Water for Gujarat

An Alternative

Technical Overview of the flawed Sardar Sarowar Project and a Proposal for a Sustainable Alternative

Ashvin Shah

"When preserved, rivers serve as visible symbols of the care we take as temporary inhabitants and full-time stewards of a living, profoundly beautiful heritage of nature."

-Rivers at Risk (1989).

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With a foreword by

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Publishers :

- Jan Vikas Andolan - (JVA)
  C/2, Rams Mig 180, Lawsons Bay Colony, Vishakhapatnam - 530 017. AP.
- Samaj Parivartana Samudaya (SPS)
  'Asha Deep', Jayanagar Cross, Saptapur Dharwad 580 001.
- Citizens for Democracy - Karnataka (CFD-K)
  14, Wellington Street, Richmond Town Bangalore 560 025.
- Federation of Voluntary Organisations for Rural Development in Karnataka,
  (FEVORD-K) Post Box. 4646
  Benson Town, Bangalore - 560 046.

Printer : Omega Offset,
Emerald Corner, Maratha Colony,
Tilakwadi, Belgaum. Phone : 24124

Cover Design : Dr. Anil Avchat

Sept. 1993
First Edition : 5000 Copies

Suggested Contribution :
Paper-back Rs. 35/- ($3)
Hard cover Rs. 70/- ($6)

dedicated
to the people
whose culture and livelihood
has been adversely affected
by the present development
strategy
but are fighting
relentlessly for preserving
their culture and way of life
and
to those scientists and
technologists
who are striving to find
sustainable alternatives.

contents

foreword

In the world of man-made objects, India is a land of dinosaurs. Its dams are amongst the largest in the world and the network of power lines and irrigation canals radiating from them amongst the most extensive. Its metropolises have incredibly high densities of dwellings, and its mines reach deep into the bowels of the earth. But just as the age of ponderous dinosaurs ended sixtyfive million years ago, the age of gigantic artifacts is drawing to a close with the twentieth century. Dinosaurs had to yield to the much smaller birds and mammals for the latter are much better at processing information. They have proportionately larger brains and more acute senses. In a very similar fashion large, ponderous machines are today making room for much smaller, electronic devices, devices that can handle information far more effectively. Human civilizations were for a long time based in biomass, in the last few centuries they gave way to civilizations whose strength lay in massive material artifacts, now human civilizations are increasingly coming to rely on information.

The paradigm of development India is pursuing today is seriously flawed, because it slights both biomass and information, and instead pursues production of cumbrous, man-made objects - like huge dams and gigantic mines. It is slighting biomass for the process of development is entirely insensitive to environmental damage and has therefore led to the creation of huge tracts of biologically unproductive lands, for instance, through waterlogging under irrigation projects. Equally tragically it is slighting information, for the whole process of development is carried out behind closed doors, with neither public scrutiny; nor public accountability.

This is a major tragedy. A significant proportion of India's population still depends on biomass for its well being, and the depletion of the country's biomass base is hurting them badly. Equally importantly our disregard for information is ensuring that we are failing to advance to the information age that is fast overtaking all of the world.

Life progressed from the stage of dinosaurs to that of smart mammals through a process of natural selection. The raw material for this process is the continual variation thrown up by the action of many agents of change in the natural world. Evolutionary progress results from ever more efficient variants replacing less efficient ones. This would never happen if variation is suppressed; the result then would be stagnation.

Civilization progresses analogously by experimenting with many, many different ways of doing things. That is why technologies advance rapidly in an open society, but stagnate in a closed, dictatorial set up. That is why, despite its few spectacular successes like the sputnik, Soviet technologies fell far behind the Western ones. While India can be proud of having nurtured a democratic tradition over forty-five years, its whole development process has unfortunately remained as closed as in the Soviet Union. It is a process in which a self-serving alliance of politicians-bureaucrats-contractors makes all developmental decisions with no role for broader public participation. The projects thus favoured may occasionally be very good; more often they are likely to be poor choices dictated by narrow vested interests. But even if the choices are good, it is inevitable they would never be as good as would be the case if they were made from a broader repertoire that would emerge from an open, public process. Our narrow, closed door development process fails to generate a vigorous base of alternate development proposals, essential to genuine progress.

