Evaluating Large Dams in India

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Three positions may be identified in the debate around large dams in India: one, that the huge social costs are paid by one section while the benefits accrue to others; two, that while the concept of large dams is acceptable, there ought to be proper treatment meted out to the environment; three, that there is nothing wrong with big dams. This paper examines these three positions using cost-benefit methodology but including environmental and social implications and touches upon 'alternatives' to big dams.

Introduction

The debate on large dams in India is organised around the following positions. There are some who totally oppose big dams on the grounds of their not delivering the results that they are claimed to, and more, the social costs paid by certain sections are huge while the benefits accrue to others. There are others who agree to the concept of big dams but want proper treatment metted to the environment—efficient planning and proper rehabilitation while another category is happy with the *status quo* and favour big dams as they exist without question.

In this paper we examine these three positions using the cost-benefit (CB) methodology. However, we will develop it further than the existing narrow CB analysis of large dams in India to include environmental and social implications. We will use techniques of 'resource accounting', 'energy accounting' and 'environmental impact assessment' while dealing with the environmental section. Social issues will be examined from a developing country perspective where the state is supposed to play a crucial role in the alleviation of poverty and redistribution of assets. As such, certain weightages and handicaps will be provided to benefits through large dams as it affects various sections of the society.

At the outset we dig into the archives for a historical approach to the origin and growth of the technology of large dams. As such an analysis could be central to the understanding of large dams. It is outside the purview of this paper to do a CB analysis of all other forms of irrigation, however for a comparative assessment we briefly touch upon the performance of other forms of irrigation under the section entitled 'alternatives'.

Irrigation Science vs Civil Engineering

The British colonisers knew very little about irrigation, compared to the Indians, [Cotton 1874]. Initially irrigation under the British rule was low priority. As a result irrigation systems deteriorated and some crumbled. It was later that they started paying attention to irrigation. However their attention replaced irrigational science by civil engineering.

> The...revenue officials... (were) of no help to the maintenance works and the revenue spent under this head was wasted. Therefore, expertise was sought in this area.

The civil engineers of the army were the only ones who could have been called experts in this area, though with a great stretch of imagination. Thus, a civil engineer was appointed as superintendent of tank repair early in the nineteenth century, which was the first modern irrigation office created. Circumstances thus made irrigation science a subject of civil engineering from which state it has not been able to recuperate properly to this date. The exaggerated emphasis on civil engineering at the cost of environmental balance, efficient crop practice and local management, as found in modern irrigation development programmes, thus arises from a historical coincidence [Sengupta 1985].

As Mankodi [1985] points out, commercialisation of irrigation followed immediately thereafter:

> ...the Company spent modest amounts on their repair and derived a more than handsome profit in terms of revenue earned from irrigation and irrigated land, milling, watering cattle, transporting timber, selling produce that grew in canal sides and from fines collected on breach of canal regulations. The revenue from the West Jamuna canal which was about Rs 15,000 in 1820 expanded to Rs 4.2 million only 25 years later. In Madras Presidency, the reconstruction of ancient irrigation works brought phenomenally high profits, and some irrigation works were reportedly earning a net annual income of 730 per cent after paying a 4 per cent interest on capital.

These enormous profits saw the restoration of irrigation systems. Mankodi points that initially the irrigation works were maintained by the East India Company. However, soon joint stock company type of management was brought in by 1880 where the superintendent was the director and the 'zamindars' (landlords) the shareholders, and they paid for the irrigation works. Mankodi continues:

> The real and professed reason that the Company favoured the extension of irrigation was not because it protected the public from famines, but because the revenue from irrigation invariably skyrocketed during famines and also the presence of irrigation made wasteful expenditure on relief and welfare measures unnecessary to the penny pinching company.

A brief experiment was made to attract private companies to finance irrigation works. However, the state soon reverted to the old policy of state monopoly on irrigation as private investors were ready for the profits but not ready to share the loss, where the increased revenue did not offset the cost of providing relief during famines. It was also realised that restoration was profitable but making new projects was not. Hence a gradual shift took place in investment, from irrigation to railways in the British Indian economy.

The shift from irrigation science to civil engineering is crucial and can be called an epistemological break. We have discussed above the economic reason for this break, we would discuss its characteristics below.

Civil engineering irrigation is Weberian with strong military features as it was an offshoot of military engineering works. It is Euro-centric, characterised with traits of 'mastering' nature. Being colonial it was cut off from traditional irrigation systems, but did not inherit much from the British irrigation as they were not dependent on irrigation for agriculture. Indian traditions were regarded as backward, hence little effort was made to learn from them. As it was primarily oriented towards revenue generation, bureaucratic and technical mechanisms which supported the efficient collection of revenue were applied. Hence it disregarded social networks among the farmers. As Tamaki [1977] discusses, it is the users and the water management technique which are the *main* systems. The concrete structures, innumerable canals, technological complexities and the involvement of experts are mere *sub-systems*. In civil engineering the sub-system is characteristically overdeveloped. There was little or no appreciation for the management needs of the farmers. It was clear that irrigation was seen as an end rather than as a hand-maiden of agricultural development.

Ownership of land puts one in the privileged group, however civil engineering further introduced inequalities in the ownership of land in the command area. Sengupta, Walter [1980], Coward [1979], Sly [1982] and Hulapea [1979] point out how in the traditional systems, the landholders owned patches of land all over the command area and not only near the main outlet. Traditions necessitated approval of every person before new varities of crop could be introduced in the command area. Sengupta points out,

> Although land is owned privately, its use cannot be determined independently by individuals...(There are) social restrictions on unhindered use of private property... (for) better use of natural resources.

These institutions have broken up with the introduction of large scale canal irrigation as the community does not have a role in deciding upon the positioning of the canals. It is isolated individuals with power who managed to divert the resources.

Later day requirements of electricity by the industry further alienated civil engineering from irrigation science. Now larger reservoirs were needed, hence more submergence of fertile land, forests and unprecedented displacement. Power generation too has become an end in itself where the lives of people living downstream is threatened to meet power requirements (see page 28). The technology of irrigation science was tested over time and its survival was a result of a dialectical process where ecologically unsound techniques were dropped. In demonstrating lack of understanding of traditions and not reacting to protests aimed at inefficient construction of canals [Whitcombe 1971, 1982] and kilometres long embankments [Wilocks 1930] civil engineering made it characteristic of itself to disregard environmental questions.

The growth of the civil engineering aspect in Indian irrigation has since been widespread. What we have today is an ideology marketed by the state apparatus that dams, the larger the better, are a must for any modern irrigation. An efficient irrigation system is certainly a prerequisite for a strong agricultural base, but not the belief that irrigation through large dams is synonymous with good irrigation.

As it has never been questioned whether irrigation and power generation through the technology of large dams is appropriate, we find serious shortcomings in the planning process. It is an agreed philosophy that all river valley systems in the country have to be tapped, dam sites are chosen taking into consideration the technological and geographical aspects. It is after this process, that irrigation and power generation factors are taken into account.

The tabulation of benefits from irrigation and power provides the necessary credence to the project. The Planning Commission calls for a calculation of benefit-cost (BC) ratio and it stipulates a minimum ratio of 1:1.5. Till some time back, the figures provided by the project authorities was taken for granted. With the controversy of dams hotting up, attempts are made to scrutinise these figures and various discrepancies have emerged. As Paranjpye demonstrates in his studies on the Bedthi [1981], Tehri [1988] and Narmada [1989] projects, the project authorities indulge in various manipulations of the figures to meet the requirements of the Planning Commission. See government and private estimates in Table 1. His calculations have deliberately been conservative and the social and environmental costs not taken into account. The Planning Commission procedures for weightages and handicaps on the BC ratio as it affects the various sections of the society has not been accounted either. There are times when the Planning Commission has taken a tough stand on the BC ratio of certain dams. However, it is easier to accept the project officials' figures than seek other evaluations. The irrigation bureaucracy is large and powerful, not allowing others to enter its preserve. At times construction work on the dam starts before the central authorities have cleared it, and then it is argued that as a considerable amount of money has been spent, it would be ridiculous to drop it at that stage. See Table 2 for a few cases where construction has begun before clearance.

Believing that big projects are the best form of investment for irrigation, the authorities go to every extent in crushing movements questioning the feasibility of such projects. The engineers consider such questioning a challenge to their competence and are often not ready to a dialogue as they may have spent a major portion of their lives in designing and executing the project. As they monopolise the data concerning the project and are reluctant to part with the same, it is extremely difficult to do a cost-benefit analysis of the projects. Paranjpye talks about the difficulties in getting public documents and how 'moles' in the administration are used. It is not surprising that till recently very little research has been done on the subject.

The statistics that we are going to present are only for a few large dams. The selection has been random and there has been no conscious attempt to distort figures. Nearly all our data is from government sources. While agreeing that the study is not comprehensive and complete, we believe that there is enough proof to worry about the performance of large dams.

Economic Evaluation

Irrigation and hydroelectric generation have made giant strides since independence. India is now one of the biggest dam builders in the world: by 1979 it had constructed some 1,554 large dams at a cost of Rs 10,560 crore, nearly 14 per cent of the total planned expenditure. Today, we have more than 2,240 large dams. The total installed hydrogenerating capacity as on 1982 was 13,856 MW[1] as compared to about 1,000 MW in 1950. The irrigation potential of major and medium surface irrigation projects increased from 9.7 million(m) hectares (ha) in 1950 to 30.5 m ha in 1985 (5.2 m ha of the potential remained unrealised).[2] The Seventh Plan provides for the creation of fresh irrigation potential for 4.3 m ha at a cost of Rs 120 billion. Foodgrains output has risen from 70 m tonnes to 170 m tonnes. Such figures are indeed impressive, however they do not give us the complete picture.

The Sixth Plan document of the Planning Commission has admitted that the huge investment made in irrigation has yielded disappointingly low results. The national average for irrigated land is 1.7 tonnes of grain per ha while it should be 4.5 tonnes.

TABLE 2: CONSTRUCTION BEFORE CLEARANCE

Name of Scheme	Approval	Commencement
Nagarjunasagar	1960	1955
Kosi	1958	1955
Tawa	1960	1956
Kangasabati	1961	1956
Malaprabha	1963	1960
Kallada	1966	1965

Source: *PAC 1982-83*, p 42.

