter-magnets in towns like Nasik, Nagpur and Kolhapur. In fact, the very reason that areas like Uran and Alibag taluka were incorporated in the BMR were to give the beleaguered city some breathing space in case it wanted to locate some vital facilities across the harbour. The establishment of the fertiliser plant and the nearby petrochemical complex will only force the pace of the urbanisation of this green area and accentuate the lopsided development of the state. The Sethna committee itself recognised that even if the petrochemical complex was situated at Usar, the downstream units should be located further south at Ratnagiri and other backward places in the Konkan. It even went so far as to suggest, wishfully, that Konkanis employed in Bombay or Pune might even trek homewards in such an event! In any case, Alibag taluka, and especially the portion within the BMR, is not designated as a backward industrial area; incentives are not available to industrialists to shift there, unlike Ratnagiri or Tarapur.

While Thal-Vaishet will inevitably lead to a further deterioration of the environment of Bombay—which, it must be remembered, is already one of the worst in the entire world—the issue is far more complex. Any major industrial investment is made in a certain political and techno-economic context and it is not always possible to examine this in isolation of such factors. For instance, will the location of a big industrial project in an undeveloped region act as a catalyst for growth, just as the Silent Valley hydel station, it was believed, would spur the development of the backward belt of Malabar in general and Palghat district in particular? As we ourselves have shown, the fertiliser plant itself is

too capital-intensive to create many jobs, though the same is less true of the petrochemical complex.\*

Another reason why the choice of the site proved difficult, as a Planning Commission official explained, was "once the decision to build a pipeline to move oil and gas from Bombay High to Uran was taken, we were in a bind. The Uran landfall constrained any decision to locate the fertiliser factory." He cited how Union Carbide, the culprit in the world's biggest environmental disaster, was the first integrated petrochemical plant in the country and came to Trombay in 1966, as did NOCIL at Thane-Belapur soon afterwards. They needed naphtha; naphtha was available because of the proximity of the refineries, which in turn were there because of Bombay port (the same is true in Gujarat of the link between IPCL, the Koyali refinery and Kandla port). The key factor, technologically, was the source of feedstock and economics-wise, the "least cost solution". BEAG did try to argue that even if the gas were taken by pipeline all the way south to Ratnagiri, at a cost of around Rs 10 lakh per km, it would have been only a small fraction of the total investment in the project (Rs 20 crore out of Rs 600 crore at the time). But yet another factor which worked against Ratnagiri was that it did not make too much sense to take the fertiliser far south from Bombay when it would have to be taken all the way back to the north-west by rail. Since Maharashtra is by no stretch of the imagination well irrigated (only 8 per cent of farm land, as against 23 per cent in other states) and therefore cannot use much fertiliser—western India is in fact already surplus with RCF at Chembur, Zuari in Goa and factories in Gujarat—all 4,500 tonnes of urea each day from Thal can only be used in Punjab, Haryana and western UP, where the Green Revolution has taken firm root. In conclusion, one can say that the best choice was Tarapur but, failing that, Ratnagiri would still have been preferable to Thal.

However desirable from a regional planner's viewpoint, it was an unfortunate sequence of decisions that worked against a site north of Bombay. The ONGC rushed its pipeline to Uran where it

\*A two-part editorial page article<sup>3</sup> in the *Economic Times*, however, makes out a strong case for importing petrochemicals rather than going in for self-reliance at an inordinately high capital cost. It argues that Baroda's IPCL in 1981 had a net investment of Rs 400 crore and employed 5,200 people at a cost of Rs 8 lakh per job. A new gas-based plant of IPCL's size in the 1980s would cost at least twice as much but, being more automated, would employ fewer people at Rs 20 lakh per job.

reached by July 1978, without identifying who would use the gas and where. In 1976 itself, according to the ONGC, Bombay High was estimated to contain 20 million cubic metres of gas a day—sufficient for six fertiliser plants; the following year, the potential of the south Bassein structure was established. Even though the Planning Commission was aware of the amount of gas available for fertiliser plants by the time the first 1,350 tpd plants were being envisaged at Mandwa-Rewas, it thought it was too late to plan a series of such plants starting north of Bombay and reaching all the way closer to the centres of consumption 2,000 km away. It was clear by 1978 that the total amount of gas would be much more than could be used by coastal fertiliser plants in Maharashtra and Gujarat. In February that year, the Centre announced its new fertiliser feedstock policy, giving first priority to associated gas.

As things are, a total of ten gas-based 1,350 tpd fertiliser plants are being built: apart from the four in Maharashtra and Gujarat (two each). There will be one in Guna in Madhya Pradesh, one at Sawai Madhopur in Rajasthan and as many as four in UP. As an official committee recommended, a Rs 750 crore pipeline (it has escalated to Rs 1,700 crore today!) will be taken from Bombay High all the way from a landfall point near Hajira in Gujarat, 1,700 km northwards to Jagdishpur in UP. It makes no sense at all, with the benefit of hindsight, to have located two of these plants south of Bombay since all the rest lie to its north. Had the planners been aware of the south Bassein field by 1975, it is certain that Maharashtra's fertiliser plants would have come up at Tarapur, as the experts subsequently advised for environmental reasons alone. The additional factor against Tarapur is that the Petroleum Ministry was only too aware at the time that associated gas—as opposed to natural gas, which could be stored and tapped like crude oil—worth around Rs 8 lakh was being flared daily offshore. There was thus a tremendous feeling of urgency in putting this natural asset to the quickest possible use. This is why the government has temporarily permitted Tatas and the Maharashtra State Electricity Board to use gas as fuel in their thermal power plants. Besides, the import of crude and petroleum products totalled around Rs 1,400 crore then—approximately one quarter of the country's imports—and the crude had to be drilled quickly to stop this huge drain of foreign exchange.

Tarapur was opposed tooth and nail, as we have seen in the

previous chapter, for purely regional reasons: the Maharashtra government was hell-bent in seeing to it that none of the downstream petrochemical industries would fall in Gujarat. The imagery of a tree allowing its fruits to fall in a neighbour's garden kept being referred to. As it is, Gujarat attracts a great deal of the nation's investment because of its pragmatic industrial policy: not only does it lack the union militancy that plagues Bombay but the authorities cut through red tape for entrepreneurs quicker than any other state in the union.

In summarily rejecting Tarapur as the site for the fertiliser plant, the state authorities were guilty of parochialism which neutralised both environmental and techno-economic considerations in its favour. RCF officials openly admit today that from both points of view, they would have preferred Tarapur. Immediately, this was to thwart the designs of Gujarat to obtain gas which Maharashtra thought "belonged" to it. At the back of their minds, moreover, Maharashtra's politicians were worried that they might lose out altogether if obstacles were put in the way of RCF. This was made amply clear by the comments of V.V. Satav, President of Pune zilla parishad, who attended a crucial meeting of the Maharashtra Prevention of Water Pollution Board as a political appointee on it. When one of the members raised several queries about various discrepancies in RCF's own figures and suggested that the grant of the "No Objection Certificate" be held up at least till these were clarified, Satav expressed the view that "there was likelihood of the project not being located in Maharashtra at all if the NOC was not given by the Board and the Board will, therefore, be held responsible for loss of such a project in Maharashtra." The Centre also used this Damocles' sword quite effectively to sway political opinion in the state; Bahuguna openly insinuated that if there was opposition to Thal, New Delhi would have no option but to shift it to Tarapur.\* At any rate, the "project mania" of every state government is a familiar phenomenon, whether it be a steel plant or big irrigation scheme. We have seen in the Silent Valley case, for

\*Such 'arm-twisting', according to Chainani, is now common with other Central government organisations like the ONGC which asks a state government for a blank cheque for relaxation of environmental and building stipulations, failing which it will simply move to another state. The only agency that can counter this, he argues, is the Department of Environment at the Centre—which refuses to play this watchdog role.

instance, how the Karnataka government has been responsible for locating the Indian Aluminium Company's plant at Belgaum, in order to placate people living in the troubled border with Maharashtra. For that matter, Karnataka has long been agitating for the Vijayanagar steel plant, which was estimated to cost Rs 3,000 crore; only in 1984 was the size reduced to Rs 1,400 crore because such a big plant was not considered viable in the area.\*

While environmentalists are all too often portrayed as starry-eyed idealists who ignore the technical and political realities of any situation, no one seems to realise how in fact so many major political decisions to locate big projects are made ostensibly on pragmatic and rational grounds when these are anything but. One has only to look at the furious wrangling to decide where the rest of the gas-based plants would be put in Rajasthan, MP and UP to understand this. After much manoeuvring by P.C. Sethi, the erstwhile Petroleum Minister, who comes from MP, the location in that state was fixed at Bijayapura in Guna district—it is Digvijay Singh, the former Deputy Environment Minister's home district and the former constituency of the prominent Congress(I) minister, Madhavrao Scindia. The MP government had earlier favoured Shamgarh in Mandsaur district, taking into account an earlier recommendation by the Petroleum Ministry's pipeline route committee. Shamgarh is on the main railway line from Delhi to Bombay and the state government had even committed its share from the Gandhisagar reservoir to the proposed plant. The investment on the site would reportedly have cost Rs 145 crore at Shamgarh as against Rs 271 crore at Bijayapura. What is more, the pipeline running north will have to be diverted for a total of 200 km at a cost of Rs 40 crore just so as to accommodate Bijayapura! The casualness with which vast sums of money are spent on locating massive industrial projects is truly staggering.

An even more shocking story is the decision to base one of the four plants in UP—always the most politically sensitive state, from

\*In the Thal case, it is revealing how Marathi papers like the *Maharashtra Times* took a "local" view of the controversy and called unhesitatingly for the location of the plant at Thal. It dubbed the environmentalists "anti-Maharashtrian" and even tarred with the same brush C.K. Parulekar, MP from Ratnagiri, who had written to the Prime Minister, suggesting that it be located further south. Yet its sister concern, *The Times of India*, took a larger "national" view, without pandering to regionalist sentiment.

which six of the seven Prime Ministers in the country have hailed (the Nehrus by domicile)—at Jagdishpur, in Amethi district, the constituency of Prime Minister Rajiv Gandhi and his brother Sanjay before him. Although the government decided, on the basis of options provided by the pipeline route committee, to set up the six plants in three states in early 1981, more than a year later rumours began to circulate that Mrs Gandhi had decided "in principle" to site one in Amethi district. Reported the *Economic Times*: "Neither the pipeline committee nor the site selection committee has recommended Amethi as a location for the fertiliser plant. If the proposed pipeline route which is along the western rail line is changed to accommodate Amethi, the country will have to spend an additional Rs 150 crore. This would hardly be prudent on economic considerations. Amethi is far away from the western rail route and there is no short-cut to link Amethi to the proposed pipeline from Bombay High . . . The delay in deciding the locations (of the four plants) has cost the nation dearly. The cost escalation alone will account for an additional Rs 2 crore per month." Political considerations did win in the end and the sites in UP chosen were: Jagdishpur, Aonla, Babrala and Shahjahanpur. In August 1984, the *Statesman's* Insight team confirmed that the construction of an extra 214 km of pipeline from the branch-off point at Auraiya in Etawah district meant an unnecessary expenditure of Rs 200 crore—the obvious site was Auraiya itself. In addition, the ONGC was desperately keen to finish construction of the pipeline, much before the fertiliser plants would be ready, which would be a waste of another Rs 250 crore (Rs 125 crore in interest charges and as much yearly for treating the pipeline against corrosion)! The plant is being set up by the UP government and a Bahrain-based company; by the time Mrs Gandhi laid the foundation stone in October 1984, the cost had risen to Rs 800 crore. Inevitably, a Rs 700 petrochemical plant will also be set up by under the same joint venture. Together, all ten gas-based plants will cost over Rs 6,000 crore at current prices; with further delays on various counts, some experts believe that the eventual bill presented to the nation will touch Rs 10,000 crore. This is a colossal investment by any standards and it underlines the total bankruptcy of the government's industrial location policy that a project comes up wherever a region within the state carries the most clout. Indeed, one can show that environmentalists—at least the committed ones—are more



concerned than anybody else in seeing to it that no resources, financial or natural, are squandered away recklessly.

As far as Maharashtra's gas-based plant is concerned, there is no question that Tarapur would have been the ideal site. If one were to toss up between Thal and Ratnagiri—assuming that there would not be too many problems at the latter location relating to infrastructure, the cost of carrying the gas and bringing back the finished product back northwards—Ratnagiri would have been better. At the very least, once the petrochemical complex had come up as well, there would be an alternative growth point of industrialisation in the Konkan. But the nagging question still remains: is the location of a gigantic industrial project really decided on “supra-regional” considerations which have little to do with promoting development—once again, assuming this to mean a betterment of living standards of the people in the vicinity? It may well be that the actual compulsions are quite different: like the least cost solution in the case of Thal, the overriding necessity of putting gas that was otherwise being wasted to use promptly, and so on. The overwhelming sentiment when huge national development projects are being established is one of pride in achievement, of high expectations of the prosperity that these will bring. This is precisely what Rajiv Gandhi said at the opening of the Jagdishpur fertiliser plant. It is a theme that runs through all the three cases in this book. The immediate problem is that the Thal fertiliser plant or Mathura oil refinery should not have been located where they were for sound environmental reasons. But rather than see the issue in the crude terms of environment versus development, it would be more instructive to question what this development really amounts to.

### **What development?**

The production of fertiliser is taken as a crucial and obligatory means for developing countries to grow more food. Worldwide, 5.6 kg of fertiliser was used on average per person in 1950; by 1980, this had risen to 25.6 kg. A rule of thumb is that one tonne of fertiliser nutrient raises food production by ten tonnes. It is important to remember, however, that the objective is not just to produce more food but to make sure that people have the means to consume more of it. This is the dilemma of countries like India, as we saw in the Taj case, which keep producing bumper crops (150 million tonnes in 1984-85) and yet have massive numbers of people suffering from

hunger and malnutrition because the food remains beyond their reach. The Green Revolution, which has been opposed on both environmental and socio-economic grounds, poses this question most clearly. Now the momentum of the new high-yielding food-grain varieties is slackening: unless more acreage is brought under irrigation at the same time, the Green Revolution cannot spread outside pockets in a few states. Indeed, the provision of irrigation itself can work more wonders than any miracle wheat or rice to grow more food and ensure year-round employment. Considering that India has vast reserves of water—the Himalayas by themselves are a veritable storehouse—which are now underutilised or simply allowed to go waste, there is a very strong case for giving much greater emphasis to the conservation of water in national plans. All the fertiliser in the world will not make a difference except to those farmers rich enough to be able to afford it. As things are, the consumption of fertilisers has been off and on declining in the country with the result that till recently, there was a big glut: imports have been drastically curtailed. In February 1983, it was estimated that stocks worth a staggering Rs 700 crore remained unsold.

One must ask a somewhat heretical question, which is likely to be dismissed as wishful thinking at best. If one took the Maharashtra government at its word—it always claimed that the west coast fertiliser plant was being located south of Bombay to relieve the poverty of the Konkan—let us suppose it had the choice to spend the same Rs 1,000 crore in different ways. Of course, it did not really have any such option since practically all the funds were coming from the Centre (“We were getting the project *free*!” exulted a retired state Industries Secretary), which in turn was to get half the amount from the World Bank. Nevertheless, one should persist with raising these fundamental issues for the simple reason that no one does. If such a huge amount was in fact spent on a number of small schemes throughout the length of the Konkan—in small bunding and irrigation works, mini and micro-hydel projects, social forestry and the like—the economic benefits to the people would be quite enormous, quite apart from the environmental enhancement that this would bring about. Instead, the area is now being confronted with the mirage of development—symbolised in the tall smoke stack in which, as Navroz Mody of BEAG put it, “the sweat and toil on the land of generations is blown up.” The actual benefit

of what is produced will not be apparent in the vicinity: all the fertiliser will be sent by railway wagons to the north-west, some 2,000 km away. When the weather smiles, the bulging granaries in Green Revolution areas in select parts of the country will bring little consolation to people elsewhere who have to eke out a subsistence on land that has been depleted of its nutrients. In 1983, for the first time in several years, the Konkan was ravaged by severe flooding during the heavy monsoon. Experts attributed it to the large scale felling of trees on the ghats, which caused landslides and the shifting of entire hills. Creeks and river beds were so burdened with silt that these were unable to contain the excessive rainfall. Such visitations will recur with increasing regularity since there is no attempt to nurse the land and water systems in the area back to life.