The ongoing debate on the Narmada project is a welcome sign that the Indian society is responding to this challenge, that it is creating mechanisms for subjecting development projects to proper scrutiny, for throwing up alternative proposals. Only when such a new open system really takes roots will we launch ourselves on a path of genuine progress. Only then will we begin to make a transition towards an information based society. This insightful analysis of the Narmada project by Ashwin Shah is a significant and most welcome contribution in this direction.

Bangalore
August 15, 1993.

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preface

The era of sustainable and humane economics, acentralized political systems, pro-life technologies and simple life-styles is born. But for all of us, critics of the centralized mega systems in all walks of life the changing of gears from conventional views about the magical superhuman powers of industrial revolution, to innovative unconventional ways and means is posing a great challenge. On a philosophical plane we may defend our position well. But, in terms of translating our alternative vision into practice so that millions of our sisters and brothers can share the perspective and start acting on it is a stupendous task.

The young infant "GREENDREAM" has to learn to use its physical abilities and mental capacities. But her presence in the modern world has to be accepted. The green-dream will need lots of efforts and failures too, before it is on its own.

Our efforts in Karnataka are small and have yet to go a long way. But while fighting a tough battle seven years long for reclaiming common lands for villages we have learnt important lessons of the need and significance of suggesting alternatives. These lessons are :

Involvement of people and creating confidence in them. (It is essential to remember that they are very capable of taking decisions.) This is the central and powerful force for a movement.

Combining constructive work (in our case-people developing their own common lands and struggle meaningfully.

a) This generates scope for creative engergies to move in positive direction.

b) People's participation in the management of natural resources is assured.

- Combining optimally legal, legislative, scientific and opinion mobilizing skills gives proper edge to the movement.
- Grassroot influence to be politically mobilized so that the candidates for MLA take up public issues.
- Linking up -
  a) With similar groups elsewhere
  b) More importantly, with concerned persons from all walks of life such as government, Banks, legislatures, bureaucrats etc.

When Karnataka Pulpwood Limited a joint sector company (of Harihar Polyfibers and State Government of Karnataka) usurped 75,000 acres of village common - and forest land for growing eucalyptus for captive consumption of the highly polluting Harihar Polyfibers, resulting in the loss of these common lands that were catering for the basic needs like fodder, fuel, fruits, raw material for artisans, green manure etc, of about 5,00,000 people and thus being deprived of their survival rights, and further, when KPL blatantly violated the Supreme Court's stay order and continued planting eucalyptus the affected people and their supporters launched a novel satyagraha "Kittiko-Hachichiko" or 'Pluck and plant' Satyagraha. This name itself embodies the emphasis on alternative. The idea was to pluck out the eucalyptus seedlings planted by KPL and plant in its place saplings of trees which meet the needs of all concerned. Thus it was not only to oppose what is unjust but shoulder the responsibility of evolving an alternative. This movement fired the imagination of the people from different walks of life, including government officials, bankers and legislators. The pressure that was built up made the government cut off land, the Banks the money, thereby bringing KPL to a grinding halt. Due to insistance of more than three score legislators belonging to all parties, the State Cabinet finally decided to wind up KPL.

Environmental activists are looked upon as anti-development tribe- be it a nuclear plant or a big dam. What do these environmentalists stand for? Is a question raised by those who have never questioned "development" as anything but beneficial.

Gandhiji was sceptical about industrialization as a panacea for all our problems. His scepticism is now shared by more and more people.

If, therefore, we are serious about evolving an alternative development strategy which is humane, and based on the principles of sustainability, social justice, equality, right to livelihood and democracy, then it is imperative that we seek an alternative strategy. The debate will have to cover not only theoretical aspects of development but also its practical aspects.

Sardar Sarovar Project being a mega project has focused the attention of the nation and it is obvious that serious thought should be given to the issues involved. We are happy to be associated in this process of finding alternative to such a mega destructive proposal through this publication. We do consider Shri Ashwin Shah's proposal as an important step in the direction of search for alternatives. He not only presents a technical overview of the flawed SSP but also suggests a sustainable alternative for the water problems of Gujarat.

We are hopeful that the book will evoke response from people, similar if not greater than what we had experienced while we took on common lands issue, and a meaningful and fruitful dialogue will ensue on this life giving resource: water.

We are also most hopeful that the presentation of this modest attempt in search for alternatives will encourage concerned scientists and engineers and equally important, from policy makers to work seriously on concrete alternatives to mega projects in general and big dams in particular in India and else-where in the world.