TABLE 1: GOVERNMENT AND PRIVATE ESTIMATES ON LAND COMPENSATION AND REHABILITATION IN BEDTHI AND TEHRI PROJECT

Items	Government	Private
Bedthi*:		
Number of persons displaced	3706	5193
Forest land submerged	10003	10003
Paddy land submerged	495	1430
Garden land submerged	36	190
Number of houses submerged	530	741
Tehri**:		
Energy generated annually on 90 per cent availability	3029×10^6 kwh	3029×10^6 kwh
Cost of power	35 paise/unit	73 paise/unit
Revenue return (with sale-rate of 48 paise at the bus-bar) (per cent)	11.52	6.89
Net benefits due to increase in agricultural production (Rs/lakh)	15,774	6,467
BC ratio for agriculture	3.49:1	1.28:1
BC ratio for whole project	Not calculated	0.56:1
Forest area lost	1600 ha	4705 ha
Number of displaced persons	46,000	85,600
Useful life of the dam	100 yrs	62 years

Sources: * Paranjpye 1981, p 32.
** Paranjpye 1988, p 42.

A reason for this is emphasis on major and medium irrigation. The Sixth Plan document states that most of the states are unable to recover even the working expenses from their irrigation projects (all kinds). The annual loss amounts to Rs 427 crore. Let us look at some reasons for these disastrous figures.

Cost Escalation

Table 3 gives a sense of cost escalation in the project cost after the project blueprint has been cleared. Our escalation figures of about 254 per cent is quite modest in comparison to those of the Public Accounts Committee (PAC). Thirty-two major ongoing and initiated projects in the Fifth and Sixth Plan studied by the PAC show cost overruns of 500 per cent or more. The committee also points out that no project has been completed within the approved cost estimates since independence [PAC 1982-83, p 38].

The officials at the central water commission (CWC) give two reasons for this: (i) price rises due to delays in the completion of the project in an inflatory economy, and (ii) the project undergoes modifications at the implementation stage. Inflation does not contribute much to the escalation as it has not been that high. Clearly a great proportion of the escalation is due to the second explanation, thereby the earlier exercise with the BC ratio is made a mockery of. As the pattern is universal, it suggests that the blueprint writers deliberately underestimate the costs. Once the project is cleared and enough investment made on it, it becomes easier to get the remaining money as now the concern of the funding agency would be to see that the project is completed as soon as possible, not squabble over the BC ratio. The problem is of irreversibility of decision-making. The project is cleared on the basis of certain facts. However after some time new facts emerge which could stall the project. However, the huge capital already invested hinders such action. While any change in design and construction based on subsequent investigations during construction should be welcome as they contribute to more stable and efficient functioning of the project, the BC ratio cannot be disregarded.

Government officials, consultants and contractors who design and build dams have a stake in keeping overall cost estimates as low as possible, and magnifying a project's potential benefits. It is common to underestimate both the need for and cost of the environment at the planning stage. Once the dam is under construction and costs run over initial estimates there are additional temptations to neglect the eco-system. This is easy as the ecological malfunctions start undercutting production after many years, by which time the engineers and contractors have shifted to other sites.

Gestation Period and Delays

Table 4 gives us an indication of the rather long period taken for the construction of large dams. The gestation period is often over a decade. Conclusions can be drawn suggesting that the environmental calculations might go wrong by the time the dam is finally complete. Similarly if irrigation is the immediate need to offset drought, as is usually asserted, then alternatives need to be identified with shorter gestation period. The table also points to the enormous delays in the completion of large dam projects, the average delay is about 160 per cent. The PAC points out that not a single project has been completed since independence within the stipulated target dates [PAC 1982-83, pp 1]

Irrigation Performance

Table 5 is about the expected and actual irrigated area. In certain cases the project authorities do not deduct the area already under irrigation before the commencement of canal irrigation, while calculating the BC ratio, as pointed out by Paranjpye [1988]. The projected benefits in respect to irrigation are not met, largely, as they are magnified. Once again our figure of 58.69 per cent is conservative compared to some other independent estimates. A micro study on the Mula dam conducted by Mitra [1986] shows that the utilisation percentage was on an average about 44.33 during 1971-82. Bandopadhyay [1987] also writes that the overall efficiency of water use in large dams is in the order of 35-40 per cent. However he does not give any indication as to where he got this figure.

Table 6 gives figures on irrigation potential created and that which is utilised. Even where irrigation potential has been created we see that there has been a failure to utilise it properly, largely as the tail end areas

Table 3: Rise in Estimated Cost of Dam

Dam Name	Estimated Cost	Final Cost (Rs Crore)	Rise in Cost	Per Cent Rise
Dhanegaon	20.19	33.22	13.03	64.54
Radhanagri	1.32	2.18	0.86	65.15
Tungabhadra	46.92	79.51	32.59	69.46
Hidkal	37.82	66.30	28.48	75.30
Nirguna	1.90	3.41	1.51	79.47
Badua	3.40	6.28	2.88	84.71
Bagh	5.79	11.68	5.89	101.73
Bhakra	79.42	176.30	96.88	121.98
Wilson	0.37	0.84	0.47	127.03
Parappalar	0.36	0.82	0.46	127.78
Katepurna	2.37	5.40	3.03	127.85
Gatana	0.89	2.12	1.23	138.20
Rana Pratap Sagar	9.44	23.54	14.10	149.36
Ichari	67.98	170.83	102.85	151.29
Gohira	57.90	146.64	88.74	153.26
Kanher	27.70	71.30	43.60	157.40
Ravishankar Sagar	15.34	40.00	24.66	160.76
Barna	5.56	14.60	9.04	162.59
Majalgaon	38.46	102.00	63.54	165.21
Gandhi Sagar	34.48	98.46	63.98	185.56
Rihand	16.25	51.52	35.27	217.05
Tawa	27.50	91.40	63.90	232.36
Maneri Bali	18.63	62.35	43.72	234.68
Aliyar	24.87	85.76	60.89	244.83
Srisailam	208.00	775.00	567.00	272.60
Mula	8.69	32.62	23.93	275.37
Pandoh	99.65	382.57	282.92	283.91
Kanhasbati Kumari	25.26	100.00	74.74	295.88
Matatila	3.12	12.52	9.40	301.28
Tilaya	3.59	14.76	11.17	311.14
Koyna	45.60	187.90	142.30	312.06
Dimbhe	27.51	120.38	92.87	337.59
Kadana	16.27	77.00	60.73	373.26
Chandan	2.77	14.06	11.29	407.58
Harangi	11.06	58.00	46.94	424.41
Karanjwan	14.20	75.50	61.30	431.69
Dham	27.66	155.00	127.34	460.38
Kamthi Kheri	20.67	143.20	122.53	592.79
Sidheshwar	2.57	18.57	16.00	622.57
Phagne and Ujjani	42.77	315.12	272.35	636.78
Sriram Sagar	40.10	308.00	267.90	668.08
Total	1144.35	4136.66	2992.31	Mean=253.78

Source: Adapted from INCOLD 1979; 1979a.

(TEA) of the command area are not provided proper canals and additional land levelling facilities. Only about 67.06 per cent of the benefits created have been utilised. While discussing the environmental aspects we will see that in some cases a lot of the irrigation potential created is either waterlogged or saline.

It has been pointed out that there are various discrepancies in the official irrigation statistics. Wade [1985] points out that,

> Statistics are socially generated and socially appraised—their use for monitoring and control affecting both content and accuracy... (However) Errors tend to be systematic rather than random—Revenue Department's being downward biased, Irrigation Department's as being upward biased.

Hence we should be careful about using the figures which give near cent per cent utilisation in these two tables. Clearly they are out of line and we have reasons to believe that they are supplied by the irrigation department.

Hydroelectricity

It is unfortunate that we could not get data on the expected and actual power generation by large dams. However, we have enough evidence to suggest that there is a shortfall in this sector too, largely due to the frequent breakdown of turbines, inadequate maintenance, inefficiency and due to the reduction in the life of the dam caused by siltation. Paranjpye [1988] has done a micro study on the Tehri dam pointing to discrepancies in the use of statistics in working out the BC ratio. For example, the 'peaking' has been calculated at 87 per cent as against the Planning Commission review of an average of 70 per cent. Similarly, while working out the BC ratio the average transmission and distributional loss, which is currently estimated at 20 per cent [Sixth Plan, p 233], is not taken into account, nor are the expenses involved in creating the transmission and distributional network comprising of high tension wires, transformers, etc. For details in cost discrepancies in the Tehri project see Table 7. In any case most of the large dams are not meant for hydro power generation. See Table 8 for a list of dams for hydro power.

CB analysis does not take account of the energy required to build and operate a dam. Where such 'energy accounting' has been carried out the results are surprising. Linney and Harrison [1981] point out,

> Blocking a river's course requires that an enormous amount of earth must be moved and a structure raised, either out of landfill and rock or concrete. Access roads must be built, often over long distances and steep terrain, as dam sites are usually isolated. If the dam is constructed of concrete, more petrol will be used to power the mixing plant on the site. Heavy, earthmoving equipment will be run during the 2-6 (or more) years of construction...Some dams built in the past create a questionable net gain in energy (energy used in construction minus power generated)

Table 4: Project Delays

Name	Initiation	Expected Completion	Completion	Gestation (Years) Expected	Gestation (Years) Actual	Per Cent Delays
Gandhi Sagar	1954	1960	1962	6	8	33.33
Vir	1957	1965	1970	8	13	62.50
Tungabhadra	1945	1953	1958	8	13	62.50
Bhakra	1948	1956	1963	8	15	87.50
Sandy Nallah	1959	1961	1963	2	4	100.00
Bhadra	1947	1955	1963	8	16	100.00
Yeldari	1958	1963	1968	5	10	100.00
Nagarjunasagar	1956	1964	1974	8	18	125.00
Jalaput	1946	1953	1962	7	16	128.57
Bagh	1958	1966	1977	8	19	137.50
Peechi	1947	1952	1959	5	12	140.00
Ibadah	1962	1966	1977	4	15	275.00
Balimela	1962	1966	1977	4	15	275.00
Sideshwar	1958	1962	1974	4	16	300.00
Malampuzha	1949	1952	1966	3	17	466.67
				5.9	13.8	159.57

Source: Adapted from INCOLD 1979; 1979a.