One hypothetical alternative to spending Rs 500 crore—the original estimate—on a single project would be to build 2,50,000 community gobar gas plants at a modest cost of Rs 20,000 each. That would mean that about one in every two villages out the total of 5,70,000 in the entire length and breadth of the country would have a cheap, renewable source of energy. What is more, the slurry left in the plants would provide an excellent source of fertiliser. The collection of the gobar and maintenance will employ at least one person per installation—which means nearly 170 times the employment created by the fertiliser factory. This admittedly sounds Gandhian and utopian in theory, impractical in actual implementation. Indeed, a study<sup>7</sup> of fertiliser production in India by Disney and Aragaw in 1977 shows that the most capital-intensive techniques for making urea tend to be the most “efficient”. Disney has also compared fertiliser production costs, using conventional manufacture of urea and production of manure and methane from gobar gas plants. Conventional methods are usually more economical; rich farmers, if deprived of fertiliser, will buy “alternative technology” only as a second-best policy. For the poor, on the other hand, even family biogas plants are expensive despite a 25 per cent government subsidy. What is more, utopian solutions of this type ignore the social reality: if the poor, who really would benefit from this alternative source of energy and fertiliser, do not possess more than one or two head of cattle, where is the gobar to come from? Unless there is a reordering of a society at its base, so that people’s priorities, as against those of a business or bureaucratic elite—are given immediate attention, it is difficult to argue for

alternative technologies in a socio-political vacuum.

Thus in China, where such a drastic revolution has taken place, it is true that even while the chemical fertiliser industry has been modernised at a faster pace than almost any other (in 1973, China ordered 13 of the most sophisticated urea-ammonia plants from abroad), production has been rising at 15 per cent per year mainly by establishing—at only a fraction of the fixed investment cost of large plants—small-scale fertiliser plants based on modern technology, either under collective or state ownership. In a different social setting, much alternative technology works because of the active involvement—or more specifically, the provision of labour—at the level of the commune or village. Environment and development, therefore, have everything to do with the political system in which choices are posed. Thus it will be make-believe to argue for 2,50,000 gobar gas plants instead of two 1,350 tpd ammonia factories on the west coast or 50 lakh gobar plants instead of the ten factories that will ultimately be built with gas from Bombay High. But the figures only show that there are alternatives to development and that the present system of rapid industrialisation may be only a reflection of the highly inequitable basis on which society in present-day India is organised. The idea that there is only one path to modernisation, and that is to industrialise like the West has done—whatever the costs that certain sections of society will have to pay—deserves to be challenged. As Dr A.K. Ganguly, later a National Environmental Fellow, emphasises, “Wherever you take industry, people initially are enthusiastic. But later, they often begin to curse it. Is the prosperity of the country only the prosperity of city people?”

There is a visible demonstration in India of what alternatives are possible, albeit in a hermetically insulated foreign enclave. This is the small utopian city area called Auroville on the east coast, south of Madras, where Europeans and Americans have been trying, not with much success, to create an ideal place to live and work. One area in which they have achieved spectacular results, however, is in the greening of Auroville: trees have been planted everywhere. They are carefully chosen for their fodder, nitrogen-fixing capacity and ability to bind the soil and serve as fencing, fuel and shade. From a bare, severely eroded landscape—the other villages in the vicinity show how poverty accompanied by environmental degradation can play havoc with the soil—Auroville is turning almost lush

even in the scorching heat of the southernmost tip of the Indian peninsula. The Westerners, it is true, have both the technological know-how as well as the capital to survive for the initial "gestation period" when trees grow. They emphasise, however, that they are not importing any new technology but restoring bunds which existed around fields generations ago and fell into disuse. In other words, they are nursing the land back to health. So enamoured has the DoE been with what is probably the most intense afforestation programme in the country—a million trees in just 2,000 acres—that it is funding a tree-growing scheme there. Granting the vast gulf between what is possible in an international enclave like Auroville and the destitute Konkan, on the opposite coast, the realisation dawns that the land is never hopelessly doomed: given the right social organisation, it can indeed become bountiful once again. Environment can blend, in perfect harmony, with development.



## 8

## What are the Alternatives?

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In his profusely documented book,<sup>1</sup> *Human Scale*, published in 1980, Kirkpatrick Sale begins: "For 2,400 years, the Parthenon has stood atop the Acropolis, an enduring monument to the imagination and craft of humankind and to the complex civilisation that gave it birth... the exterior sculptures display an extraordinary concern for the varieties of the human form... Within, where the measured classical spaces, even in their ruined condition, suggest the kind of monumentality that befits a temple, the sense of human measure is again reflected in the dimensions of the columns and remnant forms, and the rational, humanistic spirit that originally informed it is unmistakable still.

"To architects a model, to archaeologists a treasure, to classicists a palimpsest, to historians a time chamber, to humanists an inspiration, the Parthenon has no equal, on any continent, from any age... It has been the object of pilgrimages for many peoples of the world, but for the West it is even more: the seat of civilisation that has done more than any other to shape our own, our arts and our sciences, our politics and our governments, our culture and our most basic perceptions of the world." After this fulsome panegyric, Sale goes on to record how—as we have seen in the second case in this book—sulphur dioxide has now attacked the Acropolis with a vengeance. He quotes a Director General of UNESCO: "After resisting the onslaughts of weather and human assailants for 2,400 years, this magnificent monument is threatened with destruction as a result of the damage which industrial civilisation has increasingly inflicted on it." In exactly the same way, the threat to the Taj Mahal symbolises how India's glorious heritage is now under siege. The new "temples of today" seem determined to stamp out the old; the human factor in the design of all manmade things appears forgotten. Athens, in the words of the great urban historian Lewis Mumford, was a city "cut closer to the human measure".

Sale points to the irony in the UNESCO chief's phrase, "industrial civilisation". The critique of modern technology and the frenetic pace of industrialisation is now commonplace in the West. What does not seem half as clear is what options the Third World, newly freed from the shackles of colonialism, has today. India is well placed as the testing ground for the hypothesis that poor countries will have to tread the well-worn path towards large scale industrialisation before its people can hope to enjoy even a semblance of the living standards of the West. For one thing, it is large enough for such a pattern of growth to take place against a backdrop of mass poverty—unlike, say, Japan, South Korea and Taiwan. For another, it is well endowed both with substantial natural resources as well as highly trained scientists, technicians and other experts who can determine how the country will develop. Finally, and this factor should not be dismissed lightly, it is probably the only Third World country which permits a genuine debate on means and ends, even within government circles to a degree. The present political system in China, the other major Third World country, does not permit such an exchange of views, even though it is the one nation where an alternative path of development, starting at the base of society, has been attempted.

The experience of the three major development projects discussed in this book does throw a great deal of light on the decision-making process in a nation like India. Because of their size and importance to the economy, as well as the heat and dust they generated, the three are treated as milestones in the making of environmental policy in the country. Silent Valley, in particular, which is the only case where the project was called off for environmental reasons, stands out as a precedent in other instances where land is to be submerged to produce power or irrigate crops. As we have seen in the Silent Valley chapters, its very evocative name caught the imagination of people and was responsible for attracting so much attention at home and even abroad. The threat to the Taj Mahal came a close second—even today, many enlightened people firmly believe that whatever the experts say, the marble edifice is still going to be ravaged by the Mathura refinery. The public has, by and large, forgotten about the environmental factors in the Thal-Vaishet project: by contrast, the international scandal surrounding the change of foreign consultants, triggering off an unprecedented show of petulance by the World Bank, which with-

drew its \$250 million loan, is what has stayed in the memory. Within Bombay itself, once it became clearer that the fertiliser plant was not going to pollute south Bombay, as the environmentalists earlier claimed, citizens lost interest in a controversy arising in an area which had been unheard of till then.

What are the immediate and long term lessons that one can draw from these cases? In the short run, one has to indict the government for the abysmal lack of a coherent environmental policy. More often than not, it was the personal predilections of people in power which tilted the scales in favour of either the project authorities or the environmentalists. Furthermore, regionalist politics rather than the weight of scientific opinion determined the fate of these projects, as a rule. On the other hand, the tortuous course of events documented in each of these cases did have a salutary impact on the *dramatis personae*—they are all agreed that they learned a great deal from the experience. Finally, the role of the DoE is clearly highlighted: it is unable to intervene effectively in such disputes for a variety of reasons, most of which are not of its own making.

The first broader conclusion to be derived from the examination of these three projects is that the promise they held out remained unfulfilled as far as local people were concerned. While "bigness" is not in itself bad, and nor necessarily is the choice of very sophisticated technology, the location of these projects certainly left a great deal to be desired. However, the protracted controversies do serve in raising the question as to whether alternatives do exist for producing the same forms of energy—power, fuel and fertiliser. "Alternative Technology" has a few adherents in this country but it scarcely tempers the obsession with big, capital-intensive schemes. A critique of existing technology exposes the possibilities of viable alternatives.

The second major conclusion is that environment and a development are not opposing but complementing each other. "Careless technology"—in the shape of big dams, for instance—neither improves the environment nor amounts to development. Indeed, the core argument of the developmentalists in the Silent Valley case—that the project would aid the region by producing electricity—can be challenged as a general proposition. In every state, two-thirds of the power produced goes to industry, which does not employ very many people. Even within industry, the capacity to conserve electricity is enormous. No one talks about fuel



conservation with as much zeal as the need to put up more hydel projects. Besides, the alternatives—mini and micro hydel generation—are ignored. Similarly, the entire dependence on oil—as symbolised by the Mathura oil refinery for the north west—can be questioned. Once again, not only is it possible to effect huge cuts in the consumption of oil and its products in industry and agriculture, but alternative, biomass-based fuels can be introduced as well. The Thal-Vaishet case, finally, demonstrates that the country is relying excessively on chemical fertilisers as the major input for higher productivity, while this can also be achieved by other methods as well. Biogas remains a viable and localised alternative form of both fuel and fertiliser. We can now proceed to a more detailed discussion of each of these short- and long-term conclusions.

### **Lack of policy**

The most overwhelming immediate lesson, of course, is the total lack of any coherent policy on such issues. Despite the headstart provided to any environmental planning process by the very presence of a Prime Minister who took such a keen interest in it (Rajiv Gandhi appears to be following in her footsteps), *ad hocism* marked the decisions regarding the locations of these three development projects. By far the most turbulent case was Silent Valley, where the forces ranged against the project could be broadly categorised as a section of the intelligentsia in Kerala, backed by scientists throughout the country and the highest administrators in Delhi; pressing for the scheme were the Kerala power engineers, every political party in the state and local people near the site. Depending on which could exert more influence within the state and in the nation's capital at any particular time, the fate of the Rs 80 crore project fluctuated from 1976 right till 1983. It was virtually touch and go at any stage. In the case of the threat to the Taj, officially at any rate the position was always that there was no question of moving the refinery to another site but only of taking measures to ensure that it did the least damage\*. In the last case, the fertiliser plant was shifted from the original location at Mandwa-Rewas to Thal-Vaishet, but this was actually a *worse* site, environmentally, than the original!

\*The Varadarajan committee did unofficially consider the possibility and, as I have revealed, IOC officials in sheer desperation once approached the Petroleum Secretary for precisely such a purpose.

It was the personal intervention of Mrs Gandhi that saved Silent Valley after the unpredictable Morarji Desai had given it the green signal. Desai was again swayed by the blatant suggestion that his vote in favour of Tarapur, as the site of the gas-based fertiliser factory on the west coast, would be construed as a concession to Gujarat, to which the downstream petrochemical units would automatically gravitate. In both cases, regionalist politics played their role: unsuccessfully in the first but decisively in the second. Kerala's politicians, irrespective of their ideology or caste configuration, were convinced that the Silent Valley project was the state's birth-right; the Centre's resistance only confirmed their long-held belief that they had always got a raw deal from New Delhi: they were now being prevented from developing their own natural resources—and that too, of a renewable, non-polluting source of energy!—to help the most backward region of the state overcome its congenital defects. In Thal, Chief Minister Vasantdada Patil and his successor, Sharad Pawar, were easily able to whip up regional sentiment over the "loss" of the full benefits of the investment to avaricious Gujarat: the metaphor often referred to was a tree which grows and hangs over the neighbouring garden, enabling the neighbour to pluck its fruits. Anyone who had the temerity to endorse the NCEPC task force's recommendation that the plant be located in Tarapur (or, as Bombay Bachao suggested, further south in the Konkan), was branded "anti-Maharashtrian".

Decision-making, then, was influenced as much by the personality of the Prime Ministers involved as the play of regionalist politics. The reluctance on the part of the authorities concerned—the Department of Science & Technology (DST), under the umbrella of which environment originally fell in the shape of the NCEPC; the full-fledged DoE\* later on; the various ministries involved in these three cases—to divulge the findings of the investigators only added to the atmosphere of intrigue. The Menon committee report on Silent Valley has not been made public, although it was submitted in 1983. The most outrageous example of such reluctance was Chief Minister Sharad Pawar's assertion, in a note circulated to all legislators in Maharashtra, that the Ganguly task force had cleared Thal-Vaishet. In similar vein, R. Balakrishna

\*It was turned into a ministry only in January 1985, to deal with both environment and forests.

Pillai, Kerala's former Electricity Minister, publicly claimed that the Centre had okayed the hydel scheme. Several scientific and expert organisations, called upon to lend their weight in an effort to resolve these controversies, refused to disclose their conclusions—often seeking refuge in the fact that their reports were commissioned and therefore the property of their clients. This secrecy was carried to absurd limits in the Mathura refinery case: the Indian Meteorological Department was most paranoid about its data. NEERI also guards its surveys as if they were nuclear secrets. The findings of the Italian firm Tecneco, on the other hand, were not disclosed to some members of the chemistry branch of the ASI—the very experts who have to preserve monuments. In such an atmosphere, the full weight of scientific opinion was hardly brought to bear on the decision-making process.

On the plus side, whatever the mistakes of omission and commission, most of those involved in these cases agree that these were extremely valuable lessons in how to incorporate environmental factors in deciding where to locate big industrial projects. After all, such was the innocence regarding environmental hazards in the late 'sixties that among the sites first recommended for the north-west oil refinery was none other than the revered city of Agra itself! Dr Varadarajan asserts that the studies conducted into the possible effects of pollutants on the Taj were the most exhaustive ever of their kind in the entire world. In Kerala, Kochukoshy and successive Chairpersons of the KSEB also acknowledge, somewhat grudgingly, that the experience was educative for them. In a much more general sense, Silent Valley has laid the ground for a new concept of environmental awareness in development policy. Were it not for Silent Valley, it is unlikely that the Bedthi hydel project in Karnataka would have been stalled. It is also heartening to see that at least two Bombay companies accused of causing widespread pollution—RCF and Dharamsi Morarji Chemical Co.—have taken the lesson seriously and are now offering environmental monitoring services in addition to their regular business of producing fertiliser and chemicals! At the same time, the immediate lessons have at best been partial and incomplete: there has been little or no follow-up on the experience gained in the three cases. Thus, despite the Varadarajan committee's specific exhortation, the ASI has not set up a multi-disciplinary team to study how to protect ancient sites from environmental hazards on a regular basis. In Maharashtra, the

prolonged dispute between the state government and environmentalists seems to have had little effect. Although the government had committed itself to locating the petrochemical complex some distance to the south of Thal, its original site at Usar and now even at Nagothana hardly complies with this undertaking.

As a final lesson, in the short run, it is clear from the documentation of what transpired in these three cases that the government simply does not have the machinery to play the arbitrator in an environmental controversy. The DoE is hopelessly overburdened and understaffed; ideally, it should have an environmental officer in each ministry with whom it can liaise. In the absence of such co-ordination, each ministry thinks that it is meddling in its affairs, that environment is some new-fangled notion which means everything to everybody and has no clear-cut goals and objectives. Despite the grievous cost paid by the nation in money and time in each of the three projects—in Silent Valley, an escalation from Rs 25 crore to Rs 80 crore; for the Mathura refinery, from Rs 100 crore to Rs 251 crore; for Thal, from Rs 580 crore to Rs 918 crore—the procedure for obtaining environmental clearance for a big project *before* the foundation stone is laid is yet to be established. At present, any project worth more than Rs 5 crore which needs clearance from the Planning Commission should also be routed through the DoE. This means, inevitably, that only public sector projects are subject to its scrutiny. However the DoE simply does not possess the manpower and other facilities to assess each such proposal thoroughly and submit it to the kind of detailed investigation that is called for. Moreover, it cannot—or will not—initiate any enquiry on its own and is thus content with only passing judgement whenever it is called upon to do so. In this respect, the NCEP was better able to play the role of a watchdog and enlist the services of outside experts like Ganguly and Varadarajan as well.