We take this opportunity to thank our friend Shri Ashwin Shah for expressing his long time concern about the water problem of Gujarat through this insightful statement and also Dr.Madhav Gadgil for writing a very appropriate foreword.

Jyotibhai Desai
S. R. Hiremath
Dileep Kamat
for Samaj Parivartana Samudaya

Dharwad.
August 15, 1993.

1

a word from the author

In early January 1991 seven social activists began an indefinite protest-fast at the Sardar Sarovar Project (SSP) site demanding immediate suspension of dam construction pending a comprehensive review of the project. I received this news on the seventeenth day of the fast, from India Abroad, a New York weekly, which reported a standoff between the the opponents of the SSP and the Gujarat state government. The Chief Minister was reported to have said that the project is the lifeline of Gujarat and that after having experienced many droughts in the 1980s people of Gujarat will not tolerate stoppage of the project. The leader of the activists was reported to have said that this project has nothing to do with giving water to the people, that if the planners wanted to give water to the people they could have done so a long time ago. Hanging in the balance in this inconclusive debate were the lives of seven activists. After twenty-two days of fast, the activists gave up. But their nonviolent struggle continues.

The two extreme positions in the above paragraph sum up the social and political dimension of the problem. Is the project a lifeline of Gujarat or a fraud on the people by the vested interests? An informed debate is not possible between social activists who do not have access to technical information nor the expertise, and politicians who are all too often guided by poor technical advice from their captive technocrats. A complex technical review by independent experts not involved to any degree with either side of the project is necessary. It is never too late to review and fix a poorly planned project. On the other hand a well developed project will withstand scrutiny at any time during its execution. In either case there cannot be any objection to a review of the project. Such an independent technical review of this project has not taken place thereby creating this impasse.

As a civil engineer I find this conflict over SSP unnecessary and resolvable in favour of both the sides. More importantly, as a Gujarati, I am concerned about the rapidly deteriorating water situation in Gujarat which will not be solved if the SSP is implemented as designed. The key to resolution is a redesign of the project that accomplishes the broader goal of the SSP without its social and environmental costs.

Gujarat experienced severe droughts in 1986 and 1987 and experiences chronic water shortages every year. Since 1986 I have taken an interest in studying the causes of water shortages in Gujarat and the means of alleviating them. The initial effort was an intermittent but systematic technical inquiry during the years 1986 to early 1991 utilizing technical information obtained from India. Subsequently, more contacts were made with engineers in India during a trip in 1992, who provided a significant amount of technical information, useful discussions and review of my detailed evaluation of the problem and proposal for solution.

The SSP is being pushed through in the name of providing water to the people of Gujarat. This article therefore, is addressed to all the people of Gujarat. Even after the cancellation of the World Bank loan in April 1993, the Indian government has vowed to complete the project with funds obtained elsewhere. The opponents in the dam's submergence area have vowed to drown in the reservoir behind the dam. The conflict, after two years of struggle at the Bank in Washington, now has moved once again to the dam site. There cannot be any victor in such a conflict where the government chooses force rather than reason, and the opponents are left with no choice but defeat or suicide. It is time for the people of Gujarat to get involved in decisions made by others in their name that will adversely affect them both materially and morally.

The people of Gujarat have trusted successive state govenments for over forty years on this project without ever questioning the technical feasibility of the grandiose plans the politicians have made and their enormous costs. They have also trusted the technocrats and "experts" of the state government, central government and the World Bank in believing that the project is feasible and can be paid for. A time has come for the people of Gujarat to apply their own renowned business acumen, pragmatism, and tendency of self-reliance to separate the practical from fantasy.

This technical overview of the flaws of the Narmada project and a proposal for alternative design is such an attempt to separate the practical from fantasy. I bring to this endeavor, a long experience of working on engineering projects in the U.S.. It has given me a personal knowledge of how (a) technical decisions are made in designing public projects in an open and democratic country, (b) conflicts occur on engineering projects and how they are best resolved in the "war room" of an engineering office or in a "hearing room" in a public setting instead of by confrontations at the project site, (c) even on a simple and small project, a closed decision-making process that excludes opposing views always leads to bad decisions, and conversely, an open decision-making process that excludes opposing views always leads to right decisions, (d) the lack of accountability leads to complacency, over-confidence and arrogance on part of people in charge, and conversely, public accountability leads to competence, caution and humility on part of people in charge, assuring the good of *all.*

This article is presented to the people of Gujarat with a hope that they will take charge of this issue away from New Delhi and Washington and resolve it in Gujarat.