Table 5: Irrigation Performance

Name	Irrigated Area (Thousand ha) Expected	Irrigated Area (Thousand ha) Actual	Per Cent
Dantiwada	44.00	0.00*	0.00
Narayanpur	408.00	1.00	0.25
Paihan	125.00	5.00	4.00
Dhammi	23.00	1.00	4.35
Ukai	386.00	20.43	5.29
Dimbhe	108.00	10.00	9.26
Phagne & Ujjani	173.00	18.00	10.40
Ravi Shankar Sagar	150.00	20.00	13.33
Kanher	106.00	25.00	23.58
Rana Pratap Sagar	570.00	135.65	23.80
Tawa	332.00	87.00	26.20
Jaisamand	14.00	4.01	28.64
Nizam Sagar	320.00	110.00	34.38
Malaprabha	206.00	89.00	43.20
Sriram Sagar	231.00	103.00	44.59
Kuttiyadi	31.00	14.00	45.16
Gandhi Sagar	503.00	273.00	54.27
Periyar	86.00	47.00	54.65
Karanjwan	44.00	25.00	56.82
Kadana	88.49	62.00	70.06
Krishnaraja Sagar	48.00	36.80	76.67
Mula	80.00	69.00	86.25
Aliyar	101.00	88.00	87.13
Kangasbati Kumari	401.00	350.00	87.28
Mettur	132.80	120.40	90.66
Tilaya	364.00	344.00	94.51
Bhadra	99.00	97.50	98.48
Hasdeo	41.98	41.60	99.09
Massanjore	247.00	246.00	99.60
Malampuzha	42.09	42.00	99.79
Ibadoh	40.08	40.08	100.00
Shertunji	35.00	35.00	100.00
Lower Bhavani	79.00	79.00	100.00
Matatila	120.00	120.00	100.00
Badua	42.50	42.50	100.00
Bagh	35.00	35.00	100.00
Vir	26.70	26.70	100.00
Total	5,883.64	2,863.67	Mean 58.69

* One year of floods was an exceptional year of water utilisation of 31.98, otherwise there is hardly any utilisation as there is no water.

Source: Adapted from INCOLD 1979; 1979a; IIPA 1988.

due to construction in isolated energy intensive sites, and a short life from sedimentation.

Specifically, Williams studied the energy accounts of the New Melones Dam in California, and concluded that the dam would result in a net loss of energy. As Palmer [1982] notes,

> From the projected average year's 430 million kilowatt hours of electricity, Williams subtracted the energy costs of construction and maintenance: the loss of an existing power plant; energy for irrigation and pumping; and the energy costs of reservoir recreation. William's bottom line? A net loss of 39 million kilowatt hour per year.

Critics may argue that the New Melones Dam was an exception, or that Williams' methodology is debatable, but there is no arguing that for a proper calculation of the BC ratio, we should conduct 'energy accounting' as done by Williams and also take into account the possible cost escalation, delays and targets not achieved, on the basis of past performance. Some kind of an average "margin of error" needs to be worked out (depending on the size, location etc) for these sectors so as to make the ratio more respectable. Looking at large dams strictly from an economic point of view we have enough evidence to suggest that they are a bad form of investment especially as the official BC ratio in most projects just reaches 1:1.5.

Environmental Implications

The decline of irrigational science, giving way to civil engineering has led to the emergence of crucial environmental questions.

Vast areas of land gets submerged under the reservoirs of the dams. It is calculated that big river valley projects have swallowed 0.5 m ha of forest land between 1951 and 1976—roughly one-tenth of the area which has benefited from irrigation. See Table 9 for data on land submerged by a few large dams.

For a proper land and water management adequate forest cover is a must. Instead of proper afforestation, further deforestation is taking place. It is in the hilly areas that forests are submerged for the construction of dams. As most of the dams take nearly a decade or more to complete, the labourers working on the dam site put pressure on the forest resources to meet their requirements for food, fuel and shelter, putting enormous pressure on the catchment forests.

Along with the flora there is the inevitable loss of precious fauna. It is difficult to imagine the extent of this loss as there is no comprehensive study on them. These biological resources have evolved over millions of years and contain within them genetic resources that are directly linked to the survival of human beings. Many other crucial ecological functions like soil preservation, water replenishment and microclimatic stabilisation have been ignored. Of late in the Narmada project, the government is talking about compensatory afforestation. Any such effort would offset just a fraction of the total loss, however well-meaning they might be.

Interestingly the project authorities have never deducted the ecological loss in computing their BC ratio. On the other hand, till recently the timber recovered from the submerged area was treated as profit. Repetto and Gillis [1988] point out that in the name of exploiting forest resources, governments provide generous incentives to encourage conversion in the illusory expectation of high returns (in this case irrigation and power generation) but actually they are absorbing ensuing losses in the national accounts.

It is quoted that over 6 m ha have been severely affected by waterlogging, 4.5 m ha by saline soils and about 2.5 m ha by alkali soils—compared to a total irrigated area of 40 m ha [cited in Dogra 1986].

Irrigation without a proper drainage has disasterous effects. It is not enough to provide water to the crops, excess water has to be drained. If not, this causes waterlogging and in some cases renders the land useless, as in the case of 1,200 ha in the Tawa command area. In 1981, the Auditor-General of India pointed out that the Rs 3,000 million Tawa project has reduced farm production instead of increasing it [PAC 1982-83] see Table 10. This is an exceptional case, however its existence is a pointer to the grave problem existing elsewhere. Similarly since the onset of irrigation in the Chambal project in 1960-65, the amount of formerly productive land taken out of production averaged about one per cent per annum [Vohra 1972].

The other problem is salinity. All soils contain salt. But the idea is to keep the right mixture required for the crops. A high salt content also renders the land useless. See Table 11 for waterlogging and salinity figures in selected projects. In continuation of the argument of projected irrigation benefits not met, we have calculated that a mean of 17.93 per cent of land is lost to agriculture by waterlogging and salinity from the actual irrigation/potential utilised. One cannot generalise from these figures, but this is all the data that could be procured.

Seepage of water from unlined canals can result in staggering losses. Serious concern has been voiced in a stream of publications over the inefficiency of existing canals. A study from the Central Water and Power Commission in 1967 revealed that nearly 71

TABLE 6: IRRIGATION PERFORMANCE

Name of Dam	Potential (Thousand ha) Created	Potential (Thousand ha) Utilised	Per Cent
Kamthi Kheri	85.20	2.10	2.46
Taraka	10.70	1.30	12.15
Majalgaon	141.40	22.60	15.98
Dham	68.70	12.30	17.90
Barna	60.50	25.20	41.65
Mahi Bajaj Sagar	45.00	23.00	51.11
Sondur	57.40	42.10	73.34
Kaddam	23.40	18.70	79.91
Tungabhadra	452.80	362.00	79.95
Nagarjunasagar	772.80	690.60	89.36
Neyyar	17.90	16.20	90.50
Pothundy	10.90	10.00	91.74
Chandan	62.80	59.00	93.95
Idukki	74.90	74.90	100.00
Hirakud	251.00	251.00	100.00
Peechi	23.20	23.20	100.00
Vani Vilasa Sagar	9.20	9.20	100.00
Total	2167.8	1643.4	Mean 67.06

Source: Adapted from INCOLD 1979, 1979a; IIPA 1988.

TABLE 7: VARYING ESTIMATES FOR HYDROPOWER IN TEHRI

Item	Government	Private
1 Total working expenses per year (in Rs lakh)	2143.00	2418.19
2 Total annual energy available for sale (KWH)	3029.18×10	2423.16×10
3 Cost of the power component (in Rs lakh)	107650	126431.34
4 Interest charges (in Rs lakh)	8612	15171.7
5 Total charges per year (1+4) (in Rs lakh)	10755	17589.95
6 Cost of generation per KWH in paise (item 5+item 2)	35	73
7 Gross annual revenue assuming sale rate of 48 paise (0.48*2) (in Rs lakh)	14540	14540
8 Net revenue (7−1) (in Rs lakh)	12379.06	12121.81
9 Revenue return (8/5) (per cent)	11.52	6.89

Source: Paranjpye 1988, p 65.

per cent of the water is lost in transit from the reservoir to the field [cited in CSE 1985]. The 1972 Report of the Irrigation Commission estimated conveyance losses in the alluvial plains of North India as 62 per cent, i e, only about 38 per cent of water let in at the head of the canal reaches the crop root zone. See Table 12 for estimates on projected and observed water losses in a few large projects which again affects the BC ratio. Theoretically seepage losses can be curbed by lining the canals, however the cost would be enormous and would adversely effect the BC ratio and fail to justify the project. Even if this is done, there would be water loss due to the hot tropical climate of India, for which calculations need to be done.

It is only a question of time when the reservoir of a dam would be filled up with silt and other detritus, and the dam will be rendered useless. In some of the river catchments, like that of the Mahanadi, Ramganga or Chambal, the forest area adds up to only 0.5-0.8 per cent of the total catchment area in comparison to an optimal cover of about 60 per cent. Neglect of catchment area results in excessive silt which undermines projects like dams in India. The government recently surveyed 22 reservoirs to conclude that in many instances the annual inflow of sediment is at least four times as high as was calculated. See Table 13 for few figures.

It is estimated that the life of Bhakra has been almost halved from 88 to 47 years, and Hirakud's life reduced from 110 to 35 years. The National Commission on Agriculture [1976] was very critical of the area treated under soil conservation.....

> our analysis shows that in the 13 river valley projects started prior to the Fourth Plan, 3,33,000 ha of forest area have been treated up to 1971-72, which constitute only 1.5 per cent of the total area of 22 m ha of catchment area in these projects.

The silt forms a brick-hard pan, 'mud flat', when the reservoir gets filled up. The land is left unsuited for agriculture, leaving a vast muddy wasteland. A reduction in the storage capacity undermines the working of dams and effectiveness of hydropower generation, flood control and irrigation. Adequate emphasis needs to be put on the maintenance of the catchment area of a river valley project. Barren hills are especially prone to soil erosion, hence they have to be adequately afforested. Water conservation programmes are neglected as they are by no means cheap, and would adversely affect the BC ratio.

Floods are not a result of nature's action, rather are caused by the poor land and water management policies. Cutting down forests dramatically increases the risks of flooding. Trees act as natural sponge, soaking up rainfall and thereby recharging the ground water and eventually releasing it slowly to the river below. According to a UNESCO study,the watershed of one river released between 1 and 3 per cent of the total rainfall when forested, and once the trees were cut down, between 97 and 99 per cent [cited in Goldsmith and Hildyard 1984].