### **A mirage**

If one takes a broader, long term view of these three projects, the first conclusion that can be drawn is that the promise held out by the “temples of today” has turned out to be something of a mirage. This is specially true of the Mathura refinery: it is situated in an area which was earlier one of the “badlands” of UP, where dacoits terrorised a poverty-stricken peasantry. Though the coming of the first oil refinery in the north west of the country has put an end to all

that, it has not proved to be the panacea for all the problems of backwardness that it was thought to be by the local populace. The site selection committee for the refinery, it may be recalled, was welcomed with open arms by the Agra Chamber of Commerce, which told the members that the Taj could be dismantled, stone by stone, and carted away to another site, rather than create problems for the location of the refinery. Today, it is unlikely that the businessmen of Agra are half as enthusiastic about the project; on the contrary, it has threatened the very continuance of the oldest traditional industry in the town—the small foundries. As for the citizens, they are totally oblivious of even the existence of the refinery a few kilometres outside the town.

The same illusory "development" is apparent at Thal and the nearby district town of Alibag. This project has not been able to employ local people except for some 500 "non-supervisory" jobs. While the construction of the largest factory in the world producing urea from a single site has brought a boom for landlords, hoteliers and certain other trades, this prosperity is both ephemeral and double-edged in that it has triggered off an inflationary spiral, adversely affecting the older residents. The lesson is clearly that highly capital-intensive projects such as refineries, petrochemical complexes and fertiliser plants cannot employ very many hands, whatever their other benefits to the economy. Similarly, the citizens of Mannarghat, at the foot of the hills where Silent Valley is situated, were adamant about getting the dam sanctioned because they perceived that it would improve their living conditions for good. Had they exchanged notes with villagers near the giant Idukki hydel station, they may have had other ideas: many of these villagers, as we have seen, do not have electricity in their homes even today. In any case, once a massive dam and reservoir is built, it only needs a few people to run the power house. These all-pervasive symbols of hope, therefore, soon become sources of disillusionment and despair.

It is not my case that big industrial projects are invariably the villains in the Indian economy, that they do more harm than good. It is beyond the scope of this book on three environment controversies to examine their costs and benefits as opposed to smaller industrial units. They obviously have a role to play in introducing the most modern technology, reaping the advantages of economies of scale and so on. For instance, the question did arise in the case of

the west coast fertiliser plant when consultancy firms in the Indian fertiliser industry tried to make out a case for going in for 900 tpd urea plants, for which indigenous know-how existed, instead of 1,350 tpd plants, the technology for which would have to be imported. Given the size of associated gas reserves in Bombay High and necessity of avoiding further wastage of this precious resource, it is probable that bigger plants were a more economical proposition. As more off-shore oil fields were struck, a total of ten 1,350 tpd gas-based ammonia plants are being built; some may also come up on the east coast, following the discovery of gas reserves in the Godavari delta. However the intention of this book is to question whether first, enough attention is paid to the proper location of these plants, as much from the viewpoint of environment as development, and secondly, whether a fixation with big industrial units has completely obscured the need to look at other, smaller technologies which address the needs of a much large number of people. On the first count, there is no doubt whatsoever that the location of these three big projects—like so many others in the country—was harmful.

### **Alternative technology**

What about the alternatives? Not many people are aware that the high priest of small technology, the German-born economist Ernest Fritz Schumacher, developed many of his ideas after visits to Burma and India.<sup>2</sup> Interestingly enough, it was none other than the architect of India's modern industrial economy—Pandit Jawaharlal Nehru—who first invited Schumacher to prepare a report for the Planning Commission in 1962. It was in this report that he first coined the expression "intermediate technology". He wrote: "It requires no lengthy argument to agree that India is 'long' in labour and 'short' in capital. This means that she requires a level of technology, or 'capital investment per workplace', that is likely to be very different from that current in the Western countries, which are 'long' in capital and 'short' in labour. At present, in India, as in all other developing countries, the most primitive exists side by side with the most advanced—an artisan employing five rupees' worth of tools, and workers minding machines worth fifty thousand rupees. But the intermediate industrial technology which would really suit India's conditions does not exist in an articulated form, except perhaps accidentally..." Schumacher, in fact, was

influenced by the ideas of Gandhi who declared in 1934: "Mechanisation is good when hands are too few for the work intended to be accomplished. It is an evil where there are more hands than are required for the work, as is the case in India . . . Dead machines must not be pitted against the millions of living machines reproduced by the villagers scattered in the 700,000 villages of India. Machinery to be well used has to help ease human effort." He put it even more strongly when he lamented that "Men go on 'saving labour' until thousands are out of work and thrown on the open streets to die of starvation . . . Today machinery merely helps a few to ride on the backs of millions."

Intermediate technology, according to Schumacher, ought to fulfil four conditions. Firstly, the workplaces should be created in areas in which people now live, rather than being concentrated primarily in cities. Secondly, they should be cheap enough to be created in large numbers without requiring large amounts of capital investment or of imports; as a first approximation, he suggested a figure of Rs 1,000 per workplace. The production techniques involved, as well as the related methods of organisation, must be relatively simple, with only a moderate degree of skill required for their successful operation. And finally, production should be mainly from local materials and intended for local use. As David Dickson points out in his book,<sup>3</sup> *Alternative Technology* (1974), these technologies would simultaneously raise levels of both employment and productivity, rather than one at the expense of the other. Although it was in relation to India that Schumacher refined many of his seminal ideas, the country did not take to intermediate technology (IT) in a big way.<sup>4</sup> George McRobie, who succeeded Schumacher as head of the London-based Intermediate Technology Development Group (ITDG) when the economist died in 1977, cites India's experience in his *Small Is Possible*.<sup>5</sup> "At that time, in 1963, the supporters of rural industrialisation through intermediate technology were very much in the minority. The economic planners (then in the ascendant), the Planning Commission, and the government in general, were against the idea. A brave effort was made by the Rural Industries Committee of the Planning Commission to introduce intermediate technologies through the 40 or so special Rural Industries Projects that were then being started throughout the country; but lacking any official support from government departments, official research and development organisations, or

universities, the officers in charge of the projects could do little ... For nearly the next 15 years the supporters of intermediate—or as it became known in India first, and later elsewhere, appropriate—technology fought a losing battle for official support. Whatever work was done to develop and introduce small-scale, capital-saving industries that would fit the needs of rural communities, was done, so to speak, against the mainstream of economic policy ..."

This remains the situation till today, despite the sporadic efforts of small groups like the Appropriate Technology Development Association in Lucknow, which was formed at the initiative of Jayaprakash Narayan. The Janata government, which ruled between 1977 and 1980, resuscitated the idea briefly but was incapable of translating its half-baked schemes into reality.\* For that matter, Mrs Gandhi, no mean modernist herself, observed at the inaugural function of the NCEPC in 1972: "To most people, progress has become synonymous with imitation of Western models but wherever we have followed models from the industrial society and have been insensitive to our own circumstances, the results have not been happy. The time has come for us to think deeply about the kind of progress we want." Despite lip-service paid periodically to the cause of rural regeneration, the obsession with big, capital and energy-intensive projects continues unabated. A big fertiliser or power plant creates each job with an investment of Rs 2 lakh, as against just Rs 30,000 in alternative methods in the village itself. The tendency of each state to demand its own steel mill, irrespective of the demands this will place on the transport of ore or the finished product, or on the consumption of power, is distressingly familiar. As we have seen, Karnataka has been clamouring for the Vijayanagar steel plant (its name harks back to the glory of empire); the only snag is its price tag, which was estimated at Rs 3,000 crore in 1981. By 1984, however, it was pruned to a more modest Rs 1,400 crore because a big steel plant in the region was not considered viable. Belatedly, the Daitari steel mill in Orissa, also to cost Rs 3,000 crore, has been abandoned. On the other hand, by way of a sop to Vidarbha, a backward district of Maharashtra, a Rs 160 crore steel plant has been cleared there. Will the production

\*Barbara Ward, in *Progress For A Small Planet*, refers approvingly to what the Industries Minister—an unnamed George Fernandes—once claimed about a "wholly new emphasis" in creating 50 million new jobs, mainly in small industries in the countryside.



of steel come to the succour of a region which is chronically drought-prone? This dilemma is heavily underscored in the Thal case, where the residents of Ratnagiri district, one of the most backward in Maharashtra, feel that they have been denied the fruits of progress: the first occasion was when an aluminium plant failed to materialise and the second, fleetingly, when the state government attempted to coax Dharamsi Morarji to establish its fertiliser plant there. No one can deny that steel or fertiliser plays a vital role in the economy. But are the plants being located on political grounds or according to well-defined economic criteria? What is even more important, has anyone given a thought to what the same funds can yield if invested differently? Without opting for a "small versus big" policy on technology, one can pose the alternatives both to present a critique of present-day industrial society and to examine workable solutions. As Dickson argues, "An awareness of possible alternatives is itself often sufficient to stimulate a critique of the existing situation, particularly when the attractions of such alternatives can be openly demonstrated. Utopian experimentation (which has preceded the doctrines preached by Schumacher and others today) is by no means futile, providing that one emphasises the importance of placing any such experimentation in an overall social and political perspective."

### **Environment with development**

The focus of alternative technology is not only a move away from big, highly mechanised systems to smaller, decentralised ones but methods of production which are in harmony with nature. Schumacher wrote in *Small Is Beautiful* (1973): "Modern man does not experience himself as a part of nature but as an outside force destined to dominate and conquer it." Marx himself had put it more eloquently: "Nature is his body, with which he must remain in continuous intercourse if he is not to die." Schumacher then went on to decry the reckless exploitation of what he called "natural capital"—particularly fossil fuels—and pointed to a system which would instead use nature's income in the shape of renewable resources. And this brings us to the second broad conclusion of this book: the demands of development and environment are by no means competing but are instead complementary. The choice offered between the two, a recurring motif in the three cases, is a false one, perceived by men who place "economics" and "ecology"

into their own watertight compartments. Amulya Reddy of ASTRA in Bangalore, sums it up well. "Development," he emphasises, "is an ongoing process of social transformation, based on willing mass participation and control by the people over the decision-making process, using fully all the natural resources of a given society while maintaining the ecological balance of nature, and in which the benefits of growth go first to the most needy, and, in which, over time, there is a reduction of all forms of inequality." A good way of measuring both environmental and developmental progress is to look at the consumption of energy as a key concept in improving the quality of life. As we saw in the introductory chapter, even poverty is now defined in terms of how many calories an individual consumes. Fortuitously, the three cases in this book all deal with the production of energy—directly as power in Silent Valley and petroleum products in Mathura and indirectly as fertiliser in Thal. We should look at the current scale of technology in each of these fields—power generation, petroleum products and the fertiliser industry—to examine whether the objectives of development, as defined in its broadest sense here, have been met and what alternatives are open to a country like India.

### **Instead of big dams**

The apparent conflict between environment and development was most fierce in the Silent Valley hydel project. The stark choice posed was whether to sacrifice the generation of electricity for some "unproven" scientific benefit which might only be realised in the distant future. This book makes a strong case for preserving this tiny strip of forest on the western ghats as an "ecological protectorate", just as a few other areas in the country should be. Together, they do not account for more than 4 per cent of the country's total land mass and represent an invaluable natural resource. As Dr Madhav Gadgil points out, around 5 to 6 per cent of the known species of living organisms in the world exist in India with a land surface which covers only 2.2 per cent of the globe. Certain areas must be protected for their biological wealth and to maintain genetic diversity, which is fundamental in the long run in improving the living standards of the majority of the people. If scientists can obtain new sources of food, fibre, medicine and ways of keeping pests under control from these nature preserves, they contribute in no small way to genuine development. Hence the dichotomy bet-

ween environment and development does not exist in reality—provided the terms are used in their genuine sense and not narrowly synonymous with aesthetic delight and increase in the GNP.

What about the need to “develop”—to harness the waters of the Kunthi river, as part of the national effort in irrigation, producing hydroelectric power and controlling floods? India is now one of the biggest dam builders in the world: by 1979, it had constructed some 1,550 large dams at a cost of Rs 10,560 crore—nearly 14 per cent of the total planned expenditure. The Register of Large Dams, published by the Central Board of Irrigation and Power, lists the ten highest dams in 1979. The Tehri dam, now under construction over the Bhagirathi in UP, comes first with 261 metres; Bhakra in Himachal Pradesh is third with a height of 226 metres but it has the largest reservoir of all, qualifying it, along with the Nangal canal, as the original “temple of modern India”. Idukki is the fifth, and Silent Valley—described as “under construction”—is the last, at 131 metres. It is impossible to think of the tremendous progress made by agriculture without the aid of these big dams. Even so, there is now a fairly convincing documentation of their undesirable consequences.<sup>6</sup> To begin with, they cause ecological damage. The Inchampalli and Bhopalpatnam dams, on the borders of Maharashtra, MP and AP, are expected to inundate 40,000 hectares of rich deciduous forests. The Tehri dam in the Garhwal mountains, famous for the Chipko movement, is described as a time bomb because of its earthquake hazards; it is also certain to be inundated with silt as a result of the relentless denudation of the surrounding mountain slopes. Chandi Prasad Bhatt, of Chipko fame, is agitating against the 480 MW Vishnu Prayag dam proposed in the same area. Landslides have destroyed a section of the Loktak hydel scheme in Manipur; the project, the brainchild of the former Irrigation and Power Minister, Dr K.L. Rao (who also located the Indraprastha thermal power station in Delhi), is now believed to have been executed without proper investigations; and there are also doubts whether the north-eastern states themselves, which have barely any industry, will be able to use the power at all. Similar hazards have been witnessed at the Koyna dam reservoir disaster in 1967, in which 200 people lost their lives, and the recent tremors in Khardi, also near Pune. The loss of forest and other productive land when big dams are built is another of their major costs. It is calculated that big river valley projects have swallowed half a million hectares

of forest land between 1951 and 1976—roughly one-tenth the area which has benefited from irrigation!

Although big dams do bring a lot of prosperity to the people living in areas irrigated as a result, their economics is being questioned today. As we saw in the case of Bedthi, the long-term yield of the forest destroyed as a consequence is not taken into account by economic planners. Silt drastically reduces the life of reservoirs, totally altering the original cost-benefit calculations. Thus it is estimated that the life of Bhakra has been almost halved from 88 to 47 years and Hirakud from 110 to 35 years. Where hydel power is the main purpose for building a dam, this defeats the very objective. Moreover, as we have seen, it is one thing to build a dam and create a massive reservoir and quite another to ensure that canals are built to carry the water to the people. For that matter, big irrigation schemes neglect proper drainage of fields, which causes salinity: states like Punjab and Haryana are now badly afflicted by this scourge. This vividly illustrates the complementarity, rather than the "either-or", of big and small technology—gigantic engineering works are required to harness natural resources in certain cases but that does not preclude the deployment of people in myriads of small schemes in the "command area" to bring water to the remotest farms and drain it as well. The economic costs of bad management of big dams is enormous. According to the Sixth Plan document, the country loses Rs 427 crore a year on irrigation projects. Schemes have been delayed for enormous periods—dams like Nagarjunasagar in Andhra Pradesh and Kosi in Bihar have been under construction for 15 to 20 years, with cost over-runs of 500 per cent or more. Finally, the displacement of people is an adverse consequence of big dams. In Kerala itself, the KSEB is contemplating building a dam which threatens to engulf the plantation town of Munnar. In an unprecedented display of solidarity, citizens staged a *bandh* in January 1983 to protest against the scheme. Much more bizarre developments have taken place with the Pong dam in Himachal Pradesh, where the hill people ousted have been resettled in deserts of Rajasthan! In the forest belt of Gadchiroli, across Bastar, the country's biggest tribal district, the renowned social activist Baba Amte is spearheading a movement against the Rs 400 crore Bhopalpatnam hydel project which, together with Inchampalli, will displace 75,000 people. The thousands who have been uprooted by major development schemes

in this manner take quite a different view of the "benefits".

The disenchantment with big dams in the Third World is slowly growing. The most celebrated case is the Aswan High in Egypt which President Nasser—like his Indian counterpart Nehru—treated as the one symbol not only of modernisation but also nationalistic self-assertion.<sup>7,8</sup> President Sadat also referred to the largest rock-fill dam in the world as being "after the pyramids of the Pharaohs, the greatest construction erected in their history"—once again, an analogy with what was considered the most revered monument in the country. It has brought the country low-cost hydel power, has controlled floods and drought and has enabled one million hectares to be cultivated around the year instead of seasonally. Many of the adverse consequences—the spread of the dread parasitic disease called bilharzia, the impounding of nutrient-rich silt in the reservoir and soil salinity—have not proved as severe as originally predicted by environmentalists, for whom Aswan has become a password for "careless technology", where tampering with nature has provoked dire results. At the same time, the scheme, which swallowed almost 13 per cent of all development funds in Egypt in the 1960s, has seen more land lost to urbanisation than reclaimed from the desert, the death of an entire sardine fishing industry and the expenditure of \$200 million on soil reclamation. On the whole, however, there is no doubt that Aswan has proved a tremendous boon to the country.<sup>9</sup> As an Egyptian-born expert who led a US-funded \$1.2 million five-year study team to examine the effects of building the Aswan High puts it, "In 1972, Egypt would have had a terrible drought if it had not completed the dam. In 1974, there was an exceptionally high flood. Without the dam, a lot of land would have been inundated, villages washed away and people killed. How can you assess in economic terms the value of preventing a flood or supplying water during a drought? For the first time, Egypt has control over its own lifeline." The Washington journal *Environment* characterises it as a drastic solution to a drastic problem.