2

introduction

The decision to dam the Narmada was made over forty years ago. It was made independent of the justifications that have been offered in recent years. The decision to dam Narmada was made at a time when water scarcity in Gujarat was not as acute as today. The number of villages in Gujarat without a permanent and reliable source of water for example, was practically nil in 1947 while in 1987 it was 12,000 out of its 18,273 villages. The SSP is now retroactively justified as a solution for the growing and very serious water scarcity in Gujarat. People of Gujarat are led to believe that the water scarcity is a natural phenomenon and that the SSP is its engineering solution.

During this period of growing water scarcity, the Gujarat government has built over 131 major and medium (M&M) dam reservoirs and many more remain incomplete including the SSP. Instead of creating 18,273 decentralized small-size reservoirs for 18,273 villages the state has created about 90% of the reservoir capacity in these 131 dam reservoirs, most of it in the regions of high rainfall. The SSP is a continuation of that dam-building spree, and will not help solve Gujarat's rapidly deteriorating water problem.

No attempt is made to inform the people why after building so many dams the water scarcity is growing and how the SSP will solve that problem. As a result of this misinformation, as the water scarcity became serious over the last four decades, the demand to build the SSP became louder, the demand for a share of its benefits became more widespread, and the project became a make-believe "lifeline" for the entire state. The project acquired credibility as an infalliable application of modern technology because it was conceived by "visionary" politicians and designed by "world-class" experts of the state and

central governments and the World Bank. In reality, the SSP is a product of the discredited top-down undemocratic planning process of the fifties. Lacking any accountability of politicians and technocrats, the planning process has shut out the knowledge and wisdom of people the SSP is supposed to benefit and affect who are closer to the reality of their own problems.

The reason there is no relief in sight even after building 131 dams is that dams are a preconceived, and therefore unscientific, solution to address a deep-seated problem of water scarcity. Gujarat now needs to question the validity of this solution of ever increasing number and size of dams to solve the ever increasing problem of water scarcity.

A scientific examination of the problem shows that Gujarat's acute water problem is not due to droughts. Gujarat's average annual rainfall of 27 inches or 105 million acre-foot (MAF) is sufficient to provide for all its needs.

The problem is largely man-made, due to (1) the neglect of existing surface reservoirs and the failure to create new surface reservoirs of adequate capacity and number to store rainwater, (2) deforestation and other degradation of land resulting in excessive runoff of rainwater thereby reducing natural replenishment (or recharge) of groundwater and retention of rainwater in the catchment area, (3) excessive withdrawal of groundwater resulting in its depletion and deterioration of water quality and lack of a groundwater recharge program, (4) wasteful use of available water resources in "water-intensive" irrigation for cash crops and commercial agriculture suitable for national and international markets instead of efficient use in "protective" irrigation for crops suitable for local needs of food, fuel and fodder, (5) inequitable distribution of the available surface and underground water.

This man-made problem has been in the making for the past hundred years. It is reversible only if people are informed about their role in creating the problem, if people are educated about how to solve it, and if people are involved in implementing the solutions. During the past forty years significiant advances have been made in the fields of rainwater harvesting, soil and moisture conservation, watershed development, groundwater recharging, pollution control, reforestation, water and energy conservation, and renewable energy resources (solar, tidal, and wind) all of which are eminently suitable for India. The

Narmada project needs to be suspended and redesigned in light of these new technologies to become truly beneficial to all the people of the river valley and to all the people of Gujarat. This is the only way to resolve the conflict on SSP.

The SSP is an expensive megaproject beyond the means of the state and central government to fund it. The cost of SSP was estimated in 1987 at Rs.90 billion ($5 billion) with its phased completion estimated in 10 to 25 years. This amount does not include the enormous cost of pipe network for which the plans and cost estimate do not even exist. The cost of pipe network may well be another tens of billions of rupees. The SSP consumes much of the state government's budget for water projects. If the SSP is suspended immediately, these funds would become available for implementing the decentralized, user-planned and user-implemented projects described above for a much quicker solution of Gujarat's water and energy problems at a much smaller cost than the SSP.