The volume of water carried by rivers in deforested areas can be huge, putting tremendous pressure and often breaching the flood control embankments. The building up of embankments are temporary palliatives. One has to approach the problem with afforestation so as to be able to tackle both

TABLE 8: LIST OF HYDROPOWER STATIONS SINCE INDEPENDENCE

Name	Capacity (MW)	Name	Capacity (MW)
Bhakra Right	600.0	Upper Sileru	120.0
Ganguwal	77.5	Machkund	114.7
Kotia	77.5	Nagarjunsagar	110.0
Dehar	660.5	Tungabhadra	72.0
Pong	240.0	Sharavathy	891.0
Giri Bata Bassi	60.0	Bhadra	33.2
Lower Jhelum	70.0	Munirabad	27.0
Chenani	24.0	Linganamakki	55.0
Kangan	12.0	Idukki	390.0
Rana Pratap Sagar	172.0	Sabarigiri	300.0
Jawahar Sagar	99.0	Kuttiady	75.0
UBDC-1,2 and 3	45.0	Sholayar	54.0
Rihand	300.0	Senugulam	48.0
Yamuna St II	240.0	Neriamanglam	45.0
Yamuna St I and IV	114.8	Pallivasal	37.5
Obra	99.0	Panniar	30.0
Matatila	30.0	Kundah I to IV	535.0
Ramganga	198.0	Periyar	140.0
Ukai	300.0	Kodayar	100.0
Gandhisagar	115.0	Sholayar	95.0
Koyna	880.0	Aliyar	60.0
Vaitarna	60.0	Sakarpathy	30.0
Lower Sileru	400.0	Suruliyar	35.0

Source: *CBIP 1981*, p III-3.

TABLE 9: AREA SUBMERGED

	Name of Dam	Area (thousand ha)		Name of Dam	Area (thousand ha)
1	Pandoh	0.13	2	Vani Vilasa Sagar	8.66
3	Kanholi	0.27	4	Warna	8.76
5	Palkhed	0.56	6	Krishnaraja Sagar	9.01
7	Jalaput	0.59	8	Shertunji	9.20
9	Ozarkhand	0.68	10	Isapur	9.40
11	Waghad	1.27	12	Jakham	10.15
13	Bennithora	1.66	14	Maithon	10.47
15	Karanjwan	1.82	16	Yeldari	10.88
17	Kanher	1.86	18	Paihan	11.87
19	Sidheshwar	1.99	20	Koyna	12.00
21	Harangi	2.03	22	Matatila	12.93
23	Dham	2.41	24	Mahi Bajaj Sagar	14.34
25	Vir	2.43	26	Hidkal	14.52
27	Bhatsa	2.56	28	Kadana	16.60
29	Konar	2.69	30	Balimela	17.52
31	Bhatghar	2.78	32	Bhakra	17.69
33	Periyar	2.91	34	Rana Pratap Sagar	19.58
35	Bagh	3.90	36	Tawa	19.82
37	Mula	4.99	38	Nagarjunasagar	28.48
39	Nimba	5.08	40	Nizam Sagar	30.16
41	Tehri	5.20	42	Tungabhadra	35.88
43	Idukki	5.78	44	Majalgaon	36.95
45	Ibadoh	6.02	46	Gohira	41.97
47	Kabini	6.35	48	Rihand	46.80
49	Tilaya	6.44	50	Sriram Sagar	55.97
51	Dimbhe	7.35	52	Ukai	60.13
53	Kayadhu	7.53	54	Srisailam	61.20
55	Kamthi Kheri	7.75	56	Pong	62.87
57	Totladoh	8.27	58	Gandhi Sagar	68.00
59	Hemavathy	8.50	60	Hirakud	75.00
61	Panchet Hill	8.61	62	Almatti	79.02
				Total	2,028.24

Source: Adapted from INCOLD 1979, 1979a.

the problems of silting and flooding. The rapid increase of floods in recent years is testimony to the fact that deforestation is the cause. See Table 14.

During the monsoons, the reservoir level should be kept low in order to receive floodwaters. However, these norms are not respected in order to maximise power generation. Excess water flow in the reservoir raises the reservoir level to the full posing a real danger of dam collapse. To prevent a disaster, water is suddenly released thereby causing floods downstream. Table 15 documents some such cases which has resulted in loss to lives and property.

Rothe [1978], a French seismologist remarks,

> By building dams, man is playing the sorcerer's apprentice. In trying to control the energy of rivers, he brings about stresses whose energy can be suddenly and disastrously released.

Similarly Simpson, [1976]concludes:

> All large reservoirs must to some extent be considered potential sources of induced activity.

All over the world major earthquakes have occurred in some large reservoirs. So also in India. See Table 16 for some prominent ones. Gupta and Rastogi [cited in CSE 1985] talk of about 30 such cases......

> where the initiation or enhancement of seismic activity has been well evidenced following the impounding of reservoirs behind large dams.

In spite of warnings, the government has cleared the Tehri dam which is located in a highly seismic zone. Paranjpye [1988] points out that seismologists have warned about a possible earthquake and have suggested modified base structure. However, even the most conservative of these recommendations is not being implemented due to the prohibitive costs involved.

Goldsmith and Hilyard [1984] say,

> It is surely only a question of time before one of these dams causes a truly serious earthquake—perhaps killing tens of thousands of people.

The Machu dam disaster of August 1979, which killed several hundred people and destroyed Morvi town and nearby villages is the biggest tragedy caused by dams in India, bringing to light the technological faults of the engineers and use of substandard material by the contractors. The state role in the incident is deplorable:

> It took too long for the Manchu Commission (Morvi disaster) to get under way. When the commission finally reported, the government postponed the publication of its 'Statements of Facts and Opinions' no less than 37 times in 18 months. The commission was then wound up prematurely [Dogra 1986].

Reports of use of substandard material which have caused damage to dams come from Bargi, Barna, Somasila, Hirakud, Kaddam, Dantiwada, Aran, Pachna, Hinglow, Chickhde, Nanaksagar, Panchet and Kadakwasala.

Dams are also a cause of adverse health impacts. Large-scale water projects have increased the incidence of water-borne diseases like malaria (See Table 17), fluorsis and schistosomiasis. The modern, perennial irrigation projects have acted as catalysts in both the increase and lethality of malaria, much to the discomfort of the health authorities. Studies conducted by the Indian Council for Medical Research conclude that shallow weed-infested edges of the reservoirs act as breeding grounds for disease carrying mosquitoes[cited in CSE 1985].

Studies conducted by the National Institute of Nutrition (NIN) [cited in CSE 1985] point to the spread of diseases like fluorosis around the Nagarjunasagar, Parambikulam-Aliyar and Hospet dam. NIN's interpretation,

> Water seepage from the dam's reservoir and canals has increased the level of the sub-soil water. As a result, the alkalinity level of the soil has increased. This in turn has changed the fluoride, calcium and trace metals composition of the soil ....

thus aggravating fluorosis in its pristine form and in a new dimension in the syndrome of knock-knees (genu valgum).

Another disease connected to water projects is schistosomiasis, a disease caused by parasitic flatworms, the larvae of which develops within the bodies of freshwater snails and gets transmitted to humans when they swim or wade in water. White [1977] writes,

> The invasion of schistosomiasis on irrigation schemes in arid lands is so common that there is no need to give examples. The non-invasion of schemes in a region where the disease exists is exceptional.

Other related diseases like filaria, cholera, gastro-enteritis, viral encephalitis, goitre and some other water-borne and water-based diseases also go up after the creation of artificial lakes in the shape of reservoirs.

The construction of a dam leads to a reduction in the flow of water and silt downstream and eventually to the sea, causing a negative impact on the ecosystem downstream. The construction impedes the migration of acquatic mammals and reduces the silt flow which affects the fertility of the agricultural land downstream. A reduction of water flow at the mouth of the river leads to ingress of salt water up the river having negative consequences, as has been carefully documented in the case of the Farakka barrage where Bangladesh bears the cost. The same is expected in the case of the Narmada Valley Project.

There is a depletion in the fish catch throughout the river basin causing an enormous reduction in the protein availability and marginalising the fisherfolk. The increase in the salinity of many rivers also destroys the habitat of acquatic mammals. The reduction of silt, which contains nutrients, hampers the survival of fisheries downstream. Moreover, reservoirs and canals inevitably face an invasion of acquatic weeds which are not conducive to the survival of fishes and other acquatic mammals.

To sum, we can say that large dams are a cause of severe environmental degradation and such technology is unsuited for large-scale irrigation.

Table 10: Tawa Dam—Results after Irrigation
Average Yield per Acre
(in quintals)

Crop	Before Irrigation	After Irrigation 1977-78	After Irrigation 1978-79
Paddy	4.00	2.98	3.83
Jowar	2.82	3.64	2.74
Maize	4.81	4.07	4.01
Wheat	3.14	3.30	3.06
Gram	2.43	1.96	2.08

Source: PAC 1982-83.

Table 11: Waterlogged and Saline Area

Name	Waterlogged (Area ha)	Saline (Area ha)	Actual Irri/ Pot Utilised	Per Cent Waterlogged/ Saline
Jaisamand	—	606	4010	15.11
Bhakra	—	171000	—	—
Paihan	215	660	5000	17.50
Vani Vilasa Sagar	276	—	9200	3.00
Sidheshwar	558	4990	—	—
Malaprabha	1146	139	89000	1.44
Hidkal	3521	289	—	—
Yeldari	9595	316	—	—
Tawa	14000	—	87000	16.09
Rana Pratap Sagar Stage 1	16402	—	135650	12.09
Sriram Sagar	20000	—	103000	19.42
Tungabhadra	41000	81000	362000	33.70
Nagarjunasagar	57000	23000	690600	11.58
Gandhi Sagar	70000	64838	273000	49.39
Total	233713	346838		Mean 17.93

Source: IIPA 1988 and Tables 5 and 6.

Social and Political Implications

Large dams cannot be examined in a political vacuum. We have to examine the power relation of the state *vis-a-vis* the social classes which benefit from it and those who have to pay for such benefits. It is unfortunate that irrigation and power generation, which could play an important role in the alleviation of poverty and greater social justice, is doing just the opposite. The ruling class due to the power that it enjoys is successful in diverting nearly all the benefits of large projects to itself.

DISPLACEMENT

Rehabilitation of the oustees is one of the least satisfactory aspects of reservoir projects. Most dams are constructed in remote hilly areas, mostly inhabited by tribals and other weaker sections of the society. Big dams inevitably have huge reservoirs and therefore displace a large number of people. See Table 18 for figures on displacement by a few large dams.