Dams in the Amazon basin, in Latin America, have closer parallels to Silent Valley in that they too threaten the destruction of tropical rain forest.<sup>10</sup> But, of course, the scale is several thousand times bigger. Brazil, for instance, is planning a network of dams on the Amazon which may supply half the country's electricity by the end of the century.<sup>11</sup> The first gigantic project is the \$ 4 billion,

4,000 MW Tucuruí dam, which will flood over 2,000 sq km of forest. It will be the dam producing the biggest amount of electricity in any tropical forest in the world, as well as the fourth largest. But it may pay the price for being the pioneer in taking such liberties with an as-yet-unstudied natural system: an earlier dam built in Surinam has been plagued by the rotting of trees in the flooded virgin rain forest and the spread of water hyacinth. An even bigger scheme is Itaipu, which is being promoted by the national electric companies of Brazil and neighbouring Paraguay. This mammoth scheme will cost \$18 billion and generate 12,600 MW, creating a 200-km-long lake and displacing 40,000 people. Nine years after work on it began, it has generated no power for Brazil and only a little for Paraguay. Environmentalists are concerned about the seismological hazards of impounding such a large body of water and the possibility of the lake quickly filling up due to erosion. Furthermore, a criticism, which has echoes in Silent Valley, is that there are doubts whether Brazil really needs so much electricity. The dam was planned in 1973 when electricity consumption was growing at 10 per cent per year. A decade later, this had dropped to 3.5 per cent, as Brazil's much-vaunted "economic miracle" began to evaporate, leaving it with a \$ 100 billion foreign debt, the world's largest. Brazil was expected to have a 30 per cent surplus power capacity when the dam began to function. It can supply all of Paraguay's needs—but only if that tiny country can afford to instal power lines and other equipment needed. And the unkindest cut of all is that Paraguay will pay for its share of the dam by selling its share of power to Brazil—at 1973 prices!

Another dam which has caused complications in a tropical rain forest is Kariba, in Zimbabwe—it created the largest man-made lake in the world, 570,000 sq km in area, and a hydel scheme is being planned further downstream which will inundate 1,000 sq km of the valley of Mpata Gorge, one of the best wildlife reserves in the continent.<sup>12</sup> This scheme will provide only 14 per cent of Zimbabwe's power by 1990 at a cost of \$1 billion and conservationists are arguing that there are smaller hydel sites available on the Zambezi which would cause far less damage. They also point out that Zimbabwe has huge reserves of coal, which it can use for thermal power rather than barter its sovereignty by running the scheme along with Zambia. The "electricians" counter the first argument by saying that the alternative schemes are being

envisaged eventually as well—in addition to the major hydel project. Once again, the scale of technology is being questioned, with environmentalists saying that Zimbabwe should go in for smaller, decentralised growth points, using local resources and skills, with suitable technical innovations. As the *Los Angeles Times* reports, “the environmentalists are careful to avoid accusations of emotionalism at the expense of people—many of whom, in Zimbabwe, live in appalling poverty.” Two dams that have been prevented from flooding nature reserves are the Tembeling in Malaysia and another in Tasmania. Closer home, the massive \$ 3,000 million Mahaweli project is being launched with Western aid in Sri Lanka.<sup>14</sup> It should treble the island’s generating capacity and irrigate 1,40,000 hectares of new land, but will also displace 1.5 million people—probably the world’s biggest resettlement for a development scheme.<sup>15</sup> A Sri Lankan lawyer who has been opposing the scheme laments that “PhD students will flock to Sri Lanka in a few years’ time and write learned theses on the inappropriateness of high technology aid for poor countries.”

A dam which is often cited as one of the worst instances of “careless technology” is the Akosombo on the Volta river in Ghana.<sup>16</sup> Nkrumah, the great African statesman and, like Nehru and Nasser, champion of post-colonial modernisation, pushed for the dam and power plant, which cost \$200 million in 1959, with funds provided by the World Bank and US loans. The argument in Silent Valley that a hydel scheme might meet the needs only of big industry is almost parodied in this case: 90 per cent of the electricity generated is used by one single company—the Kaiser Aluminium plant there, a US multinational, which now pays \$17 million a year for electricity worth \$ 200 million at world prices.\* To add insult to injury, Kaiser uses imported ores instead of Ghana’s bauxite for making aluminium—thereby ensuring that the value is added outside the country. The dam displaced 80,000 people and bilharzia has spread rapidly. Revenue from the dam barely covers interest payments and operating costs—and Ghana faces power shortages. It has had to borrow money to build smaller dams and now imports power from its neighbours.

\*Ironically, the US government had to be persuaded to allow Kaiser to open its plant in Ghana in the days of Nkrumah, who was considered a communist and anti-American. He saw the project as lifting the country out of its morass of poverty and unemployment. In other words, he prostrated himself before Ghana’s “modern temple”!

These shocking instances of big technology running amuck should be sufficient to point to the dangers of uncritically accepting a centralised pattern of economic growth. One must reiterate that this cannot lead to the conclusion that big dams are always harmful but that they need to be planned properly.<sup>17</sup> Robert Goodland, ecologist for the World Bank, points out that they have some "undesirable negative potentials" but "practically all can be negated through careful design." Developing nations, he contends, receive many benefits from big dams, not the least of which is an energy alternative to expensive imported oil (or nuclear power). Joseph Lowe, former American Chairman of the International Commission on Large Dams (ICOLD), evidence from which was often cited in the Silent Valley controversy,<sup>18</sup> confirms that "the world is crying for water and high dams are a good way to providing it." In a special ICOLD session on the environmental consequences of big dams, held in Madrid in 1973, the consensus was: "On both sides (of the argument) we find life. If a dam submerges forests, wild floods also submerge them and furthermore will also kill men and animals. If a dam wipes out some agricultural land, it irrigates much vaster areas. If a dam destroys a few villages, it gives prosperity to much larger communities and improves their way of life. This includes the villagers who have been displaced." Certainly, big dams should be built, but only in exceptional cases—not as the rule, as is now the practice.

### **Power to the people?**

There is a tendency to look to the advantages of big dams, whatever their ill effects; we are more specifically concerned here with electricity. Lowe asserts that "there is a pretty good relationship between the standard of living in a country and the number of kilowatt hours generated per person." This brings us to the central point in the environment-development debate in relation to Silent Valley. The provision of electricity in particular and energy in general is seen as a vital component of economic growth. As Rajendra K. Pachauri, head of the Tata Energy Research Institute in Delhi, observes, "Growth in consumption (of power) is often viewed as a proxy for economic progress itself, and increasing a country's electric power supply is treated as a core activity in economic development plans and policies. In many cases this view has been carried to an extreme by regarding the development of the power sector as an end in itself, without regard to its impact on the output of other sectors of the economy or on the welfare of



society.”<sup>19</sup> Thus many planners decry the vast disparity between the US consumption level of 10,457 kilowatt hours (kWh) per capita in 1979 with the Indian average of a niggardly 154 kWh, which corresponds to the US level in 1910 or England’s in 1925. More recently, however, some analysts are seeing the generation of electricity as only one means, along with others, of achieving the goals set by a society. Pachauri has done a revealing exercise in plotting per capita power consumption figures of each state in India against real per capita incomes and finds no linear, rigid relationship between the two. For instance, Orissa, Bihar, MP and UP all have relatively low money income but high power consumption levels, while exactly the reverse is true of Haryana and West Bengal.

As we have seen in Silent Valley, whatever the mystique surrounding electricity as a universal boon, the bulk of it goes to industry. This prodigal use of energy in a chronically deficient country needs to be examined. When the First Five Year Plan was launched in 1951, the industrial sector accounted for as much as 72 per cent of the power consumed; it had declined to 63 per cent by 1979 because of the use in intensive agriculture. In the Sixth Plan, power had been allocated almost 23 per cent of the total outlay, which gives an idea of the importance given to this sector. As much as Rs 67,000 crore is sought for power in the Seventh Plan—including Rs 20,000 crore (as much as was allocated to the entire sector in the Sixth Plan) to improving transmission and distribution alone. (In Kerala and most other states, it consumes a third of the state governments’ budgets.) Given the emphasis in the country on heavy industries as the only way to make it economically self-reliant, the generation of power is seen as a crucial input. Yet, contrary to the popular belief that industry in this country—as indeed other Third World nations—is extremely sparing in its use of energy generally and electricity specifically, it is actually very wasteful. The Working Group on Energy Policy, headed by N.B. Prasad, former Chairman of the ONGC and energy adviser in the World Bank, reported in 1979 that the “intensity” of energy consumption in the economy was high.<sup>20</sup> Between 1953 and 1979, the index of “elasticity” remained around 1.80, which means that energy consumption increased 1.8 times faster than GDP—a rate high even by international standards. During roughly the same period, the index was invariably lower than unity in developed countries; for exam-

ple, it was 0.81 for the USA and 0.84 for the USSR. The similar index (coefficient) of electricity (as against overall energy) to GDP was even higher at 2.70 in the same 26 years. As a World Bank document,<sup>21</sup> "India: Economic Issues in the Power Sector" (1979) underlines, India has the highest elasticity of power consumption among poor countries.

One reason for this situation in India is the substitution of other forms of energy by electricity—particularly in agriculture, where electric pump sets have installed on a huge scale since the late 'sixties.<sup>22</sup> However, as the World Bank notes, "India's pattern of industrialisation in the last several years may have been one which called for a higher level of electricity consumption than was typical among most developing countries," and asks pertinently: "Since electricity is particularly scarce in India, it is natural to ask whether the available supply is being used efficiently. It is important to know as much as possible about how much waste of electricity there is and where. Are there times when it is too costly to use? Could more goods and services be produced with a given supply of electricity if redistribution among uses was encouraged? Would technological improvements in user sectors aimed at economising on electricity be worthwhile? Are there situations where electricity should be substituted with another type of energy, or vice versa?" To a large extent, these problems arise because of the predilection for huge capital- and energy-intensive industries. Thus, in terms of value added, fertilisers and cement are the most power-intensive major sectors—close to using ten times more than Indian industry in general. States the World Bank: "Fertilisers should be singled out as a very power-intensive industry, where production has grown by 19 per cent annually (between 1960 and 1977) and electricity consumption by close to 15 per cent per year." Aluminium, of course, is another insatiable consumer. But this dependence of the "modern" or core industrial sector on power is turning out to be, on very many occasions, its own undoing. As one can glean from even a cursory glance at any daily newspaper, the shortage of power in most states is crippling industrial growth. In February 1984, for instance, even the Kudremukh iron ore plant had to be closed down for this reason. According to the Federation of Indian Chambers of Commerce and Industry, the country loses nothing less than Rs 10,000 crore a year on this account. If nothing else, this should prompt another look at the current pattern of industrial growth in

the country, based on big industries fed by power supplied from highly centralised systems.

Even in the US, critics of the wasteful use of energy—the most prominent of whom is Amory Lovins, author<sup>23</sup> of *Soft Energy Paths*—argue that big energy plants (whether producing gas or power) suffer from diseconomies because of their exorbitant distribution costs. In the US in 1972, for instance, every dollar worth of electricity cost 29 cents to produce and 71 cents to deliver! Besides, the heavy investment in a massive power plant involves huge gestation periods, cost escalations and the risk of breakdowns. A survey of 13 hydel and 16 thermal projects in India revealed cost over-runs of as much as 700 per cent. Lovins in fact calculates that every big American power station *loses* the economy 4,000 net jobs because it starves other sectors of capital. The culmination of such large scale technology is nuclear power, which is both economically prohibitive and environmentally disastrous: the controversy over the building of such plants throughout the world is bound to lead to a re-examination of centrally planned power systems. The abysmal performance of nuclear plants in India speaks for itself.

According to energy experts like D.K. Subramanian of the Indian Institute of Science, there is a great deal of scope for conservation in Indian industry. Up to 15 per cent of the electricity used can be saved. Steel consumes 6.5 per cent of the nation's power, as well as 23 per cent of its coal and accounts for 14 per cent of the freight carried by the railways. Japanese manufacturers use only half as much energy per tonne of steel. The potential for saving energy in producing steel—it consumes a quarter of the "commercial" energy used by industry—is enormous. If one considers just the proper location of steel mills close to pithead coal stocks, rather than to assuage regionalist sentiment, the savings are obvious. Besides, since Indian coal has about 40 per cent ash content, it makes sense to eliminate at least part of the ash at the pithead, thus saving the railways from carrying this extra load. Of course, the proximity of ore deposits also has to be taken into account. Conservation, like environment, calls for a holistic view and can question the end-uses of steel. For instance, single-storey buildings do not require it, contrary to practice in the country.\* Aluminium, which

\*Similarly, the brick and cement industries consume 16 per cent of industrial energy, though there are many categories of buildings which do not require them. One has only to recall, as does the author of *Human Scale* quoted at the beginning of

accounts for 3 per cent of the energy, is mainly used to replace copper for electrical conductors. If more was used in cooking vessels (only 3 per cent today), it would save total cooking fuel consumption drastically in the rural areas.

According to the National Productivity Council, one-fourth of the fuel oil now used by Indian industry could be conserved with better "housekeeping", while replacement of old boilers and installation of waste heat recovery equipment could result in further savings. Major industries like textiles burn fuel oil to produce steam, which could also be employed to generate electricity. The Council shows that almost all refineries, fertiliser and petrochemical units can use this "total energy" concept with profit. The simple expedient of pre-heating furnace oil by solar heaters before use can save substantial amounts of energy. Sugar mills are already using their bagasse (waste) as fuel; alcohol distilleries can also convert their waste, which now pollutes rivers throughout the country, into biogas (and pump the slurry left to algae or fish farms). Unfortunately, banks lend money to an industry to enable it to expand or build a new unit but not to redesign an existing plant and conserve energy.

The other huge potential saving of energy, as we saw in Silent Valley, is to cut losses on the transmission and distribution of power. These now amount to 20 per cent of the power produced in many states and can easily be reduced. One estimate puts the annual loss to the economy on this count to Rs 525 crore (at a cost of 25 paise per unit). There is waste in agriculture too. According to Subramanian, farmers in many areas work their electric pump sets at only 13 per cent of their efficiency. Although they may need a 1 HP set, the only pumps available on the market are 5 HP sets. This amounts to a criminal waste on a national scale, considering that there will be some 6 million sets by 1985. Improving the efficiency of sets could save 3 million kWh, which would serve an installed capacity of 800 MW. Each megawatt of power conserved saves the nation Rs 7 crore in investment.\* If one considers the hazards of relying solely on energy-intensive agriculture—the frequent power

this chapter, that the Taj Mahal was not built with steel or cement and seems to have weathered the centuries pretty well!

\*Diesel sets fare no better: the Productivity Council states that in Punjab alone, 100 million litres are wasted through low efficiency; in other states, they consume twice the fuel they are supposed to.

breakdowns and shortage of petroleum products can mean no irrigation—the lessons are clear.

But a critique of the existing state of technology in the power sector cannot simply rest at conservation: there is also the possibility of using alternative sources of energy and electricity. Instead of large hydel or thermal projects, mini and even micro hydro schemes can produce anything between 1 kW to 1,500 kW (1.5 MW) each from falling water in streams, canals and so on. This is putting to use renewable forms of energy in a manner which will not harm the environment. The Planning Commission believes the potential of micro schemes is nearly 5,000 MW. Says the CSE "State of Environment" report for 1982: "Small scale hydroelectric plants can be very useful in augmenting the country's available hydroelectric potential and in providing electricity in remote areas, particularly the hill districts. Small hydel works require relatively short water drops. Since the transmission is over short distances, distribution costs and losses are relatively low. They have shorter gestation periods and have a negligible impact on the environment. They are relatively easier to operate and maintain. A survey of India's hydel resources by the Central Electricity Authority (CEA) estimated the small hydroelectricity potential of India at 25 billion kWh, which is about 60 per cent of our present installed capacity. Indian planners, however, have so far shown disdain for small hydel schemes. The Sixth Plan has no specific allocation for small hydro power projects."