It is said that the project has gone too far for a redesign. In reality, the project has just begun. Construction has just begun on only one megadam of the Narmada project. The entire project involves 3,000 small dams, 130 medium dams, 28 large dams and 2 megadams. This one megadam, the SSP, is constructed to only about 115 feet height of its 455 feet full height. Only a small portion of the main canal is completed which represents a very small fraction of the canal network of 45,000 miles. Plans have not even begun for laying unknown thousands of miles of pipe network to supply drinking water to over 8,215 villages and 135 urban areas.

In short, the SSP dam is only a small portion of the total project. The completed work represents perhaps less than ten percent of the cost of SSP (plus pipe network) and less than five percent of the cost of the entire Narmada project. Past experience of dam projects in India shows that top-down centralized planning of these projects places greater importance on the construction of dams than on the planning of infrastructure where much of the other costs are. The Gujarat government is already experiencing severe financial drain because of this project. The financial, social and environmental costs that Gujarat will experience during the canal and pipe network phase of the project are yet to be understood by the planners themselves. The SSP is likely

to get completely bogged down in the canal and pipe infrastructure phase and not deliver the "immense" benefits to anyone.

It is prudent to suspend the project now and not invest any more money than risk the loss of a much greater investment at a later date. It is still possible to redesign the project which would utilize the incomplete dam and portion of main canal that have been built without a significant loss of capital invested so far. It is shown in this article that:

(a) the SSP benefits are inadequate in comparison with the magnitude of the water and energy problems faced by Gujarat and its water benefit is inequitably distributed,

(b) the quantity of rainfall in Gujarat is twelve times the water to be supplied by the SSP and it is sufficient for Gujarat's needs,

(c) the depletion of groundwater, not droughts, is the main reason for Gujarat's severe water scarcity and access to groundwater by all should be assured; artificial recharge of groundwater should be undertaken on a large-scale with harvested rainwater or with water imported from existing reservoirs of Narmada water, if necessary,

(d) the agriculture benefit of SSP is unsustainable, and the long-term problem of salination is not addressed,

(e) the drinking water benefit of SSP is not feasible and is used by the project authorities to bolster the case for SSP,

(f) sustainable development of water and energy resources for Gujarat is possible with people's participation for equitable distribution of benefits.

3

inadequate SSP benefits and inequitable distribution

The SSP is called a lifeline of Gujarat and justified by the "immense" benefits claimed on paper. These benefits however are inadequate to solve Gujarat's water and energy problems, and they are inequitably distributed. The SSP will not benefit most of the people of Gujarat even if successfully completed. On the other hand, Narmada water has the potential to solve Gujarat's water problem permanently by its proper use and equitable distribution.

3.1 Inadequate SSP Benefits

Gujarat's share of benefits are summarized in Table 1. The water benefits will be examined in detail later. Three observations must be made now : (1) The drinking water benefit of 1 MAF is only 12 percent of the total quantity of 9 MAF SSP water. This is less than 1 percent of the total average rainfall. Several times more than this quantity of rainwater is going to waste and can be collected at a fraction of the cost to be incurred in the pipe network that will be required to supply SSP water to 8,215 villages and 135 urban areas. (2) The remaining 8 MAF or 88 percent water is allocated to irrigation. This project is primarily an irrigation project. It will provide irrigation benefits to only 3,393 villages out of 18,273, will benefit a population of only 4.56 million or 11 percent of the total popultion, and irrigate only 15 percent of the cultivable area while over 60 percent cultivable area is in need of irrigation. (3) The net power benefit for Gujarat is negligibly small.

A project with such a limited agriculture and power benefit in a drought prone state with serious water shortages and watershed degradation cannot be called its lifeline.

3.2 Inequitable Distribution of Irrigation Benefit

3.2.1 Protective Irrigation vs Water-Intensive Irrigation

The World Bank has documented serious problems with the past dam projects in its India Irrigation Sector Review (IISR). It states that with "rare exception, there is no justification in the medium term for new surface irrigation investments"[4d]. Among the rare exceptions is the Narmada project for which the Bank finds a "compelling justification" for "irrigation development in water-deficit" Gujarat state. The Bank does not go beyond this "water-deficit" argument to assure that the water of Narmada is indeed going to the "water-deficit" regions of the so-called water-deficit state. Similarly, the sole justification given by proponents of SSP in Gujarat for importing water from the SSP is that most of the state is "drought prone".