The government of India is still using the Land Acquisition Act 1894 enacted by the British colonisers to handle rehabilitation. The government believes in giving cash compensation for land and houses submerged. It does not envisage a plan for compensating loss of employment or disruption of livelihood other than from ownership of land. The landless labourers, marginal farmers, sharecroppers, tenant cultivators, artisans, cattle grazers, fisherfolk and the like who depend on the regions natural resources are not compensated for their loss. The relocation plan is aimed at satisfying only the elite, and that too marginally, who own land. Even this meagre plan is not implemented satisfactorily. There is evidence of widespread corruption and inordinate delays in payment of compensation which is usually below the market rate. Use of force is often resorted to. Where land is provided for relocation, it is of an inferior variety or not productive at all. At times forests are cut to provide resettlement sites. No effort is made to recreate the village as it was in the old site. Neither is any effort made to minimise the loss of essentials of social, cultural and spiritual value. What they are essentially provided is an atomised housing facility which breaks their community support systems.

Scudder [1986] who has studied forced relocation concludes that, "next to killing a man, the worst you can do is to displace him". He attributes this statement to the fact that there are various stresses the individual faces—social, cultural and psychological which are a result of the breakdown of their social and economic lifestyle.

Cash compensation is paid in lump sum without any advice to the oustees in terms of proper investment or channelising it towards a new livelihood. Farmers who have learnt nothing but the technique of agriculture are thus unable to decide upon a new occupation. Once provided the cash, they fall prey to the consumerist attitude—they buy a motorcycle, a bicycle, a transistor, nowadays television, and the like. And in no time they are penniless. Left with neither cash nor employment, but only one's labour, the drift to the city begins. The city provides a dream of employment and of a good livelihood, proper health care and education to the children. But it is only a fantasy. The oustees land up at shanty towns, ghettos and roadsides where life is miserable.

There are a number of studies highlighting the plight of the oustees. An increasing number of people's movements have also laid stress on the issue but the government prefers to silence such protests. Their perceptions are ruled out and their demands ignored. One is not advocating that the tribals, their economy and culture be left untouched. But there is no disagreeing that they are a deprived lot. The economy should shift gears to benefit them. There is absolutely no talk about 'development-oriented resettlement' on the part of the authorities. Even when such opinion is voiced by the oustees and people's movements aided by the intelligentsia, such proposals are neither operationalised nor accepted.

IRRIGATION LEADING TO CONCENTRATION OF CAPITAL

After four decades of independence, there has been no significant reduction in the extent of land concentration. All that the land reforms achieved is the abolition of certain intermediaries, thus eliminating the often absentee landlords, though not an end of landlordism. Commentators believe that the land reforms were not directed towards an egalitarian distribution of land, rather to smooth out the tax collection procedures. Patnaik [1988] points out,

> At one end, a somewhat homogeneous class of landlords was created; at the other end, there was outright eviction or degradation in status of large numbers of petty-tenants; and, in between, a section of rich tenants moved up the social scale by acquiring ownership rights. But land concentration was not broken....land reforms legislations themselves contained clauses which essentially enjoined upon the landlords the need to convert themselves into capitalist landlords. And the entire thrust of a series of programmes...to make inputs available... shift to more intensive cultivation along capitalist lines...a tendency towards landlord capitalism has been evident almost throughout the country.

A section rightly believes that irrigation by dams helps in strengthening the capitalist structure, largely because of the extreme inequality in the distribution of land in the command area which gets further polarised with the introduction of irrigation by big dams.

Inevitably the big landlords are the first to hear about an irrigation project. In fact many of them lobby for them with their political representatives. Once it is clear that the project would come through, they are

TABLE 12: WATER LOSSES

Canal	Projected	Observed	Difference	Per Cent Rise
	(Csecs/Million Sq Ft)			
Chambal R Main Canal	8	15.0	7.0	87.5
Tawa	8	22.8	14.8	185.0
Mahanadi Canal	8	39.7	31.7	396.3
Nagarjunasagar LB Canal	8	21.2	13.2	165.0
Nagarjunasagar RB Canal	8	16.7	8.7	108.8
Periyar Main Canal (Lined)	2	3.5	1.5	75.0
Periyar Branch Canal (Lined)	2	3.3	1.3	62.5
Periyar Vaigai Distribute and Water Courses (Unlined)	8	2.7	−5.3	−66.3
Girna/Jamda LB Canal	8	11.0	3.0	37.5
Mula RB Canal	8	24.5	16.5	206.3
Nira RB Canal	8	6.0	−2.0	−25.0
Purna (Bamath Branch)	8	15.0	7.0	87.5
Mula Sonai Distributary	8	15.0	7.0	87.5
				Mean 108.3

Source: PAC 1982-83, pp 100.

TABLE 13: SILTATION RATE

Name of Dam	Expected	Actual	Per Cent Rise
	(Acre Feet/Annum)		
Nizam Sagar	530	8725	1,646.23
Massanjore	538	2000	371.75
Maithon	684	5980	874.27
Parambikulam	1089	4366	400.92
Panchet Hill	1982	9533	480.98
Ukai	7448	21758	292.13
Tungabhadra	9796	41058	419.13
Bhakra	23000	33745	146.72
			Mean 579.01

Source: *Report of the Irrigation Commission*, 1972, Vol 1, pp 326.

known to buy off land from the small and marginal farmers at a price much below the rate after the irrigation project comes through. Even before a project has been passed, the big landlords have managed to increase their landholdings and eke out the small farmers.

In the second stage they manage to divert the irrigation canals to their fields with political and other influence. They also see to it that activities, such as land levelling and shaping of land is done properly on their land so as to provide smooth irrigation. Those with secure water supplies are able to crop their land three times a year while others who rely on one irrigation take one crop. The physical position of fields relative to channels is critical [Chambers 1977].

Moreover, the timing of water deliveries is now, with the new seeds, at least as important as the total amount. Farmers now want water at particular times; deliveries outside these times may be of little value and may even be harmful. The farmers therefore adopt a variety of tactics to try to get water when they want it. In one way or another, most of these tactics involve them with the irrigation bureaucracy. It is through connections with the bureaucracy that they try to get water in the amounts and at the times they desire, and to minimise the costs of obtaining it. It would be entirely unsurprising if ... certain categories of clients tend to be favoured .... (and thus) widen the scope for discrimination against some individuals or groups and in favour of others ... one would expect ... discrepancies between water service of those with resources and those without...One would similarly expect growing inequalities in the distribution of the other functions performed by the irrigation bureaucracy: setting the roster of turns; adjudication of appeals against rank and file officers; and assessment of revenue[Wade 1975a].

The command area can be divided into three parts—Head Reach Area (HRA), Middle Reach Area (MRA) and Tail End Area (TEA). It is usually in the HRA that there is a good water flow supplemented by efficient water levelling. In the MRA, the land levelling is not properly done, due to shortage of funds and also because of carelessness on the part of the engineers as the project is nearly complete and and there is hardly any inspection. They however receive water but not as well as the HRA. The TEA is the sufferer as the financial allocations have exhausted and there is hardly any water left due to siltation, water loss and intensive use of water in the HRA and MRA.

Wade [1982] calls this a common feature. He says that as the canals are not constructed in the MRA in time and farmers in the HRA are allowed to take water, which is in abundance then, they adopt water intensive cropping pattern which is commercially profitable. Later on they exert strong pressure to make sure that the quantum of water provided to them earlier is not reduced, thus stalling the objective of irrigating as much land as possible. Similar conclusions have been drawn for Sreeram Sagar [Ali 1986] and Mula [Mitra 1986] dams.

Let us look at a micro-level study of Sreeram Sagar Dam in Andhra Pradesh conducted by Ali. As in other places, the landholdings is a skewed one, where the minority own the majority of land. In this case,

> Big farmers who were only few in number possessed more than 64 per cent of land...The average size of holdings for each farmer category varies from one area to another area...The averages are higher in the HRA as compared to MRA and similarly they were higher in MRA than in TRA (TEA). One can surmise here that more irrigation facilities may bring about an increase in the average size of holdings operated by each category of farmer. This could be due to the higher utilisation of land and also an increase in the size of their landholdings attempted by every farmer due to increased profitability from each acre of land. At the same time the benefits may not be even as there are inequalities in the distribution of land...Apart from more land being brought under cultivation, the size of the landholdings may increase due to leasing-in of land. Similarly land can be leased out also where some farmers may make more profit out of leasing than self-cultivation...while (in) TRA (TEA)...most of (the people) are compelled to seek (employment) outside agriculture in order to eke out a living.

Research by Water and Power Consultancy Services (WAPCOS) [cited in Lenton 1982] on the Mahanadi Reservoir Project has found a gradation in paddy yields on outlets from 1.54 tonnes at the head down to 0.22 tonnes at the tail. Even on the Upper Ganga Canal, where 'warabandi' is practised, research on one distributary reported by Padhi and Suryavanshi [1982] has shown a contrast between an irrigation intensity of 119 at the head, 72 in the middle and 68 at the tail, accompanied by a concentration of sugarcane at the head.

A Planning Commission study [1965] on irrigation projects has come with data strengthening the theory of power distribution. Studies were conducted on the Tribeni, Sarda and Gang canals on landholdings, tenancy and cropping pattern. In the Tribeni canal project areas, the size of the average farm in the commanded zone is higher in comparison to the average farm in the uncommanded zone. Average size of a farm in the project area is 12.14 acres as compared to 9.84 acres in the control area. Similarly in the Sarda canal project, the sample holding in the commanded zone has on an average an area of 4.6 acres as against 2.9 acres in the uncommanded zones. The study points out,

> A little larger size of family holdings in the project area is on account of people from outside buying substantial area of land with irrigation facilities.

Thorner [1962] reported that there were two standards of water service on the Sarda canal: a small minority of rich farmers got as much water as they wanted and were able to adopt profitable irrigated crops; the mass of small farmers had to adopt a rain-fed

TABLE 14: DAMAGE CAUSED BY FLOODS, 1953-81

Year	Crop Area Affected (lakh ha)	Damage at 1982 Prices (Million Rs)	1952-53 Prices (Million Rs)
1953	9.3	540	520
1954	26.5	580	590
1955	54.0	1190	1340
1956	21.0	510	510
1957	4.5	240	220
1958	14.9	510	460
1959	15.4	790	680
1960	26.5	670	550
1961	18.3	320	260
1962	35.6	930	750
1963	19.7	380	300
1964	24.7	670	450
1965	2.5	60	30
1966	16.1	650	340
1967	33.0	1370	620
1968	26.9	2030	950
1969	43.4	3330	1490
1970	48.5	2870	1210
1971	62.4	6320	2630
1972	24.4	1580	630
1973	76.0	5690	1790
1974	33.0	5690	1400
1975	38.5	4710	1190
1976	76.8	8890	2390
1977	82.5	12000	2820
1978	100.5	14550	3420
1979	20.0	5970	1400
1980	54.1	8300	1950
1981 (as on August 19)	16.2	2050	480
Total	1025.2	93390	31370

Sources: *Report of the National Commission on Floods*, Vol 1, 1980; Replies to Rajya Sabha, 1980-81.