The glaring disparity in the use of alternative forms of energy between India and China is quite apparent when one considers that since 1968, some 90,000 small hydro units have been built there, with a generating capacity of 6,330 MW. Although each project only produces an average of 72 kW, small plants account for 40 per cent of China's installed hydro capacity. A Worldwatch book<sup>25</sup> titled *Renewable Energy: The Power to Choose* cites how in more than a quarter of the nation's counties, these are the main source of electricity and by the end of the century, China hopes to provide six times as much energy through small hydro as it did in 1979. Significantly, the country considers these plants another part of integrated water management and rural development. "Driven by the need to feed and employ a billion people," says Worldwatch, "the government has given highest priority to agricultural water storage, irrigation, flood control, and fishery needs." It is

impossible to over-emphasise the multi-faceted nature of such development. Contrast it with "development from above": a small hydro expert from the CEA advocates microhydel projects because "a large number of remote villages in the hilly regions have yet to see an electric light in their vicinity. *In order to make these villagers aware of the advantages of use of electricity, and to bring them into the mainstream of development being achieved in the rest of the country...*" (my emphasis).

Neighbouring countries—Nepal in particular, but also Pakistan and Bangladesh—have gone in for small hydro in a bigger way than India. The small Himalayan kingdom is believed to have a hydel potential of 40,000 MW, only 1 per cent of which is tapped today. According to the World Bank, Third World countries can unleash 5 to 10 per cent of their hydropower by building small dams, which can also help to control floods and to provide irrigation in difficult terrain. Critics of small hydro technology point to the higher capital cost of generation as compared with centralised power systems, which enjoy economies of scale. The World Bank estimates the cost at around \$3,500 per kW of installed capacity, but Pakistan has been able—through its Appropriate Technology Development Organisation—to bring it down to \$350–\$500. Argues Worldwatch: "Because relatively fixed engineering and site-preparation costs can be spread over a larger power output, larger dams seem to enjoy considerable economies of scale. But small-scale projects look more favourable if the hidden or discounted social costs of large dams are taken into account (as we saw in Bedthi). In general, developing countries stand to reap more by developing the cheapest small sites available before venturing into additional large dam projects. Besides generating revenues, small hydro plants can reinforce economic development by converting poor countries' most abundant and least-used resource—labour—into critically needed capital. They can also catch silt-laden storm waters, thus protecting large downstream dams from premature sedimentation." The potential along the west coast of India—where two of the three projects studied in this book are situated—is large, with rivers originating in the ghats.

It is important to remember that small hydro can never replace a centralised power system—they perform different tasks altogether. The former caters to basic needs—the subsistence sector—as opposed to the modern, cash sector. Small hydro should be con-

sidered a means to an end, which is a drastic improvement in living standards in the villages. Despite all the official rhetoric about rural electrification—a separate public sector corporation has been created to do the job; the 20-Point Programme bleats about bringing light to all of India's 5,70,000 villages—the record is pretty bleak. Although the number of villages with electric power increased from only 3,000 in 1951 to 3,20,000 in 1983, this still left more than four out of every ten villages in the dark. Rural electrification, though extremely expensive (much of the accumulated losses of some Rs 4,400 crore of state electricity boards can be ascribed to it), will raise the quality of life in the countryside as few other amenities can. As things are, most electricity flows to industries and urban consumers, though the environmental costs of big hydel projects are borne by hill and rural folk, usually tribals. But there is no reason why the use of energy should remain so inequitable: according to the Working Group on Energy Policy, "it is not only possible but necessary to reorient our strategies of economic growth in such a manner that the input of energy required to produce a given level of goods and services is reduced gradually over time. This would require a detailed study of the specific operations which should be mechanised in agriculture and industries, the type of technology that should be chosen to produce a given set of goods, location of different production activities in the country so as to reduce the requirement of transport of the inputs and outputs of production activities, the extent of urbanisation and other factors. In other words, the economic growth strategies would have to be realigned so as to be consistent with the current expectations of increasing scarcity and price of all energy products..."

The significance of the Silent Valley controversy is that it has drawn attention to these issues concerning the relationship between energy and development for the first time in the country. The arguments are being carried further, as we have seen, in the Bedthi hydel scheme and will doubtless surface in other projects throughout the country. The lessons to be drawn are that big dams are not necessarily the best way of providing power, especially when a valuable precious and irretrievable natural resource is threatened. But even more fundamentally, Silent Valley shows that the very objectives of economic growth can be questioned: in the final analysis, what matters is what use the power is being put to. While it will be ridiculous to imagine that alternative energy methods can

fuel a steel mill or indeed any big industrial unit, one has also to see who benefits from the project in question, whether it is best located in a particular area—or even in a particular state, for that matter.

Small hydro can supplement, not supplant, big dams. One of the protagonists of the Silent Valley hydel project quoted an American ecologist: "At present, both practices (big and small technology) have a place in our flood control activities. The Missouri River Project and the Tennessee River Project have depended largely upon the construction of multipurpose dams. Hundreds of small watershed projects have demonstrated the effectiveness of upstream control, at least in controlling water at the local level. While the controversy will no doubt continue, both types of works will probably be important in flood control for the foreseeable future." China puts it well: "Walking on both legs"—one big, the other small; the implication is that without either, the person will totter. It has 18 large dams and is planning the Three Gorges dam on the Yangtze which will probably be the world's biggest, producing 25,000 MW; it also has 90,000 small hydro schemes. Thus it will be foolish to argue that power produced from big hydel projects in Kerala should be used for cottage industries. A better compromise would be a decentralised pattern of development, such as that advocated for Kerala specifically by the Centre for Development Studies in Trivandrum. This shows that electricity produced from centralised power systems need not only be taken to a single industrial belt in Cochin-Alwaye but also used for agro-processing and other units which add value to another of the state's major resources—cash crops. Small hydro projects, on the other hand, can meet the needs of the poorest people; what is more, local communities will have control over the technology themselves, instead of being dependent on a centralised authority like the KSEB. This, as we shall see in the final chapter, is as much a political and social issue as a technological one. The controversy over the dam in Kerala serves to question, therefore, not just whether development is taking place at the cost of environment but, far more crucially, what the pattern of development is.

### **Reducing dependence on oil**

The two other cases in the book have very much in common—they concern oil and its downstream product, fertiliser, made from associated gas; coincidentally, both the oil and gas come from



Bombay High. This form of energy is now considered the pivot on which every modern economy rests. The consumption of oil and natural gas reached its zenith in 1973—the year when OPEC raised prices for the first time—when it accounted for an astonishing two-thirds of the world's use of commercial energy.\* In his *Building A Sustainable Society*, Lester Brown, who heads Worldwatch, writes: "Industrial economies turned to oil because it was convenient, abundant and cheap . . . Oil was the source of nearly all the world's transportation fuel and chemical feedstocks as well as much of the fuel for heating buildings and water, and for generating electricity. Production of the wondrously versatile fuel and feedstock multiplied fivefold between 1950 and 1973. Within a generation, it reshaped the economic system. Yet, most of the readily accessible reserves of oil formed over hundreds of millions of years will be consumed within a single generation, spanning the years from 1960 to 1995."<sup>26</sup> Experts trace the decline of the "age of oil" from the 1990s, when production begins to drop. Oil now supplies 44 per cent of the world's commercial energy and 38 per cent of total energy; industries have built thousands of new plants that rely on oil and natural gas, while people use it to heat and cook. In the West, electricity is being produced by new oil- and gas-fired plants. And yet the Third World, which contains three-quarters of the world's population, consumes just one-fourth of its oil. Many developing countries use less than one barrel of oil per person per year, compared to over 20 barrels in rich countries. No wonder, then, that wood is sometimes referred to as "poor man's oil".

In India, oil is seen very much as crucial to the growth of the economy. A.K. Malhotra, the ONGC's Member for Offshore Drilling, writes: "Energy is linked with economic progress. Various studies have shown that the higher a nation's income or output on the current international scale, the higher, in general, its level of energy consumption. As its GNP rises over time, so does its energy consumption—in close, even if not proportionate, conformity. Recent events, such as the increase in oil prices and the concomitant conservation measures and increasing efficiency in use of energy, have tended to decrease this ratio. Despite this, the fact remains

\*Although Western energy specialists tend to equate energy with "commercial" energy—that which is paid for, as against "free" like firewood collected or agricultural and animal wastes—they forget that in India, like other Third World countries, such non-commercial energy forms half the total energy consumed.

that there is a direct correlation between energy consumption and the per capita national income of a country.<sup>27</sup> In 1982-83, the value of the output of petroleum products in the country was Rs 12,500 crore, which represented about 8 per cent of the GNP of Rs 1,55,000 crore. At current trends, oil's share in India's total commercial energy requirements is expected to drop from 48 per cent in 1979 to 33 per cent by the turn of the century, which is still very sizable: Malhotra warns that a different strategy will have to be adopted in future when oil is not as freely available any longer. In the meanwhile, the country is continuing to put a lot of eggs in one basket: the oil and petrochemicals industry swallows a huge amount of the nation's investible funds.<sup>28</sup> The ONGC, which has doubled its production of crude oil from 10.5 million tonnes in 1981 to 21 million tonnes two years later, thanks mainly to off-shore drilling, has sought Rs 18,000 crore in the Seventh Plan—two and a half times more than its outlay in the Sixth Plan. During 1983, it was reported to be spending Rs 13 crore a day! By the beginning of 1984, however, the Centre was worrying about the availability of resources for other huge oil industry projects, including the six gas-based fertiliser plants to come up in MP, Rajasthan and UP, the Rs 1,167 crore gas cracker petrochemical complex in Nagothana, the two new Rs 1,250 crore oil refineries in Karnal and Mangalore, the Rs 500 crore Haldia refinery expansion and the Rs 200 crore production-cum-process platform in the south Bassein off-shore field. That totals nearly Rs 10,500 crore—at current prices.

The Mathura refinery was set up to provide petroleum products in the north-west of the country, where the Green Revolution was spreading in the late 'sixties. Oil and its products have helped throughout the world to boost the productivity of agriculture tremendously. Thus the rise in the price of oil—and subsequently of fertiliser—was largely responsible for lowering India's grain production from 108 million tonnes in 1970-71 to 103 million tonnes in 1973-74. While the refinery posed an immediate threat to the environment—damage to the exquisite marble edifice of the Taj Mahal—this book seeks to go further and examine whether a development policy which stresses energy-intensive agriculture, to the exclusion of alternative methods of producing more food, is really wise. To cite one indication, as much as Rs 4,000 crore was invested in the tractor industry by 1984, which turns out 7 lakh machines a year. If one takes farm equipment as a whole—to

include implements, trailers, pump sets, fuels and lubricants etc—the investment is of the magnitude of Rs 5,000 crore. This gives an idea of how resources are sucked away to enable Green Revolution technology to flourish.

Is this pattern inevitable? Amulya Reddy has presented one alternative in a 1981 paper<sup>29</sup> entitled "A Biomass-Based Strategy for Resolving India's Oil Crisis". He points out how India's oil consumption has been steadily rising at an average annual compound growth rate of 7 per cent since 1975-76. Indigenous production only accounted for one-third of the consumption, about 33 million tonnes, in 1980 and the country spent \$7 billion on importing this extremely expensive form of energy. In 1980-81, the imports of oil equalled as much as 80 per cent of the foreign exchange earnings of the country. Reddy tries to show where this oil goes and what can be done to reduce consumption (environmentalists are more concerned than economists about ensuring that scarce resources are not wasted!). Thus 80 per cent of the oil is used in two sectors—transport (60 per cent) and households (20 per cent). The main fuel for transport is diesel, used in trucks and buses, railways and shipping; the first two modes consume nine-tenths of it. The greater fuel efficiency of diesel locomotives in carrying freight is obvious: they haul 37 per cent of the goods and consume 11 per cent of the diesel used in the transport sector. By contrast, trucks swallow 64 per cent of the diesel to carry the same amount of freight. One reason for the gradual substitution of rail by road transport (apart from the incessant problems of the railways) is the subsidy in the price of diesel. It is only about one-third as expensive as gasoline, whereas in the West it is almost the same price. Any attempt to raise the price of diesel would cause problems because it is now pegged to the price of kerosene, used by the poor, and can be substituted in diesel engines. Hence if diesel prices are raised without increasing prices of kerosene, truck drivers would simply switch to this form of energy, as has happened in recent years.

If any economy such as India's wants to reduce its use of oil, it must find ways of replacing kerosene. The Centre has hardly ever raised its price because it is used by the lowliest of households. Of this domestic consumption, 67 per cent goes for lighting and the rest for cooking, according to Reddy. In fact, he shows that almost nine out of ten rural homes and half the urban ones—some four-fifths of the country's 116 million households—depend wholly on kerosene

for lighting, an overall average of 2.2 litres a month per family. And yet, it is an extremely inefficient way of producing light—an electric bulb is 200 times more efficient. While all the 2,700 towns (with a population above 10,000) have been electrified, only a little more than half the villages have been. What is more, this rural electricity is used mainly for pump sets for agriculture (87 per cent) which means its benefits go to bigger farmers. "While the number of new electricity connections increases at the rate of about 1 million households a year," says Reddy, "the number of new households increases at the rate of about 2.2 million per year, that is, the number of unelectrified homes is continuously increasing despite the decreasing number of unelectrified villages." (In exactly the same way, the number of illiterate people in absolute terms is increasing, even as the proportion of illiteracy decreases.) The first prong of an alternative strategy, he believes, is to electrify *all* homes and provide them with lights, which will bring about a major improvement in the quality of life. Kerosene will no longer be required as a fuel for this purpose and diesel can then be made as expensive as gasoline. If, in addition, the permit system for trucks and buses is redesigned and enforced to keep these vehicles within their break-even distances—they are more cost-efficient than rail for short hauls—there will be a drastic reduction in oil consumption.

However, as the economy grows, the fuel needs of transport will rise appreciably and Reddy points to the necessity of shifting to an altogether different source of energy for trucks. He cites fuels made from biomass—such as producer gas, methanol, biogas and ethanol—as the answer. These require careful scrutiny because the use of land and biomass cannot be allowed to compete with more pressing needs of food, fibre and fertiliser. Thus ethanol or "gasohol", produced in Brazil from sugarcane, cannot be used in a country with a high population density because switching over to its cultivation on a big scale will lower food crop production. Biogas cannot be easily liquefied and is thus only suitable for road trips a short distance from the biogas plant. The feasible fuels, according to Reddy, are producer gas and methanol (which is obtained in turn from producer gas). He points out how producer gas generated *in situ* with charcoal gasifiers was used in buses and trucks throughout the country during the last World War; considering India and other poor countries have what are sometimes called "siege economies",

another look at this alternative seems long overdue.<sup>32</sup> Producer gas has the disadvantage of requiring solid fuels (wood, densified biomass or charcoal) for which large scale distribution networks are not convenient. Methanol, on the other hand, is a liquid which can be distributed through the national system already established for gasoline and diesel. "All this underlines the great importance of multi-fuel internal combustion engines," believes Reddy.

The snag is that both producer gas and methanol require wood, which is as short in the "siege economy" as oil. Today, 130 million tonnes of firewood are used for cooking in the country every year; the Working Group on Energy Policy puts the average price of wood bought—as against collected "free"—at Rs 400 per tonne. Indeed, energy experts are beginning to realise that the shortage of the future in poor countries may not be food to cook, but wood to cook it with. Again, like kerosene for lighting, the efficiency of wood stoves or *chulas* for cooking is only 5 per cent. More efficient stoves would not only be much more convenient for housewives but also conserve precious firewood. Fortunately, India's vast cattle population can come to the rescue. There is one head of cattle for about every 2.3 people and the waste from these animals can provide gobar gas for cooking in villages. In urban areas, piped mixtures of sewage, coal and producer gases can replace firewood, kerosene, soft coke and liquefied petroleum gas. "If gaseous cooking fuel is thus provided to *all* homes," says Reddy, "not only will the 33 per cent of the kerosene presently used for cooking become unnecessary, but the 130 million tonnes of firewood now being used for cooking will become available for other purposes, and in particular, as a renewable biomass fuel. Out of this 130 million tonnes of firewood, about 75 million tonnes is sufficient to completely replace (after considering efficiency losses) the 10 million tonnes of diesel now used in trucks and buses." His scenario also extends to the diesel-based irrigation pump sets (2.7 million in 1981) which are expected to number 4.4 million by 2,000. These can also be run on producer gas or methanol. By switching to this form of energy, no more electric pump sets need be installed, and the electricity thus saved, he calculates, can go towards providing power for lighting all homes.