The fact that Gujarat is drought prone or water-deficit is not sufficient in itself to justify importing water from the SSP. It should be first demonstrated that locally available surface and underground water resources are productively and optimally utilized. Then a clear case must be established for the quantity of imported water needed for "protective" irrigation, that is, to overcome the water deficiency during deficient rainfall periods to protect rainfed crop from failure. This has not been done by the Bank or the Gujarat government. Instead, the present design of SSP seeks to arbitrarily distribute the bounty of 8 MAF water at the rate of 21 inch per unit area to only 15 percent of the state's cultivable area for "water-intensive" irrigation regardless of the rainfall in the region or the need. There is no technical justification for the present water distribution of the SSP.

3.2.2 Unacceptable Use of Narmada Water

The SSP is justified by the proponents [1c] with a claim that 74% of the area receiving irrigation benefit is "drought area" as defined by India's Irrigation Commission in 1972 [13d]. This is a misleading statement because the proponents are using the less severe of two

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4d is Reference 4(d) in Section 12, References on Page 48.
The author regrets that not all references in Section 12 are cross-referenced in the text.

definitions issued by the Irrigation Commission to classify areas subject to droughts as explained below :

The "drought areas" are areas that receive 25 percent or more deficient rainfall once every five years.

The "chronically drought affected areas" are areas that receive 25 percent or more deficient rainfall twice in five years, instead of once in five years.

The first definition is only a measure of minimal scarcity conditions. It merely establishes a lower limit of drought condition, beyond which rainfed agriculture should be able to absorb the variation of rainfall. 25 percent deficiency or more only once in five years is not a very strict standard. By that definition many areas of the world would be called drought prone. This does not mean all such areas should be given 21 inches of imported water for irrigation. If an area is classified as a drought area by this definition, it only means that the rainfed agriculture cannot survive during the drought year, and protective irrigation to overcome the deficiency is justified. This definition does not justify indiscriminate import of large quantities of water to an area classified as drought area for water-intensive irrigation.

The proponents of the SSP have ignored the second definition issued by the Irrigation Commission because it does not help justify the present distribution of the water. The SSP canal command area is shown in Figure 2 along with a table that correlates the command area with irrigation needs and the rainfall information from Figure 1. The table in Figure 2 also identifies the category of drought area of each region of the state and the command area. 26% of the command area is not at all drought area, 51% is drought area, and only 23% is chronically drought affected area by the Irrigation Commission's definitions. There is no technical justification for giving 79% of the imported water to areas of Gujarat that are either not drought areas at all or merely drought areas, and giving only 21% to areas which are chronically drought affected. Considering the state as a whole, the chronically drought affected areas to be served by the SSP constitute only 3.5% of the total cultivable area of the state, while they represent 73% of the area of the state and 62% of the population. The SSP does not solve water problem of water-deficit or drought prone state of Gujarat.

The Irrigation Commission has gone even further and established "priorities for the different uses of available limited quantity of waters". Briefly, the priorities of water uses are as follows : (1) Drinking water use of human beings and domestic animals (2) Employment generating uses for the drought affected people (3) Uses for grass farming, tree farming, animal husbandry like sheep, pig, and poultry farming (4) Uses for growing hard food crops which can survive long spells of dry weather.

The Irrigation Commission did not assign any priority to commercial food crops and cash crops which are expected to be grown in the SSP canal command area. There is no evidence in the SSP design that it complies with the full requirements of the Irrigation Commission. The project should be redesigned to comply with the full requirements of India's Irrigation Commission.

3.2.3 Rich Farmers Benefit More than Poor Farmers

The Gujarat government justifies the SSP because it will benefit the marginal and small farmers, whose number among the beneficiaries is claimed to be 54 percent [1c]. The definition of small and marginal farmers is not given but is hectare or 2.5 acres. The irrigation projects are highly subsidized. The beneficiaries do not pay for cost recovery nor the full cost of operation and maintenance. Farmers do not pay income taxes on their agriculture income nor any indirect taxes. So the benefit derived by farmers is directly proportional to their land holding. The land ownership in India is highly skewed in favour of a few owning most of the land. In Gujarat, the land ownership is distributed as follows [20]:

Range of Farm Size (Hectares)	Percent of Farmers (1)	Percent of Land (2)	Benefit per Farmer (2)/(1)
1. 1.0 or less	24.2	3.7	0.15
2. 1.0 to 3.0	43.9	29.2	0.67
3. 3.0 to 4.0	10.1	10.1	1.00
4. 4.0 to 10.0	16.0	32.2	2.00
5. 10.0 or more	5.8	24.8	4.27

Average size = 3.5 Hectare Number of Farmers = 2,930,130 Total Area = 10 mil.Ha.