TABLE 15: DAM INDUCED FLOODS

Dam Name	Year	Effects
Nanak Sagar Kalagadh Begulband	1978	Vast areas in Rohelkhund division of Uttar Pradesh were flooded.
Damodar Valley	1978	Aggravated West Bengal floods.
Bhakra	1978	About 65,000 people made homeless. The chief minister of Punjab said, if something had happened to the dam, then half of Punjab would have been inundated.
Hirakud	1980	Hundreds lost their lives.

Source: Dogra 1986.

cropping pattern, treating canal water as "an intermittent blessing, to be welcomed when it comes" but not to be relied upon. Velde [1971] who studied the distribution of water in part of the Bhakra canal gives evidence that landholdings closer to the canal outlet have a better standard of water service, and that big holdings receive more water per acre than small holdings. Reidinger [1971] also studying the Bhakra says that "it was commonly noticed that the holdings of the larger and more powerful landlords often were closest to the head of the watercourse". In one case, the larger and more powerful farmers were originally placed towards the end of a watercourse, because their land was relatively low; they then got the position of the outlet changed so that their lands came to be near the new outlet (p 109). Prasad [1972] who researched the Kosi canal writes that the biggest size group of landholders get the maximum land irrigated.

Some data on tenancy is also available from the Planning Commission [1965] study. In the Gang canal, a larger proportion of the farms are owned and cultivated by owners in the commanded zone while in the uncommanded zone, there is more of tenant cultivation. The percentage figures for fully tenant cultivated holdings are 24 and 63 respectively in the project and control areas. The remaining holdings are partly owned and rented.

We have analysed in our discussion how large dams lead to the concentration of land among the powerful. Their activities are also directed towards the market and hence the inevitable shift to cash crops. According to Table 19 more than a third of large dams are in Maharashtra, where sugarcane farming is thriving. However, only 41 per cent of Maharashtra's cultivated area is irrigated. Dhawan [1985] says that it requires ten times more water to irrigate sugarcane in comparison to kharif and seasonal crops.

The Planning Commission study points out that in the Gang canal area irrigation has led to diversification of the cropping pattern through the introduction of new crops such as sugarcane and cotton. It has also made possible cultivation of a wet crop like paddy in this semi-arid region. In the Sarda canal area, irrigation has helped to extend cultivation of sugarcane, wheat and a few other cash crops of minor importance.

To remove such discrepancies in distribution of water and proper land-levelling works, popular opinion has been voiced for a farmers' organisation [Pant 1986; Mass and Anderson 1978], in large irrigation projects. It has also been argued as to why irrigation water, provided by public funds, could not be for all. Bottrall [1981] insists that there are "very good opportunities for land redistribution at the initial planning stage, before project completion". However these issues are put under the carpet.

Distribution of Electricity

We find anomalies in the distribution of electricity. Table 20 gives a mean percentage break of demand for electricity. Clearly a large chunk goes to the industry. Table 21 indicates the meagre demand for electricity by the rural households.

In spite of the fact that most of the electricity is generated through hydropower or thermal power stations, which are located in the rural areas and which get their resources after displacing and encroaching upon the resources of the local communities very few of them receive its benefits. There is hardly any allocation to the weaker sections to set up cottage industries and the like; instead electricity is diverted to the national or regional grid which meets the requirements of the industrial houses, urban dwellers and lastly the rural areas. The government has not as yet provided electricity to all the villages and households, leave alone provide continued supply.

We find that the bigger the project, the more centralised it is. This centralisation has a bias towards the economically powerful, while the localised and small projects of irrigation and power generation provide a greater chance of equitable distribution, as we shall discuss when examining alternatives.

Another social group that benefits enormously from big dams are the contractors. With the project costs at times staggering to tens and hundreds of crores, the ten or twenty per cent cut off can be enormous. The engineers also collaborate with the contractors so that they can get an adequate share, having a say in deciding upon the tenders. It is interesting to note that such big construction companies are just a handful and they are closely aligned with the state.

We see that large dams do little to alleviate the social inequalities that exist, on the contrary they further aggravate the already skewed social structure in favour of the socially, economically and politically powerful, thus throwing to winds the socialist pretensions laid down in the Constitution.

Those in favour of large dams do not want proper rehabilitation of the oustees as it is very expensive for them. The ecological movements may try to get some concessions after a protracted struggle, but they will only remain concessions and not rehabilitation in the true sense of the term. Similarly, the ecological and anti-dam movements may be successful in seeing to it that the eco-system is duly respected, but the ruling class will see to it that only that much respect is granted that would be beneficial to them, as after all, a totally ruined nature is not productive and thus not profitable. At places where the anti-dam movements get very strong, the state concedes defeat, but shifts the dam sites to other parts of the country.[3]

TABLE 16: SEISMICITY

1 Radhanagri	—magnitude of 6.5 on the Richter recorded in 1967.
2 Mula	—magnitude of less than 3 on the Richter recorded in 1972.
3 Parambikulam	—magnitude of less than 3 on the Richter recorded in 1963.
4 Koyna	—magnitude of 6.5 on the Richter recorded in 1967.
5 Idukki	—magnitude of 3 and 5.9 on the Richter on July 2 and December 1, 1979. Recently (1988) another earthquake has brought loss to property in the region.

Source: IIPA 1988.

Alternatives

Environmentalists are attacked for opposing nuclear, thermal and also large hydroelectric projects. Hydroelectricity is considered to be the least pollutant. We have examined how hydropower from large dams is not very green after all. So what are the substitutes.

'The cheapest form of alternate energy is energy saved'. Efforts should be directed towards curbing wasteful energy use on luxurious items by the pampered few. Equally important is exploring alternate forms of energy. We have the know-how for energy from petroleum, gas, earth's crust, biomass, solar, tidal waves, animal excreta and wind. There should be more research into their practicability and expanded application.

Nuclear energy is dangerous. However, in thermal power stations, pollution can be reduced to the bare minimum with the help of electrostatic precipitators and other gadgets to tap sulphur dioxide and other poisonous gases. Other than these let us seriously examine concrete options and look for space within the existing technical know-how.

Small vs Large: Which is Cost Efficient?

The Planning Commission figures show that it costs over Rs 2,800 to provide irrigation to one hectare of land through major and medium irrigation schemes in comparison to Rs 840 for an equal area by groundwater. Table 22 points out that the outlay on minor schemes have been less, but the potential realised is more. Kanwar [1988] observes that the "cost of groundwater development are hardly one-fourth of surface water development in the Seventh Plan". Again, a study by the Afro-Asian Rural Reconstruction Organisation [1982] talking about irrigation planning concludes, "The investment cost of unit irrigated area for major and minor irrigation projects was 118 per cent more than for minor irrigation."

Dhawan [1989] reacting to these calculations quotes from an earlier paper of his saying, "surface irrigation works may score decisively over well irrigation, possibly by a margin of 3:2". The objective of his paper is to point to the flaws in processing data relating to irrigation and thereby tilt the balance in favour of major projects. He rightly points out that, "it is inappropriate to compare the irrigation projects on the basis of unit capital cost". He points to five major drawbacks in the available estimates.

(1) The reported outlays are for the public sector only, thereby leaving out investments by farmers which can be substantial in case of minor works.

(2) There is lack of compatibility between outlays on irrigation in a given plan period and the resultant addition to irrigation capacity in the same plan period. The argument being that major irrigation works have a longer gestation period, hence the addition to irrigation capacity is not explained by looking at the potential generated during that plan. It would be reflected on completion of the project.

(3) A portion of the project outlay is not meant to result in any addition to the irrigation capacity as it may be directed towards (a) research and investigation, (b) remodelling of headworks, lining of channels and strengthening of drainage of old irrigation, and (c) replacement of old works.

(4) He points out that the capital saving argument is more tilted in favour of major irrigation. The reason being that its useful life is around 100 years, while minor works need frequent replacement.

(5) Major works use the natural force of gravity in their operation, while minor works require energy for countering the pull of gravity. Hence the operational cost of minor schemes would be large. The equation being about 1:10 in favour of major projects.

Dhawan has brought to light certain factors that need to be taken into consideration before any serious debate on the cost aspects can take place. However, there are a number of points which he does not refer to that would tilt the balance in favour of minor projects. Before laying down these five objections he emphasises the need for an exercise in terms of social costs, which he sees in terms of (a) submerged land and (b) rent. While agreeing that there is rent-seeking he intends to exclude such cost and thus bring down the true resource cost of major projects. Rent-seeking after all is part and parcel of the mode of production in operation and the technology it markets. In his detailed accounting he does not mention rent-seeking in the case of minor schemes. Clearly he concedes that there is an inherent bias; rent-seeking being rampant in case of major projects. As such our calculation should handicap major projects for this bias for which public money is being spent. Similarly, why are other social costs like inequitable distribution of water and electricity, unsatisfactory rehabilitation and improper treatment of the environment not taken into account.

We can turn around all his points against his case. In his first point he is right in saying that the figures quoted for minor works are public sector outlays only. However, he omits mentioning the fact that the quoted figures of benefits by major schemes should deduct the benefits by minor schemes within the command area of the project. As a government of Punjab [1970] document points out,

> Tubewells and wells are also coming up in areas irrigated by canals. It, therefore, becomes difficult to access the net benefits accruing from these works. The old norms of area irrigated by minor irrigation works also no longer hold good and require reappraisal (p 1).

While appreciating the content of the second point, one can point out that long gestation periods could be a serious handicap. To cite a case, preliminary work on the Narmada Valley Project started in 1950s (i e, feasibility studies and paper work) when the environmental situation was different. But the project has just begun and by the time it is completed it may be 2010. The situation in 1950 is different from the one in 2010 or 1990. Assuming *status quo* in environmental variables could be harmful.

Dhawan is unclear in dealing with point three. Clearly these are capital costs and should in all fairness be apportioned to the respective schemes to which they belong. Later on he talks about the replacement and operational costs of minor schemes, surely similar costs for major projects cannot be disregarded. His fourth point concedes that minor schemes can at least be replaced at a cost, a large dam, alas, cannot be. We have dealt with this point in detail in the environmental section. Point five deals with operational costs and 'energy accounting' of minor projects. Dhawan once again does not talk about the energy required to build a large dam with its innumerable channels as discussed earlier.