"The new two-pronged strategy," he concludes, "shows that by the provision of electric lighting and efficient gaseous fuel to *all* homes, the country can move towards a virtually oil-free road trans-

port system along with a transition to renewable biomass resources and a dramatic improvement in the quality of life for its people. And if development is viewed as the process of satisfying basic needs (starting with the needs of the neediest), of strengthening self-reliance and of ensuring harmony with the environment, it turns out that this strategy of resolving the oil crisis also promotes genuine development of the country." Reddy's solution may appear deceptively simple and naive but in reality, such a mutli-sectoral approach calls for massive planning and co-ordination. To take only one dimension, the provision of sufficient biomass to meet the needs of a huge population will require a countrywide afforestation scheme as a matter of national priority. However, as we shall see in the final chapter, this will in turn create thousands of jobs, quite apart from enhancing the environment in incalculable ways. Reddy's strategy must not be seen as an instant solution but shows one way to a more sustained pattern of development, based mainly on renewable resources. These sketchy ideas need to be further refined. The dilemma symbolised by the choice between the smoke stacks of the Mathura refinery or the protection of the Taj ought to lead to the broader questioning of the entire policy of basing the growth of the country on expensive and exhaustible fossil fuels. As nature's treasures, buried deep in the earth, it is quite apparent these fuels should be used only very sparingly for the most vital purposes.

### **Fertiliser & biogas**

The third and final case concerns the production of fertiliser, which is closely linked to the economics of oil. As we saw in the Thal-Vaishet chapters, the real reason for the Maharashtra government's insistence on this site was its keenness that the petrochemical complex that would follow in the wake of the fertiliser plant should not be lost to Gujarat. The growth of petrochemicals and its ancillary industries could harm the environment in as much as it rapidly sets in motion the process of urbanisation, as has happened in the Thane-Belapur belt in Bombay and may well be the pattern with the Mathura refinery with the petrochemical complex at Salimpur. What is more, it is certain that the fertiliser factory will neither help local people by employing them nor even provide people of the state with fertiliser. We are concerned as much with the "development" that plants like Thal promote. Fertiliser, like oil, has attracted a

large chunk of the nation's investible funds. In 1982-83, the value of the fertiliser output was about Rs 1,950 crore—1.2 per cent of the GNP. The twin 1,350 tpd ammonia plants at Thal cost nearly Rs 1,000 crore together; so will the identical plants at Hajira (in addition, the terminal facilities there will cost Rs 750 crore). The remaining six plants were estimated to cost Rs 600 crore each in 1982; by the time funds are allocated for them in the Seventh Plan and they are all ready by 1991 at the earliest, they will cost, according to one estimate, a total of Rs 5,300 crore instead of Rs 3,600 crore. Add to this the cost of building the Rs 1,700 crore pipeline—and one gets the staggering figure of Rs 9,000 crore for all ten gas-based plants. Once again, is this huge cost worth it?

The fertiliser industry is entitled to a subsidy on the price of its product because, it claims, every tonne of actual nitrogen nutrient (equivalent to 2.2 tonnes of urea) yields ten tonnes of foodgrains. Faced with a prospect of a decline in fertiliser consumption in 1983, the government agreed in June that year to lower prices by 7.5 per cent. Since the subsidy for fertiliser in the 1983-84 budget was already Rs 800 crore, the price reduction, together with the subsidised rates for feedstock, naphtha and fuel oil offered to the industry, added up to a total handout of Rs 1,400 crore to the manufacturers that year. Urea, the most commonly used fertiliser, was thus selling for Rs 2,150 a tonne, when its actual cost of production was Rs 3,350 per tonne—a difference of Rs 1,200. According to one comparative study,<sup>33</sup> the Gujarat Narmada Fertiliser Co, a reasonably well-managed concern, invested Rs 6,500 on an average per tonne of installed capacity of urea with its 1981 fuel oil-based plant. With a total outlay of Rs 9,000 crore on ten gas-based fertiliser plants, which will together have an installed capacity of 7.5 million tonnes of urea a year, the corresponding investment by 1991 will be Rs 12,000 per tonne—or nearly twice as much! This well-documented study of the subsidy to fertiliser, published in the *Economic Times* in January 1984, challenges the conventional view that gas is a cheap source of energy and should be priced lower than other feedstocks—fuel oil or naphtha. On the contrary, it argues that “free” natural gas fields like south Bassein, which can be tapped at will, need not be exploited immediately and, instead of being flared, should replace naphtha and fuel oil in existing fertiliser plants or industries using fuel oil. To conserve oil, just like diesel can be made as expensive as gasoline for trucks, as we saw in

relation to the Mathura refinery, so too can gas be priced the same as naphtha or fuel oil, which would reduce the consumption of these products (3 million tonnes and 7 million tonnes a year respectively). Any price lower than this should be treated as a subsidy for fertiliser.

But the study goes further and questions the off-repeated claim by the fertiliser industry that one tonne of nutrient yields ten tonnes of foodgrains. It points out that the two years studied in arriving at such a conclusion were 1964-65 and 1978-79. These were both good weather years, and though the consumption of fertilisers increased from 0.8 tonnes to 5.1 million tonnes between these two points, this was also due to other factors like the extension of cultivable area, irrigation, improved agricultural practices and so on. Thus fertiliser was only a component of the total package. The case for subsidising fertiliser does not look half as strong, especially if one considers that over 90 per cent of this subsidy goes to well-to-do farmers who are the only ones who can afford it. As a matter of fact, one-quarter of the total consumption of fertilisers is for cash crops and only 10 per cent for unirrigated land, which is cultivated by marginal farmers. The study also shows that by keeping the price of fertilisers low, it discourages the use of "slow release" fertilisers which have a much higher efficiency than conventional urea. In some rain-fed areas, the loss due to leaching of the soil is as high as 60 per cent. Experts from Punjab Agricultural University and elsewhere are also coming around to the view that careless application of fertiliser is not only wasteful but can harm crops. "Cheap availability of subsidised chemical fertilisers," concludes the study, "competes with other means of improving farm productivity that are available locally, thereby taking away a number of rural jobs. Rich farmers would find it profitable to use larger quantities of subsidised fertilisers to improve yields rather than applying them more judiciously, to get the same productivity level, by adopting methods that are more labour intensive . . . The wrong impression created by understating subsidies, and grossly overstating benefits from the use of fertilisers, has influenced policy makers to give undue emphasis to ensure growth in fertiliser consumption at a tremendous cost to the nation. Production of fertilisers is highly resource-intensive. Policies should therefore be directed to ensure efficient utilisation of scarce resources." The subsidy given to fertilisers could instead be used to increase the procurement price of foodgrains, which



would place a premium on overall productivity—not on that achieved by heavy doses of just one input.

This, then, is the critique of the exaggerated importance given to the fertiliser industry, to the exclusion of other methods of improving average output per farmer—rather than per hectare of land. There is also the question of scale. We saw, in Thal, that there was the choice of going in for 900 tpd ammonia plants instead of 1,350 tpd technology, which would have to be imported. It would be naive to argue that small is invariably best in such cases, that 900 tpd plants, relying on indigenous know-how, would require less capital and employ more labour. This is a highly technical question, which depends on a number of factors—not least, the availability of feedstock. The perennial catch in the case of the west coast fertiliser plants was the waste of associated gas which was yielded when off-shore crude was brought to the surface. However, it is possible that the gas could have replaced other feedstocks in existing fertiliser plants, instead of deciding to build plants from scratch. These are all issues which are beyond the scope of this book. All that one can say is, first, that all such possibilities ought to have been looked at, and second, that it is quite conceivable that going in for the latest technology for off-shore gas specifically—only some ten 1,350 tpd plants had been constructed in the world by the late 'seventies—is quite compatible with building smaller plants elsewhere. Thus a recent study by the United Nations Industrial Development Organisation (UNIDO) reveals that mini fertiliser plants are a viable and economic alternative for most developing countries. This will utilise their raw materials and provide them with a better opportunity of enlisting domestic technical participation in manufacturing equipment and erecting the plants. It found that 150 and 250 tpd ammonia plants performed better than 900 tpd plants operating in most developing countries. UNIDO had commissioned India's public sector fertiliser consultancy unit FEDO—which was pressing the Centre not to go in for 1,350 tpd technology at the time of Thal—to prepare the basic engineering designs of a 100 tpd plant. The reason for looking for smaller technology, the study says, is the "trend towards energy saving solutions by simpler and less sophisticated technology and equipment, economic revaluation of alternative feedstocks to natural gas and the current economic and financial problems of most developing countries."

But there are alternatives to the very use of chemical fertiliser as

well. Sailen Ghosh, formerly one of the country's leading oilmen, who has turned ecologist (in 1968, he convinced P.N. Haksar, then the PM's Principal Adviser, that India could explore for oil in Bombay High on its own; he was later Director of the Bureau of Petroleum and Chemical Studies) points out that "an understanding of environmental science will free man of the craze for 'forced fertilisation' of sick soils: it will point to the need for restoration of health and replenishment of soil humus as *the* foremost and continuing task in a tropical and sub-tropical climate.\* This in itself will introduce an important change in the structure of relationships within rural society: the landowner will develop a new dependence on the landless, whose composited waste products will be a key factor to save the farmer's humus-depleted soils. . . . When the small farmer, for example, comes to know that there is more nitrogen plus the very vital micro-nutrients (1) in the cultivation of blue-green algae, ferns, composts, and (2) in intercropping with legumes (or in certain wild growths)—and when he finds the way to reducing the incidence of pests in the biological control of cropping patterns—he will be freed from the effects of cornering by the rich of the factory-produced inputs: his burden of dependence on the rich will be reduced." Presumably, the use of these "biofertilisers" will not produce food as fast as the chemical products, but they will make a farmer more self-reliant, which is a cardinal factor in development. Tropical countries like India have a disadvantage over temperate countries like China in that organic matter in the soil decomposes rapidly with heat and high bacterial activity: hence the crucial importance of replenishing this organic matter. Organic manure from animal and plant wastes serve to fertilise and soil as well improve its structure.

The question can be posed starkly, as we did in relation to Thal: two gas-based fertiliser plants, which were to originally cost around Rs 500 crore together, could have instead been scuttled to build 2,50,000 community gobar gas plants (Rs 20,000 each), or roughly one in every two villages in the entire country. Extend the argument further to all ten gas-based fertiliser plants: when they are built, along with the gas pipeline to UP, their total cost will be around Rs 10,000 crore in all probability. This could build 20 times as many

\*Ghosh compares it to making a sick woman produce babies, rather than nurse her back to general health first.

biogas plants in the country—or between eight and nine in *each and every* village! In addition to providing fertiliser, which is left as sludge after the gas is generated in the plants, they could supply energy for cooking, lighting and even for running agricultural machines, as well as small agro-industries. It would be wishful thinking to posit this as an actual alternative—50 lakh gobar community gas plants instead of ten huge fertiliser factories. The two really do different things, the conflict being that the huge chunk of resources swallowed by the “modern” sector tends to starve the “traditional” sector of funds. What it does reveal is the total neglect of other forms of producing energy in the haste to go in for the biggest technology. It does not require much sagacity to realise that the mere existence of this source of fuel in each village would transform life overnight. In Maharashtra specifically, 86 per cent of the people depend on kerosene for lighting but the per capita consumption is a meagre 17 litres per year.\* Moreover, although 65 per cent of the state’s population lives in the countryside, it consumes only 18 per cent of the power produced in the state. Of this 18 per cent, 14 per cent goes to agriculture, 2 per cent to industries and just 2 per cent to households! It is against this bleak backdrop of deprivation that the introduction of alternative technology has to be viewed. The facts tell the story: the Sixth Plan aimed at building only 100 community biogas plants; a Rs 200 crore programme to set up 3 lakh family plants in 350 districts, drawn up by the new Department of Alternate Energy at the instance of Mrs Gandhi, was shot down by a committee of Secretaries in 1984...

India has the largest cattle population in the world—an estimated 240 million animals in 1976. According to a study by the DST, these can yield 575 million tonnes of usable dung a year which, in turn, can yield about 22,400 million cubic metres of biogas—enough to meet the cooking needs of about one-third the total households in the country.<sup>34</sup> As the foodgrain crop increases, the quantity of residues left for cattle feed will increase, as will the dung. If fodder is properly used, the dung can perhaps increase by 50 per cent. This would be sufficient for 5,70,000 plants of 140 cubic metres per day—each one serving 500-600 people—and some 19

\*As former Union Planning Minister S.B. Chavan puts it, anyone would be horrified if someone set fire to a rupee note but that is precisely what is happening when crores of rupees worth of expensive imported kerosene and diesel is being inefficiently burnt!

million family size gobar gas plants of 1.68 cubic metres, at a total investment of Rs 6,600 crore. Energy analysts Jyoti and Kirit Parikh estimate<sup>35</sup> that if the current dung output doubles with an improvement in the health of cattle, and 80 per cent can be collected, 200 million well-fed animals can sustain 16 lakh community plants, sufficient to meet the needs of the projected 660 million rural people in the country by the turn of the century. The government has encouraged biogas plants since the Fourth Plan and today, there are some 1,10,000 family plants in the country. But this has necessarily restricted the benefits of this technology to the relatively rich in the villages: only one-tenth of the rural population have five or more heads of cattle which are the minimum to keep such a plant running. Once again, the contrast with China is glaring—it had some 7 million units by 1978, though the grandiose plans for 20 million by 1980 and 70 million by 1985 have been forgotten, according to Vaclav Smil, a Canadian expert in China's energy policy.<sup>36</sup> The earlier Maoist zeal—"Dung is better than dogma" was one of the Great Helmsman's famous quotes!—has plainly evaporated. In the meanwhile, the Indian government is now paying some attention to renewable energy (Rs 50 crore in the Sixth Plan) generally, and biogas specifically. It sought Rs 5,500 crore in the Seventh Plan.

Because of the problems with the skewed ownership of cattle and the fact that the rural poor cannot invest Rs 3,600 which the smallest family plant costs (China has reportedly been able to manufacture them for only Rs 500 each, but economy has been achieved at the expense of efficiency), the more sensible approach is to go in for community plants, which can serve nearly 60 families at a cost of Rs 20,000 to Rs 25,000 each. One of the first experiments with such a plant—in a village called Fateh Singh Ka Purwa in the district of Etawah in UP (one of the alternative sites proposed for the Mathura refinery)—proved a failure; a year after it was set up, villagers refused to supply dung and the gas, which had been supplied free (along with burners), was later provided only on alternate days. The more well-to-do in the village wanted it for cooking or electricity (each of the 27 households in the tiny village had been given two 40 watt lights). The poor could not understand why they had to pay for fuel, as the authorities hoped they would do in order to recover some of the costs and establish a model to be followed in other villages, when they had always obtained their cooking energy free. Indeed, by creating a new use for dung, the

poor can be deprived of this source: in Fateh Singh Ka Purwa, many reverted to burning dung and more expensive kerosene after dissonance began. This drives home two lessons: more than capital, alternative sources of energy based on biogas call for social harmony and a high degree of community discipline and organisation—human resources, in other words. Whereas this can be imposed from above, as in China, it is difficult to imagine that these alternative systems can work harmoniously in such a caste- and class-ridden society as India's. Secondly, no technology—whether it is "soft" or "alternative" or "intermediate"—is neutral in its impact on society; everything depends on the political system in which it is introduced. As long as land reforms and other methods of redistributing wealth are not introduced in the country, it is wishful thinking to assume that biogas can work.

Conflicting claims have been made regarding its advantages over the conventional power system in providing rural energy. Reddy, for instance, believes that biogas is a good source for rural electrification. In 1974, he calculated the generating cost per kWh with biogas at between 5 and 8 paise, which compared favourably with the Karnataka Electricity Board's 4 paise. Arjun Makhijani,\* co-author of *Energy And Agriculture In The Third World*,<sup>41</sup> based on his case studies in three continents funded by the Ford Foundation and published in 1975, is similarly enthused. Comparing the costs of electricity from a biogas system (actual figures from Nagaon, a UP village) with a conventional central electricity grid, he found that if half the gas was used for cooking and half to produce electricity, it cost slightly less per kWh than the conventional system. On the other hand, if the entire supply of gas was used for power, it cost only half as much. This calculation has been challenged by Tyner and Adams,<sup>42</sup> who have found (in 1977) that a centralised system can deliver power more cheaply. They make an exception in the case of isolated or hilly regions, where biogas would be preferable and note that they have not taken into account the fact that cooking with biogas is far cleaner and healthier for the housewife. Even more importantly, they admit they have not estimated the value of the fertiliser left in the slurry that the plant produces. The nitrogen content of this sludge is twice that of the original dung (volume for

\*Coincidentally, he briefly worked with a community health service a couple of years later in Dhokavade, one of the villages in Mandwa-Rewas that was originally threatened by the west coast fertiliser plant.

volume) and Reddy argues that some 26,000 community plants can produce as much fertiliser as a single \$140 million coal-based fertiliser factory. Besides, these will cost \$14 million less to build and employ 130 times as many people. Furthermore, it produces fertiliser where it consumed and therefore removes the burden on the transport system, in addition to reducing overheads on distribution.