Small Hydel Schemes

The success story of China in this field is an oft-quoted one advocating its implementation in a big way in India. China has over 88,000 small hydropower stations with an installed capacity of about 8,500 MW [Guifen and Jizhang 1987]. In contrast India had an installed capacity of 220 MW only, till 1980, with no major plans for expansion [cited in CSE 1985].

Small hydel schemes require a drop of about ten metres only, they require less capital, there are lower distribution costs and transmission losses are negligible. Moreover, as production is small it meets local requirements and plays an important role in the overall development of the people of the rural areas. The Chinese experiment has demonstrated the important role such hydel units can play in overall development and direction towards the realisation of social justice. Cada and Zadroga [1982] and the Hangzhou Regional Centre (Asia Pacific)'s *For small hydro power* [1985] elaborate on the vital role small-scale hydroelectric power can play for developing countries.

In India there are innumerable sites on fast flowing hill streams and river slopes where small hydel schemes can be implemented by constructing a small dam. In

Table 17: Incidence of Malaria and Progressive Increase in Irrigation Potential in India, 1960-78

Year	Incidence of Malaria (Millions)	Gross Irrigation Potential* (Million ha)
1960	—	29.05
1965	0.10	33.53
1968	0.27	37.10
1973	1.93	44.20
1977	4.74	51.37
1978	4.14	54.00**

* Figures relate to the year ending following March 31.
** Estimated.

Source: Y P Sharma and K N Mehrotra (1982); Ministry of Irrigation, 1980.

Table 18: Displacement

Name of Dam	Villages Displaced	Population Displaced
Kamthi Kheri	7	889
Ozarkhad	3	1354
Bagh	16	1374
Karanjwan	1	1600
Palkhed	1	1716
Ibadeh	19	2258
Bennithora	6	3000
Kanher	29	7080
Kayadhu	35	8857
Kabibi	20	11250
Hemavathy	46	11600
Nagarjunasagar	18	13227
Krishnaraja Sagar	25	15000
Isapur	26	15589
Dhimbe	69	18000
Hirakud	249	18000
Dham	35	19735
Almatti	228	20000
Mahibajaj Sagar	109	27325
Warna	37	29300
Koyna	100	30000
Gohira	130	31000
Hidkal	44	31133
Bhima	80	35069
Bhakra	375	36000
Tehri	92	46000
Narayanpur	93	48125
Gandhi Sagar	228	51514
Ukai	170	52000
Srisailam	65	52049
Rihand	108	55000
Balimola	91	60000
Majalgaon	65	65296
Nizam Sagar	40	67445
Sriram Sagar	64	75090
Ukai	170	80000
Tilaya	—	13455
Maithon	—	28030
Panchet Hill	—	41461
Tungabhadra	—	54452
Pong	—	80000
Kangsabati Kumari	—	125000
Total		1,385,273

Source: IIPA 1988.

some cases turbines can be fitted in the river bed to generate electricity. All that a small hill village would require is 0.1 MW of electricity. The great advantage is that these can be operated by the local people without much bureaucratic or technical help.

As per the Central Electricity Authority, small hydel units cost between Rs 8,000-15,000 per kilowatt of installed capacity in comparison to Rs 3,000-7,000 by large hydel projects. However, if we look at the small capital outlay, shorter gestation period, socio-economic development, environmental costs, loss of social and cultural heritage and the menace of displacement, the difference can be more than substituted. The voluntary sector has installed a few micro-hydel units successfully at Chamoli, Gopeshwar and Bhudha Kedar where the lives and livelihood of the local people have changed for the better.

Small Dams

Building small check dams with or without the provision of hydelpower generation is another viable option. A small dam can be constructed by putting a concrete block on the river stream or nullah and thereby storing water in a few acres of land, depending on the topography of the site. This storage not only provides irrigation for 'kharif' and 'rabi' but also results in the recharging of groundwater, thus enhancing irrigation by wells and tubewells in the adjoining areas. Apart from agricultural development, they play a crucial role in the regeneration of trees, bushes and fodder grass.

Vanvasi Sewa Ashram in Mirzapur has constructed some 750 small dams, each costing about Rs 60,000 and irrigating about 40 acres of land. Similarly at Sukhomajri village, 35 km north of Chandigarh, small dams have greatly improved agricultural productivity and the eco-system.

The success of these experiments and also going by government records, irrigation by small projects is certainly advantageous. As far as electricity goes, we already have a large installed capacity of hydropower. A lot more can be generated through mini and micro-hydel projects. If China has a theoretical potential of 1,50,000 MW and a developable potential of 70,000 MW, India should not be far behind. However, a proper assessment is lacking. We have demonstrated that alternatives are not only economical in the long run, have little or no negative effect on the eco-system, and most importantly help in the genuine socio-economic development.

The neglect of these small projects is perhaps because they directly benefit the weaker sections and run contrary to *stus quo* interests. The stakes in the case of small projects are not high for the contractors, engineers, politicians and bureaucrats.

Conclusion

We have examined the technological inappropriateness of large dams to present day requirements. The shift from civil engineering to irrigation science is the urgent need. We have also pointed out that the conventional BC calculation, purely on economic terms, fails to justify the existence of large dams. The introduction of social and environmental aspects would definitely put a brake on these projects. We have also seen that alternatives need to be taken seriously and extensive studies are required in the area.

We agree that the technology and the environmental and social relations of large dams are inappropriate. We already have more than 2,240 large dams, hence there should be no reason for more. Theoretically, one can argue that in special cases like the Deccan, perhaps this could still be the best form of irrigation. But these arguments have to be backed with ample hard facts which would be very difficult if not impossible to find. And clearly serious modifications need to be done to respect the environment. Similarly, land and social reforms should go hand in hand with irrigation and power

Table 19: Statewise Breakup of Major Dams Constructed and Planned'

States	Number
Andhra Pradesh	74
Bihar	31
Gujarat	276
Himachal Pradesh	3
Jammu and Kashmir	7
Karnataka	63
Kerala	44
Madhya Pradesh	131
Maharashtra	631
Meghalaya	6
Orissa	39
Punjab	2
Rajasthan	67
Tamil Nadu	77
Uttar Pradesh	84
West Bengal	17
Goa, Daman and Diu	2
Total	1554

Source: INCOLD 1976.

Table 20: Projected Demand of Electricity in India (TWh)

Category	1982-83	1987-88	1992-93	2000-01	1982-2001 Approximate Mean Per Cent
Transport	3.2	4.0	5.4	8.7	2.2
Commercial	8.1	10.3	14.7	23.9	5.8
Household	11.4	15.5	28.0	35.8	9.1
Agriculture	16.8	22.2	29.2	33.0	11.1
Industry	83.8	121.4	173.5	302.6	67.4
Other	5.2	8.2	11.9	19.5	4.4
Total	128.5	181.6	262.7	423.5	100.0

Source: Adapted from Planning Commission, 1979, pp 119.

Table 21: Projected Percentage of Households Using Electricity, Firewood, etc, for Lighting and Cooking Respectively

		1982-83	1987-88	1992-93	2000-01
Electricity for lighting	Rural	12.9	19.3	27.6	45.2
	Urban	53.0	62.3	73.8	89.0
Firewood, etc, for cooking	Rural	94.5	89.0	82.9	70.0
	Urban	58.1	47.9	36.0	10.8

Source: Planning Commission, 1979, pp 32.

Table 22: Outlay on Development of Irrigation Potential

	Outlay/Expenditure (Million Rupees)		Cumulative Potential (Million Hectares)	
	Major/Medium	Minor	Major/Medium	Minor
Pre-Plan benefits	—	—	9.70	12.90
First Plan	3,800a	760	12.20	14.06
Second Plan	3,800	1,420	14.30	14.79
Third Plan	5,810	3,280	16.60	17.01
Annual Plan 1966-69	4,340	3,260	18.10	19.00
Fourth Plan 1969-74	12,370b	5,130	20.70	23.50
Fifth Plan 1974-78	24,420c	6,310	24.82	27.30
1978-79	9,770	2,370	25.86	28.60
Annual Plan 1979-80	10,790	2,600	26.60	30.00
	75,100	12,930	168.88	187.16

Notes : Inclusive of Rs 800 million incurred during the Pre-Plan period; b excludes Plan outlay on unapproved Kaveri basin projects; c excludes non-Plan outlay on unapproved Kaveri basin projects.
Figures for minor-irrigation pertain to government outlays only.
Source: *Draft Sixth Five Year Plan*, 1981.

generation. If the technology of large dams is applied at all then it should be directed to benefit the weaker majority and not the privileged few.

However, the state is going ahead for a wider application of large dams without serious modifications. Basically the technology of large dams is an ideal answer to the needs of the ruling class. The contractors get their usual cut plus more by using inferior raw material and paying less for the labourers who are in most cases also oustees of similar 'developmental' projects. The engineers, politicians and bureaucrats see to it that their man gets the tender. They also have their share of the cake in boasting that they have implemented such a big developmental project which gets appreciably registered with the mass of the people as it is in their psyche that thinking big is thinking right. The capitalist farmers seek to monopolise resources for themselves by easing off the weaker landholders, landless peasants and tribals. For the industrial capitalists, they get a cheap labour force as once the people are displaced from their resource base and not provided another, they migrate to the city where deprived of their social roots their bargaining power is weak and work for lower wages living in subhuman conditions.

Clearly these are issues of political economy which cannot be ignored. As large dams are expressions of deep political, economic and cultural structures, campaigns against them purely on the basis of CB analysis would not provide fruitful results. Such calculations and arguments have been going on since 1880, when the first modern irrigation office was set up in the country. Debates on land and water management, on irrigational reforms have been going on since. It seems that the *status quo* is not interested in these arguments as it has learnt little from it. As a result, the anti-dam lobby has got restless and movements are springing everywhere dams are being constructed. Beyond a point, arguing one's case with the BC ratio seems apologetic, it has to be supplemented with questions of power.

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Dr. V. Siddhartha

51, Bharati Nagar
New Delhi 110003

26 March, 1990

To

The Editor
Economic And Political Weekly
Hitkari House
284, Shahid Bhagatsingh Road
Bombay 400038

Sir:

May I comment (by extraction from the cited Reference) on the conclusions drawn by Satyajit K. Singh in his article: "Evaluating Large Dams in India" [EPW, March 17, 1990].