The moral, as we saw at the very beginning of this book, is that such technology attends to problems at the very base of the social pyramid and thus improves the well-being of the poorest. It makes the villager self-dependent since he does not have to obtain energy—electricity, petroleum products or fertiliser—from outside agencies but from agriculture, to which it returns. Environment, therefore, is demonstrated to go hand in hand with development, each complementing the other. Resources are not extracted from the countryside to bring prosperity to the cities but are exploited where they are generated, without being irreversibly depleted. On the cover of his *Building A Sustainable Society*, Lester Brown carries a telling quotation: "We have not inherited the earth from our fathers; we are borrowing it from our children."





The account of what transpired in each of the three controversies in this book makes it clear that it is difficult to shake people's faith in the omnipotence of big projects as a cure-all for economic backwardness. These views were most forcefully put across in Kerala, where industrial development is seen as the only answer to the problems of large scale unemployment and the dependence on cash crops. The mystique of these huge projects is conjured up in the imagery, verbal and visual, used by their promoters—the smoke stack of the modern industrial plant signifying a new era of change, of progress amidst a sea of poverty and hopelessness. Although it does not take very long for such promise to turn to disillusionment, the power of this symbol of modernisation is all-pervasive. It takes a tragedy on the scale of Bhopal to reveal the malevolent face of modern industrial growth.

The mighty multi-purpose dam is the most telling demonstration of big technology: the ability of man to tame wild, unruly nature and turn its destructive potential to benign use—water for irrigation, power for industry. All newly independent countries in the 1950s and 1960s went in for such Goliaths: the Volta and Aswan dams in Africa, the Mekong proposal in South East Asia, and in India, Bhakra-Nangal, Damodar and Hirakud. The prototypes for these schemes were the Dnieprogres in the Soviet Union and the Tennessee Valley in the US. As the economist Sudhir Sen observes, it was "myopia and megalomania, thanks to the aggressive salesmanship of some of India's leading irrigation engineers" that were responsible for going in for these massive projects. Former Irrigation Minister K.L. Rao (and Visvesvaraya before him) was a typical exponent of this technology: it was he who first advocated linking the great rivers of the Deccan, a supreme bid to rid the country of its perennial visitations of flood and drought in one fell swoop. Considering that most of India's water supply has to be



collected in just four months of the year (during the monsoon), these huge reservoirs have undeniably aided such management.

These dams, it was believed, would harness rivers to usher in agricultural prosperity, as well as to generate electricity on an unprecedented scale. This power would in turn set in motion the wheels of heavy industry, making the nation strong and self-reliant. The whole emphasis on big industry, Soviet-style, was based on the conviction that once the basic infrastructure was established, the benefits would trickle down to the rest of society. As we have seen in the very first chapter, this has simply not happened. The economist Raj Krishna pointed out how by the turn of the century, some 470 million people will be living below the poverty line—more than the entire population when independence was declared. No amount of juggling with growth rates and other economic indices can camouflage this abysmal failure to provide this other half with even the barest means of survival.

We now take the industrial society for granted; we treat it as the ultimate national objective we must try and attain. But it is sobering to remember that as of today, only a third of all humanity enjoys the benefits of a fully technological society. What is more, as we have seen in this book, it is impossible, given the high rates of consumption of energy in the affluent West, for others to catch up with them: the rapid depletion of natural resources will see to that. However there are signs, following OPEC's intervention in the oil market, that Western countries are beginning to cut down on their prodigal consumption levels. Moreover, with the rapid spread of computerisation and high-technology communications, the very pattern of heavy industrialisation may be undergoing a gradual change, where big workplaces give way to more fragmented and dispersed ones, even in the home. Indeed, this clearly underlines both the benign as well as sinister aspect of newest (and every) technology: it can reduce the tedium of everyday work by decentralising activity or bring about an even greater centralisation of power, as we see in the nuclear industry. All those who are convinced that a modern society has to be founded on centralisation, urbanisation and high energy consumption ought to remember that it was only as late as in 1967 that oil replaced coal as the world's number one commercial fuel. For that matter, it was only in 1859 that the very first oil well was struck (in the US) and till 1850, wood provided 90 per cent of the heating in all American homes.

The figures clearly show the futility of expecting industrial growth to take care of employment in Third World countries like India or China. Developing countries as a whole have been growing faster—5 per cent per year through the late 'fifties and 'sixties—than their Atlantic counterparts at a roughly comparable period in the early 19th century (3 per cent). And yet in India in 1978, nearly 21 million people were unemployed—over 16 million in the countryside and a quarter as many in the cities. At that stage, six million more workers were entering the labour force yearly but both the public and private sector could only absorb about half a million a year. The country's total labour force is likely to grow from 225 million in 1975 to 400 million by the turn of the century, but industrial employment, growing at roughly 5 per cent per year, could at most give between 25 and 30 million people jobs by 2,000, leaving the vast majority idle. There is just no way that big industry can provide people in poor countries with the means to live a better life. The total labour force in the organised sector is only around 23 million today. The function of big industry should be seen as entirely different: to make available certain key inputs for the "modern" sector of the economy to expand.

People are drawn by the lure of the modern industrial sector from the countryside to the cities in search of largely illusory jobs. The growing number of unemployed migrants in slums is the direct outcome of the inability of the industrial sector to provide work for all those who seek it. Industrialisation has been proceeding, cheek by jowl, with a dizzy rate of urbanisation. Barbara Ward mentions how there were only 11 cities with over a million people in 1900, six of which were in Europe. By 1950, there were 75, with one-third in developing countries. By 1985, the total number was estimated to go up to 273 with nearly half in what is politely dubbed as the "South". By that time, of some 17 cities with over 10 million people each, 10 may be in the Third World. "Yet by the end of the century," she warns, "about half the world will be urban, more than half will be living in the developing lands—and perhaps nearly half of that half will be either unemployed or unable to earn enough to live on." Not very many people realise that the number of urban Indians is already a colossal 156 million—more than two-thirds of the total population of the US! What is more, the living conditions of the lower half in the big cities are truly wretched, as anyone who has visited Bombay or Calcutta will readily testify. Although urban

subsistence affords an escape from starvation in the countryside, this is about the worst environmental degradation that a human being can possibly be exposed to. And yet many so-called environmentalists not only ignore their existence but actually strengthen the arm of the authorities who attempt periodically, and unsuccessfully, to evict slumdweller from the city. Some idea of the contrast between town and countryside can be gleaned from the fact that while 34 per cent of the families in the country as a whole lived in one room a decade ago, 44 per cent of urban families had to suffer this indignity and the percentage went up to 67 per cent in the four largest cities, leaving uncounted the pavement dwellers. Ward describes Kanpur, with its long-established textile industry, as very much resembling Manchester a century ago, except that "it is already six times the size and the effluents of industry are estimated to equal those of another whole city of 1.5 millions." The prospect of rapid urbanisation is something those who live in the vicinity of the Thal-Vaishet fertiliser plant and Mathura refinery can hardly look forward to with equanimity.

When Bombay graduates in a few years to a city with more than 10 million beleaguered inhabitants, anyone who records its immediate history cannot fail to document how the fertiliser factory, along with the petrochemical complex, set in train another big industrial spurt, this time on the mainland itself. This investment will have drawn to itself yet more thousands of people dispossessed of their homes in the countryside, even from outside Maharashtra. This "iron hand" of industrialisation is all too painfully obvious: the cities are attracting, as a magnet does to filings, all the nation's resources, leaving rural areas totally devoid of any development. The cruel contrast between town and countryside is as strong indictment as any of the preoccupation with industrial growth. It is not that "agriculture" has been neglected—the amount of petroleum products and electricity that the Green Revolution areas have received, together with the deployment of farm machines and implements, show that it is both energy- and capital-intensive in certain privileged sectors. High-yielding varieties now cover 80 per cent of the area devoted to wheat and 56 per cent of rice. But it is the overall lack of agricultural productivity which, as we saw in the introduction to the book, is responsible for producing less than 2 tonnes of food from each hectare of irrigated land as against a norm of at least 4 tonnes.<sup>1</sup> Thus an improvement in

technological inputs in the countryside, coupled with social reforms, would enable the bottom half of the social pyramid to escape from the clutches of poverty. Till now, all the emphasis in agriculture has been on irrigated areas, to the neglect of dryland farming where the ecological balance is very sensitive and has to be carefully handled. High-yielding varieties, after all, occupy a third of the cultivable area, leaving as much as two-thirds to rain-fed crops.

### Soil, water, wood

It does not require much economic sophistication to realise that rural India needs to be given a fresh infusion of blood; by the end of the century, which is only 15 years away, something like 100 million jobs will have to be created in the villages. Only labour-intensive technology and proper use of agricultural land can put to productive use the entire pool of available labour. This is necessarily not only to provide employment but also for a larger and more sustainable product. This in fact is what is summed up in the catch-all term "development". An enlightened environmentalist would cite the husbanding of three resources which would make such a transformation come about: soil, water and wood. Take soil first. It is now well understood that entire civilisations—Mesopotamian, Roman, Mayan, Indus Valley—crumbled because of the environmental degradation of the soil, which could no longer sustain these expanding societies. Closer home, the most inhospitable part of the country—the Rajasthan desert—was once fully forested till increased cultivation of marginal lands led to overgrazing and cutting of trees on the remaining lands. "Northwestern India is the world's most densely populated arid zone," observes Erik Eckholm in *Losing Ground*<sup>2</sup>—and he adds: "a distinction that may turn out to be an epitaph." There is a dispute among experts as to how fast the Thar desert is now spreading. Although topographical studies in 1952 by the Planning Commission showed it had been advancing at the rate of half a mile (0.8 km) a year for the last 50 years, subsequent findings of the Central Arid Zone Research Institute were less alarming. "At least part of the discrepancy between this recent conclusion and the continuing assertion by other authorities that the desert is indeed expanding may well be due to definitional differences—what, after all, constitutes the spread of a desert amid a rather desolate landscape?" asks Eckholm pointedly. "There is no question that thousands of acres of arable land are lost to cultivation

each year, and all parties agree that the productivity of an arid area covering more than a fifth of India, an area larger than France, is being seriously impaired. After several decades of accelerating deforestation and chronic overgrazing, much of western and central India is assuming the appearance of a lunar landscape." In the book, *Careless Technology*, Reid Bryson of the University of Wisconsin reveals from his studies of the desertification of north western India that the pall of dust (which among other things contributes to the "pitting" of monuments like the Taj Mahal) also lowers the precipitation of rainfall over the entire area, thereby creating a vicious circle of aridness and drought.

Considering it takes generations to create an inch of precious topsoil, the importance to the country of protecting land from erosion can hardly be over-stressed. And this brings us to the second resource which should be conserved and properly managed. Water, fortunately, is not in short supply in absolute terms in most parts of the country. Fed by the melting snows of the Himalayas and the heavy monsoon rains, the average annual runoff of the Ganga is nearly 500 cubic km (80 per cent of which now flows into the sea). On average, the runoff from the Brahmaputra is even larger. As Barbara Ward points out, "only the Amazon and the Congo boast larger discharges of water than the Ganges-Brahmaputra system. The trouble lies in the enormous irregularity of the water's flow and the long months—after the monsoon and before the spring melting in the mountains—when the rivers' reliable supplies can fall to the danger point. With a failed monsoon, disaster is certain." As the first chapter stated, the Himalayas are the nerve centre not just for India but surrounding countries and the Indo-Gangetic plain; if environmentally protected and nourished, it could feed many more millions of people. This calls for proper management of the catchment areas of the great rivers, through big schemes as well as small. The hydel potential of the country, now only 40 per cent of which is tapped, can also be fully exploited. After all, as much as 70 per cent of the world's hydropower lies in the South, and most of it is simply going waste. The tiny Himalayan kingdom of Nepal, if it is able to harness its "falling water" potential, can provide three times as much power from this renewable source as India and thus become the "Switzerland of Asia", selling electricity to its neighbours. Of course, if hydel power is generated through big dams, the consequences may be disastrous. In the downstream areas, in addition to

irrigation works, underground reservoirs or aquifers are nature's way of providing a source of water which can be drawn upon (with renewable energy) whenever necessary and replenished during the next monsoon.

The third key factor, and one which has a crucial bearing on the conservation of soil and water, is afforestation. It is important to remember that with all the technology in the world, not more than one-tenth of the rainwater which falls in the mountain catchment areas can be stored there. The large scale planting of trees in these areas would catch and store water and release it in manageable amounts, as well as prevent the soil from turning into silt. An ardent advocate of forestry, the Bombay industrial executive, Shankar Ranganathan, calculates<sup>3</sup> that the insurance cover provided by forests against floods is of the order of Rs 40,000 crore—equivalent to what would have to be spent on dams to store as much water; similarly, they provide Rs 30,000 crore worth of protection to soil—equal to 20 times the annual saving on Rs 1,500 crore worth of crops and nutrients lost. Their value as a "factory", producing fuelwood and timber, he places at Rs 45,000 crore. The following table summarises this:

#### WHAT FORESTS ARE WORTH

	Rs crore
1. Insurance against floods:	40,000
2. Protection to soil:	30,000
3. "Factory" producing fuel and firewood:	45,000
<b>Total</b>	<b>Rs 115,000</b>

Even if his figures are somewhat questionable, it is difficult to disagree with his assertion that "If Rs 20,000 to Rs 30,000 crore were spent annually on reforestation, construction of percolation tanks, canals, drainage, ditches and the like, it would be possible not only to quadruple our food production but also to employ 30 to 40 million people to do this work. Their increased purchasing power would create a vast market for food, fuel and other commodities which industries supply. Reforestation would create more wealth than any industry and do it faster." Ranganathan, in fact, contrasts the investment in a Rs 200 crore petrochemical plant with the much more widespread benefits of spending the total sum on fuelwood plantations instead.

Singly, it does seem evident that growing trees can provide a number of solutions to the country's most pressing problems. This is

already happening in a small way—witness the fiery debate over whether eucalyptus is ecologically and economically disastrous and the enthusiasm for *leucaena* or subabul. But the bulk of tree-planting, public (by forest departments) and private (even by small farmers), is to meet the insatiable demand for firewood in the cities or for pulp needed by industries. Truly “social” forestry schemes are conspicuous by their absence. A family of five, with a fuelwood demand of a little over 1 tonne a year (assuming that one-fifth of its energy needs are met by farm wastes) can grow 50 trees and harvest ten of these on a five-year rotation. Even a small farmer can conveniently grow a sufficient number of trees to meet the family’s fuelwood requirements. A rough estimate reveals that nearly 100 million tonnes of wood could be produced in this manner, by opening up between 2 and 5 per cent of agricultural land. There would be no loss of farm production because the manure saved as fuel would boost productivity. Once again, like biogas, the requirements for such a programme are technical and institutional, more than financial. Barren wastelands, some 80 million hectares in the country, can be forested, as well as degraded forest lands, amounting to a colossal “greening” of India. China has planted more trees in the last 30 years than in its entire history: it has *forested* 70 million hectares between 1950 and 1970, very nearly equal to the total officially declared forest area of 75 million hectares existing in India (which, everyone knows, is actually far smaller). “Money does grow on trees!” as Ranganathan puts it. Anyone who has doubts about the viability of such “tree technology” has only to pay a visit to Auroville, south of Madras, where Westerners, attempting to create a Utopian society, have planted an immense number and variety of trees which serve multiple purposes.