At the level of the engineering function, dams in India are, barring a few exceptions, competently designed and built. So much so that many teams come from other parts of the world to see these and possibly learn something from Indian design and construction practice, which bear the hall-mark of professionalism, much of it of commendable quality.

Note, however, that the network of institutions that perform this engineering function, that reward and confer approbation, are all populated by persons largely from the same middle-class.

On the other hand, the elected representatives of the people (in Parliament) are drawn from all classes. They (e.g. PAC quoted by Singh) have repeatedly pointed out that the function expected to be performed by these engineering feats have not been performed. The same representatives have revealed, on the basis of facts, the gross professional and administrative shortcomings (in function) amongst those who plan, appraise and approve these projects.

Note, however, that those who professionally plan, appraise and approve are also from the middle-class with broadly the same educational and social backgrounds as those who design and build the dams.

Whence, then, the difference in professional conduct between those planning dams and those building them?

One explanation for the above difference is this: unprofessional conduct in the design and construction of the dams may result in highly visible catastrophic failure with a concentrated point-source of adverse opinion radiating (through the media) into the same middle class which judges professionalism. <u>Per contra</u>, poor planning and appraisal of dam projects will reveal themselves only in small doses spread-over a long period and will affect only the "masses" of rural and small-town India who are unlikely to make the connection between cause and adverse effect. At any rate, they will not make it in a politically consequential way, except, of course, where there is an immediate 'lumpy' effect - such as dislocation of large numbers of people ('oustees') mobilised, even if exogenously. Put in another way, projects which are validated by the Centre (in the Prebisch sense) have the legitimacy of 800 million people validating that Centre, the adverse effect on

P.T.O.

even 20 million people on the Periphery will not greatly influence the legitimacy of the Centre. Even purely geographically, rural people in the North-East or the South of India would not have heard of the Narmada dams, let alone the controversies surrounding them.

The other explanation - which to me sounds more plausible - is that these projects have hidden agendas, which drive a variety of interest groups. When these agendas coalesce, they confer self-protecting legitimacy - at least for such duration as enables a fait accompli to be established.

In support of the above hypothesis, consider the following quote extracted from an official booklet on the Sardar Sarovar Project on the Narmada:

"22. Other Minor Issues under debate: Issue (7) Performance of major irrigation works is dismal. [Response] The same is equally or perhaps more true for soil conservation and dry farming works also. Thus what is required is to upgrade our efficiency as a nation as a whole."

[Source: Sardar Sarovar Project, speech delivered by Vice-Chairman and Managing Director, Sardar Sarovar Nigam Ltd. in Bombay on June 10, 1989].

The performance of previous major irrigation works is regarded as a "minor issue" by a very key professional player in the whole scheme. Even this "minor issue" is not addressed at all - other 'dismal' experience is alluded to instead!

Yet a lay Parliament indicts the executive for not learning from past experience - the essence of scientific policy.

The nature of an institutional "failure" thus appears in outline: it is the absence of constitutional "due process" which alone can ensure that at each stage of that process, the findings of the relevant sciences are incorporated into policy. It is only such constitutional due process which can institutionally match in social and political terms the scale of intended action to the scale of expected effect, and to do this in a scientific way.

This is not to say that constitutional "due-processes" cannot be captured and twisted out-of-shape by the operating ruling class(es). But that is another issue.

Yours faithfully,

V. Siddhartha

Dr. V. Siddhartha

Reference

Siddhartha V, 1989 "Notes on Large Dams with Large Effects in Large Countries with large Populations that are Largely Class Divided", Paper presented to the International Science Policy Foundation Meeting No. 3, Budapest, October, 1989.

LETTERS TO EDITOR

Evaluating Large Dams

THIS is in response to the conclusions drawn by Satyajit K Singh in his article, 'Evaluating Large Dams in India' (*EPW*, March 17).

At the level of engineering function, dams in India are, barring a few exceptions, competently designed and built. So much so that many teams come from other parts of the world to see these and possibly learn something from Indian design and construction practice, which bear the hallmark of professionalism.

Note, however, that the network of institutions that perform this engineering function, that reward and confer approbation, are all populated by persons largely from the same middle class. On the other hand, the elected representatives of the people (in parliament) are drawn from all classes. They (e g, PAC quoted by Singh) have repeatedly pointed out that the function expected to be performed by these engineering feats have not been performed. The same representatives have revealed, on the basis of facts, the gross professional and administrative shortcomings (in function) amongst those who plan, appraise and approve these projects.

Note, however, that those who professionally plan, appraise and approve are also from the middle class with broadly the same educational and social backgrounds as those who design and build the dams. Whence, then, the difference in professional conduct between those planning dams and those building them?

One explanation for the above difference is this: unprofessional conduct in the design and construction of the dams may result in highly visible catastrophic failure with a concentrated point-source of adverse opinion radiating (through the media) into the same middle class which judges professionalism. *Per contra*, poor planning and appraisal of dam projects will reveal themselves only in small doses spread over a long period and will affect only the 'masses' of rural and small-town India who are unlikely to make the connection between cause and adverse effect. At any rate, they will not make it in a politically consequential way, except, of course, where there is an immediate 'lumpy' effect—such as dislocation of large numbers of people ('oustees') mobilised, even if exogenously. Put in another way, projects which are validated by the centre (in the Prebisch sense) have the legitimacy of 800 million people validating that centre, the adverse effect on even 20 million people on the periphery will not greatly influence the legitimacy of the centre. Even purely geographically, rural people in the north-east or the south of India would not have heard of the Narmada dams, let alone the controversies surrounding them.

The other explanation—which to me sounds more plausible—is that these projects have hidden agendas, which drive a variety of interest groups. When these agendas coalesce, they confer self-protecting legitimacy—at least for such duration as enables a *fait accompli* to be established.

In support of the above hypothesis, consider the following quote extracted from the speech delivered by vice-chairman and managing director, Sardar Sarovar Nigam in Bombay on June 10, 1989:

> Other minor issues under debate: Issue (7) performance of major irrigation works is dismal. [Response] The same is equally or perhaps more true for soil conservation and dry farming works also. Thus what is required is to upgrade our efficiency as a nation as a whole.

The performance of previous major irrigation works is regarded as a 'minor issue' by a very key professional player in the whole scheme. Even this 'minor issue' is not addressed at all—other 'dismal' experience is alluded to instead! Yet a lay parliament indicts the executive for not learning from past experience—the essence of scientific policy. The nature of an institutional 'failure' thus appears in outline: it is the absence of constitutional 'due process' which alone can ensure that at each stage of that process, the findings of the relevant sciences are incorporated into policy. It is only such constitutional due process which can institutionally match in social and political terms the scale of intended action to the scale of expected effect, and to do this in a scientific way.

This is not to say that constitutional 'due processes' cannot be captured and twisted out-of-shape by the operating ruling class(es). But that is another issue.

V SIDDHARTHA

New Delhi

Contradiction in Terms

I READ 'Kashmir: Deep Rooted Alienation' by N Y Dole (*EPW*, May 5-12) with great interest. I was a little surprised that in such a well reasoned and moderate article he should have said "people trust BBC news which is always anti-Indian". I do not think the people of Kashmir, who are highly intelligent would "trust" a news service because it was biased. That is a contradiction in terms.

I would be the last person to claim that BBC news achieves total balance—such a thing is impossible because balance is always to some extent in the ear of the listener. I do believe that people turn to the BBC because they trust its impartiality.

MARK TULLY

New Delhi

Secularism and Pedagogy

WITH reference to Iqbal Khan's comment (*EPW*, February 3) on Krishna Kumar's piece on secularism and pedagogy (*EPW*, November 4-11, 1989), I am afraid Kumar exaggerates when he considers both secularism and education mere legitimacy building exercises of the ruling class (*EPW*, March 31 letters). There were secular and non-secular segments of this class—and with regard to education its subjective belief and objective capacities were not the same.

In the original article one did get the impression of a simplistic belief that discovery (or activity) methods would by themselves promote secularism. However, these methods actually cut both ways and could equally well promote communalism. It is here that culture and 'confrontation with problems' comes in—as rightly implied by Iqbal Khan. The one thing which the state did do in this regard, belatedly though, was to secularise the content of textbooks. These Kumar does not mention, possibly considering them legitimacy building tokenism. Of course, these were far from effective, being often poorly done, but due even more to lack of linkage of ideas (culture?) with praxis (discovery method?).

S SHUKLA

Delhi

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Price of Power

Energy planning today has gone beyond a matter of choices between supply options and in particular centralised energy technologies partly because of financial constraints and partly due to popular opposition to environmental degradation. The list of options for energy decision-making needs to be extended to include both decentralised sources of supply and energy efficiency improvements and other conservation options. An attempt at a comparative costing of electricity generating and saving technologies. 1201

Coalition Policies

The norms and styles of functioning of political leaders and workers in this era of coalition politics is bound to be different from those in the days of single party domination. The most striking feature of the present coalition is the emergence of the rich peasantry to a formidable position in the political alignments, a fact which will make its impact felt. 1179

Bihar's Peasant Movement, Then

In 1937 the Congress passed a decree directing its members to maintain their distance from Kisan Sabha activities. This decision drove a permanent wedge between the Sabha and the Congress facilitating the triumph of factional and class interests. What were the events which led to this momentous decision of the Congress? 1217

And Now

Unless the land question becomes the focal point of the agrarian struggle in Jehanabad, the movement will remain stagnant, the unprecedent mobilisation of agricultural labourers notwithstanding. 1181

Creating Nationalities

Whether in Armenia, Azerbaijan, Georgia or the Ukraine, Byelorussia or the Baltic Republics, extremists were in the minority in the initial stages of all movements; secession was not a demand. And yet in the last year and a half a point of no return has overtaken the Baltic and the three southern republics. 1187

'Human Rights', the Enemy?

Lessons from the past should tell our liberal intellectuals so vocal on Kashmir that slogans of 'nationalism' and 'patriotism' always blind people to violation of democratic norms by their own governments which may affect for the time being only a negligible section of the population. 1193

No Lands for Tribals

Despite various laws protecting tribal land, land alienation is a feature of tribal societies in every state. A report on a recent survey in Tamil Nadu. 1185

Blurred Future

Predatory communism which destroyed individual freedom is dead and gone, but east Europe's new leaders are unsure of the shape and substance of things to come 1178

Oil Afire

Never before have edible oil prices ruled so high at this time of the year nor have prices registered such a steep rise as they have done this season. 1174