Soil, water, wood—these in essence provide the blueprint for an entire rural regeneration. Lest this be seen as a romantic and naive solution, it is necessary to point out that in reality, it is far more difficult to organise schemes which reach the smallest farmer than to go in for big technology. Nurturing trees is not a one-time or clearly defined technological task like building a dam or putting up a chemical fertiliser plant: it calls for constant care and, above all, the active involvement of the community, without which the best of intentions can fail. It is one thing to plant trees, as so many ministers do symbolically every *vanmahotsav*, but quite another to ensure that they grow to maturity. The seedlings tended by Chipko

volunteers or by Harivallabh Parikh's Anandniketan Ashram, a Gandhian institution in Gujarat, alone have a 90 per cent survival. Once the productivity of each cultivator is raised in this manner, not only will food production rise dramatically but so will the entire quality of life. Ecological enhancement will reinforce developmental change—the classic example being the huge increment in energy from biogas plants, induced by an increase in the output of foodgrains, the waste from which is consumed by cattle. This process, significantly, is by no means at cross purposes with industrial advance, but in fact can go in tandem with it. Makhijani (see previous chapter) refers to how an alternative scheme for rural development in the Fifth Plan (1974-79) could concentrate on such labour-intensive occupations as land reclamation, minor irrigation, soil conservation and road construction, at a total cost of \$2 billion, of which \$240 million could be provided in the form of food for work. According to him, this could have created some 6 million man-years of employment during the Plan, a number of permanent jobs in the countryside and boost food output sizably. Once rural incomes rise, there will automatically be a greater demand for steel implements, fertiliser and an entire spectrum of goods which industry can provide. In fact, Indian industrialists are constricted today by what is euphemistically known as the "size of the market"—in other words, even in the cities, only a small proportion of inhabitants can afford their products. In the final analysis, the prosperity of industry is inextricably linked to the well-being of people in the countryside. The failure of the monsoon brings on an industrial recession. Raj Krishna estimated that the rate of growth in agriculture induces an equal rate of growth in the non-farming sector: Punjab, which grew between 15 and 20 per cent per annum in the golden years of the Green Revolution from 1966 to 1970, saw a sudden spurt in purchases of tractors, pump sets and so on.\*

Development from below, instead of being imposed from above, will tend to do away with many of the invidious distinctions in life styles between city and countryside. Just the conservation of energy

\*The industrial economies of the West seem to have a shrewder realisation that their salvation in the long run depends on penetrating the markets of Third World agrarian giants like China and India. John F. Kennedy, in his famous inaugural speech, saw it clearly when he said: "If we cannot help the many who are poor, we cannot save the few that are rich."



by preventing the unnecessary cross-haulage of human and material resources between the towns and villages will by itself be tremendous. There would no longer be any need for a few millions to live in the most dehumanising environment in hovels in cities. Investment in the countryside would reap far bigger benefits than in huge industrial projects. The FAO recognises that spending on rural needs can increase job creation three or four times. The alternate pattern of decentralised development, mooted for Kerala by the Centre for Development Studies, envisages that the expenditure of just Rs 1 crore can generate 4,000 jobs. Think of the total spent on the three projects, and ancillary industries, cited in this book. What is more, industry could also be planned on an entirely different pattern and scattered in each state, without being concentrated in one major belt, like Alwaye-Cochin is in Kerala today. The Bombay-Pune industrial belt, for that matter, is even more iniquitous, considering that it is by far the largest in the country and located in a state which is regularly visited by drought and hunger (in March 1984, Ratnagiri was sought to be declared one such district in distress).

### China's experience

Small is possible, as China's experience shows. Describing it as one of the world's most comprehensive ventures in rural renewal, Ward writes: "the 'big industry first' of Soviet planning was put aside. The key elements—more direct investment in the farm sector, more investment in nonfarm activities in the countryside—became the accepted policy of the 'sixties ... this pattern was reinforced by new investment and new technology in the shape of new seeds, some new fertiliser, new emphasis on fisheries and animal husbandry, and small-scale mechanisation, with tools often manufactured in village workshops. These local advances were combined with systematic reafforestation, a very large extension of flood-control works, and irrigation, with hydroelectricity at every suitable site—not necessarily the big sites but even convenient points among the rivers' fall which could accommodate small generators." It is useful to recall that in the 1950s (till 1958, to be precise), China also wanted to traverse the Russian route through heavy industrialisation. As much as 90 per cent of the country's industrial investment was devoted to iron and steel, cement, electricity, petroleum and the chemical and engineering industries.

Now the wheel seems to have come full circle, with China in the post-Mao phase going in for big technology with a vengeance, with consequences which may well reverse the strides it has made in promoting social justice. But one must bear in mind that it is doing this *after* providing its people with a minimum standard of living. Under Deng Xiaoping's direction, the "leg" of Western-style modernisation is being emphasised only because the other leg has already made purposeful strides ahead.

China is by no means the only country to have demonstrated that small is workable. The intensive cultivation patterns of Japan, South Korea and Taiwan are another striking example. South Korea, in particular, has achieved remarkable success in its afforestation drive. In India, as we saw in relation to intermediate technology, only faltering steps have been taken. Small units have proved viable in such industries as leather, cement, paper and pottery. Mini-sugar mills which process only one-twentieth of the output of big factories but cost only one-fiftieth as much are now located all over the country and produce a fifth of the sugar. The know-how for these mills is in fact being exported to Pakistan, Nepal and Sri Lanka. The potential, even within the existing political system, for turning to small technology is tremendous. George Fernandes, as the Janata Party's Industries Minister, pointed out how only three firms manufactured most of the nation's soap, whereas 500 smaller companies could do this at a fraction of the cost per workplace. The situation regarding matches is even more enlightening: WIMCO, a Swedish multinational, produced a third of the total output while employing only 15,000 people, while cottage units employ as many as 5 million. To counter any scepticism about the economics of such small scale production, one should realise that other multinationals operating in India in fact do employ small units in far-flung locations (to avoid labour problems, among other reasons). Thus Philips has set up nearly 600 small suppliers of electrical and electronic equipment, who rely on the company for no more than 30 to 40 per cent of their orders. Bata, likewise, farms out work to hundreds of cottage cobblers and merely markets the shoes they produce. Another country which has tried, albeit with not too much success, to give small industries priority, is Tanzania, with its Ujamaa programme. Sri Lanka has encouraged such units on a modest scale as well.

It would be a grave mistake, however, to make a fetish of small

scale technology. It is not necessarily always beautiful: it all depends what it is used for, by whom and for whom. Take the case of rural electrification (though, admittedly, it does not constitute small technology unless it is based on renewable energy). Most energy experts agree that it is desirable but, as things are, who will benefit from the country's schemes to electrify villages from a central grid? As we saw, although 57 per cent of all the villages in the country have been connected to a grid, only 14 per cent of households have power connections because the rest simply cannot afford them. What is more, studies have shown that once the needs of the rural rich are met in the first ten years of electrification (for pump sets, domestic use and so on), the demand begins to drop; at this stage, only one-fifth of the homes in the typical electrified village have power. It may make more sense, therefore, to talk of rural *energification*, rather than electrification alone, especially that based on power from a central grid. Again, small dams may be even more susceptible to floods and drought: Vaclav Smil, who has also edited a book<sup>4</sup> titled *Energy In The Developing World* (1980), warns that severe floods, such as those which swept India in 1978, may simply sweep away earth-fill dams built to impound water for small scale generation, just as prolonged drought in 1975 affected China's small hydrostations, which is why it is now hastening the construction of large dams capable of storing large volumes of water.\*

We have already dealt with the problems of introducing biogas plants in a country like India where one-third of the rural population is landless and social discipline lacking. In China itself, the enthusiasm for these digesters appears to be waning; many of the hastily built pits turned out to be a waste of labour and money. According to Smil, at least 15 per cent of the 7 million plants built by 1978 have since been abandoned.\*\*

\*Sailen Ghosh, however, also points out that large dams can *contribute* to floods in tropical countries like India, as they allegedly did in 1978. "When there is a reservoir for irrigation and flood control," he says, "the tendency is to store more water for irrigation. When there is a sudden heavy downpour, the authorities release water to prevent a dam burst. Thus the release of water takes place precisely at a moment when the countryside can least afford it. Moreover, those who see virtue in building a series of small dams will also undertake afforestation on a large scale. The forests will store water underground through the roots of trees. Village forests will thus nourish agriculture too."

\*\*Once again, Ghosh disagrees with critics like Smil. "If in China, the enthusiasm for biogas is waning," he states, "it is because biogas does not fit in with a drive for

But Smil's main criticism is against the "sweeping generalities" about solving the energy problems of Third World countries by biomass. It can meet the needs of the subsistence economy but not that of the cash economy. He points out that the most densely populated regions of the developing world—apart from tracts of China, they are UP, Bihar and West Bengal—have been "deforested for centuries" and large areas have been stripped of their primary growth, while tropical forests have receded more than 40 per cent from their climax area. In India, there are no more than 0.13 hectares of forest land per capita; in China only 0.11, much of it just low-productive secondary regrowth. The tropical forests cannot be planted with fast-growing species with short rotations because their fragile eco-system does not permit such energy plantations. Brazil, for instance, would have to devote one-fifth of its fertile land to sugar cane to produce all the "gasohol" it needs to do away with oil imports. In the deforested areas, on the other hand, the only relatively abundant biomass comes from agricultural wastes. "All of these by-products already have a wide variety of *indispensable* uses," Smil stresses. "Fodder crops are virtually nonexistent in the crowded lowlands where grazing is severely restricted and most of the draft animals, the principal source of motive power, subsists on these by-products. In China and India, nearly three-quarters of all harvested straws, stalks and leaves are used as animal feed and bedding." Growing crops for energy, like Brazil is doing with gasohol, will mean that there will be less land for food: the average holding in India is half a hectare only. In the raging debate over whether to plant the fast-growing eucalyptus in states like Karnataka, it has been pointed out that this will shrink the area under ragi—a poor man's cereal. Smil concludes that the only form of biomass conversion that can provide a steady supply of flexible and clean fuel for households and farms is biogas, and this too has its limitations. However, it is clear that in any country like India where at least half the population is poor, biomass and renewable forms of energy should to be given urgent priority to meet basic needs.

all-round 'modernisation'. When the idea of centrally generated power is buttressed in modernisation programmes, the interest in biogas is bound to decline. That decline is no indication of the earlier waste of time and money. Any 'hastily built pit' is a product of slipshod work: it does not prove that the biogas approach was inherently inferior."

Small scale renewable energy systems, according to Smil, cannot produce two critical inputs of modern economic growth—chemical fertilisers and steel. “Just to maintain current—in most cases inadequate—diets, all developing nations require substantially higher applications of synthetic fertilisers. The need for additional nutrients cannot be filled by cultivating nitrogen-fixing crops and ‘green manure’ plants. Nitrogenous fertilisers are needed in the largest quantities but there is no commercial technology that can synthesise ammonia without fossil feedstocks. Natural gas is, of course, the most suitable input, and as its exploration and transportation are relatively costly it makes good sense to use it not just as a chemical feedstock but also as an efficient and clean fuel for appropriate industrial applications. Many developing nations with a good potential for significant natural gas discoveries should thus proceed to secure this excellent resource which offers a combination of quality and utility that none of today’s renewable soft technologies can claim.” The uses of steel for a wide range of agricultural and domestic implements are obvious and though India, among other developing countries, uses charcoal for part of its commercial pig iron production, the environmental costs are tremendous.

Smil thus makes a convincing case for not treating “small as a pure knight coming to slay the evil dragon of bigness and to usher in beauty.” The reality, he believes, is somewhat more prosaic. “Just as there is hardly anything inherently superior about large scale energy extraction, transportation and conversion, so there are very few clear-cut, undisputed advantages to small scale processes. To anyone familiar with energy—and energy-related—technologies, both approaches have advantages and serious drawbacks. To judge the merit of a technology solely by its scale is neither rational or useful. The need for a much greater diffusion of a variety of small scale and relatively simple technologies throughout the rural areas of the developing world is indisputable. Yet it is necessary to stress that such technologies are often inefficient, highly energy-intensive and costly, and that better results can be achieved by opting for modern large scale processes.” He cites how the Chinese, “the world’s greatest practitioners of frugal smallness”, have discovered that small is useful but *small is not enough* and calculates that by producing three key inputs through big projects—steel, electricity and nitrogen fertilisers—rather than through small rural establish-

ments, the country would save by 1985 about 100 million tonnes of coal-equivalent energy per year. "China may be self-sufficient in energy, but it is a crippling self-sufficiency whereby at least a quarter of the country's productive capacity stands idle owing to the chronic energy shortages, where fuel and electricity are strictly rationed and grossly wasted at the same time—and where the output of coal and crude oil will not go up (in 1981) for the third consecutive year."

### **No magic wand**

This should remove any illusions about the magic wand of alternative technology. There are no easy answers, "soft" or "hard". Like China, India has to learn to walk on both legs—till now, it has leaned far too heavily on that of heavy industrial growth, with all its attendant dilemmas. To an extent, this is a technical question—concerning the use of resources, transport requirements, energy consumption and so on. But to a much larger extent, the whole issue is one of equity as much as of environment or development. Dickson puts it in a nutshell: "An alternative technology can only be successfully applied on a large scale once an alternative form of society has been created. The task of doing this a political, rather than a technological one." Reddy, summing up his biomass-based strategy for solving the oil crisis, emphasises that "as in the case of economic growth, energy planning is meaningless unless one asks: 'energy for whom?' and 'energy for what?' In the case of India, it appears that the country has been engulfed by a grave oil crisis because it has ignored two crucial basic needs of poor households: efficient energy sources of lighting and for cooking. Energy is for satisfying the basic needs of people, and the most important guideline seems to be: Look after the people, and the energy will look after itself." A look at Brazil, another Third World giant, is revealing.<sup>5</sup> Between 1960 and 1970, its economy grew rapidly, but the richest 10 per cent of the people took nearly half the national income, while the share of the remaining 90 per cent actually declined during this decade. This export-led "Brazilian model" was once held up for India to emulate. Its environment has also taken a heavy beating, with grandiose schemes to cultivate and industrialise the Amazon forests turning to dust. Its lesson is: neither environment or development...

Ecology, as we saw, always looks to the inter-connectedness of

things and one can invert Reddy's last statement and say with equal conviction, "Look after energy, and the problem of too many people will look after itself." Just as this book has sought to demolish the myth that the environment is a resource than can be sacrificed in the interest of "development", so too does the notion that rising populations are the basic cause of the degradation of the environment deserve to be attacked. Robert McNamara, former President of the World Bank, once made a comparison which characterises this "population bomb" paranoia when he stated that the cost of bringing up a child in the Third World was \$600, but that of preventing it from being born thorough contraception was only \$6. The implication is clear: populations act as a brake on progress—it is cheaper to prevent a child from being born than to feed it. High population growth rates do cause tremendous strain on resources, but this is the *effect*, rather than the cause of poverty. We quoted the slogan raised at the UN population conference in the introductory chapter: "Development is the best contraceptive." Demographers throughout the world are pointing to the experience of Kerala (and Sri Lanka), where despite no economic growth (in fact, high unemployment), birth rates have begun to fall, because of the extraordinarily high degree of social progress registered by the people. It is not only higher money income which cause people to stop having more children but development in the true sense—availability of food and energy, education (specially of women) literacy, health and political consciousness. Thus the average age of marriage has begun to rise in Kerala because of the push from below—rather than by enforcement by law as the Central government has been trying to do with no success for some years. This multi-faceted social progress has done more to lower the birth rate than all the contraceptive methods put together. And yet the funds allocated to education and health—Rs 2,500 crore and Rs 1,800 crore respectively in the Sixth Plan—are minuscule compared with big industrial projects. In Kerala, half the state budget goes to education and only 8 per cent to industry.

Any attempt to force solutions on an unwilling people—whether it is in the form of economic growth imposed from above or compulsory family planning—is doomed to failure because it does not recognise that in the ultimate analysis, it is people who are the instruments of development, as well as its beneficiaries. Look after their needs, and the "population bomb" will defuse itself. All over

the West, governments are beginning to worry about exactly the converse: they have already reached "zero population growth", which means that there will not be enough children born in the future to keep these societies functioning as they have been accustomed to. In prospering Third World countries like South Korea and Taiwan, experts talk of the success of family planning without realising that it is the consequence of social change as much as of economic growth. One statistic sums up the situation in this country. It was calculated, a decade ago, that for an Indian male child to survive till adulthood (allowing both for sex ratios as well as child mortality), an average family would have to have six children. This is the stark reality which works against the family planning programme. With better health facilities, together with which family planning should certainly be offered, and an overall improvement in the quality of life, parents would be guaranteed that their children would survive and would not produce so many. Unfortunately, many so-called environmentalists, who argue with a great deal of passion for the preservation of natural resources, see nothing contradictory in advocating birth control without seeing that the root cause is underdevelopment. A holistic approach, which is the distinguishing feature of the science of ecology, would demand a much greater humanism, a recognition that human beings are central to the whole process. One reiterates what the head of the Chinese delegation told the UN environment conference at Stockholm: "We hold that of all things in the world, people are the most precious."

To recapitulate the broad conclusions of this book, therefore, the unquestioned faith in existing technologies—"the temples of today"—is misplaced and often counter-productive—hence "tombs". There is no conflict between environment and development, provided we redefine development to mean looking after the needs of the poorest in society. Thus development implies the management of natural resources for improving the living standards of the majority of the people and once this is accepted, issues like providing more energy or plant nutrients are seen in the proper perspective. The provision of more energy or plant nutrients does not in itself constitute an improvement in living standards: it may work out to an impoverishment instead. Once we redefine development, we must look to finding alternative ways of producing energy and plant nutrients. Till now, all the emphasis in the country has



been placed on big industry, the modern industrial sector: it is time that small, decentralised systems were also examined. The three milestone cases in this book pose these crucial questions.



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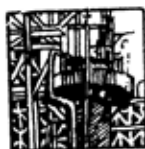
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