The government's claim that 54 percent of SSP beneficiaries are marginal and small farmers is not backed up by any detailed breakdown of the beneficiaries as above. The land-holding data in the command area should be similar to the above statewide data which are used to determine the percent of benefit received by the marginal and small farmers. Taking the top 20 percent as "rich" farmers (lines 4 and 5 in the above table) and the bottom 20 percent as "poor" farmers (line 1), it is seen in the above table that the rich farmers together receive 57 percent of the benefit and the poor farmers receive 3.7 percent of the benefit. Assuming that the government has specially targeted the poor to receive the SSP benefits raising their numbers from 24.2 percent to 54 percent, their share of benefit will go up from 3.7 to about 9 percent without significantly reducing the benefit derived by the rich farmers. The government has not claimed that the poor receive 54 percent of the benefit, merely that their number is 54 percent. Such a claim misleads people who are not adapt at numbers and statistics. This is another example of an attempt to justify the project using partial information as was the case with the use of less severe definition of "drought areas".

Access to development funds should be equal for all farmers. The NGOs have succeeded in implementing this development principle by providing equal rights to water for all including the landless, thus creating marketable water rights and reducing the disparity between rich and poor. The SSP will achieve the opposite result of what the country needs; it will make the rich richer and the poor poorer.

The opponents of SSP have not objected to Gujarat getting its share of Narmada water. The opponents have merely objected to the human and environmental costs of the present design of SSP and the inequitable distribution of water for profit-making agriculture. The project needs to be suspended and redesigned to assure equitable distribution of Narmada water for restoration of degraded watershed and depleted groundwater.

Table 1 : Summary of SSP Benefits for Gujarat State
(References 2,10,13)

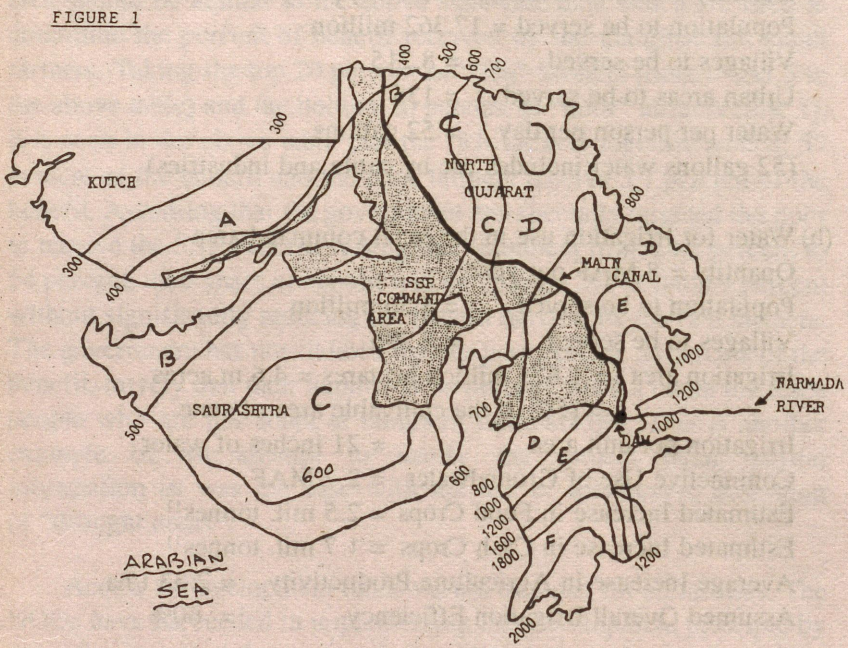
(a) Water for Domestic and Industrial Use :
Quantity = 1 million acre-foot (MAF) per year
Population to be served = 17.362 million
Villages to be served = 8,215
Urban areas to be served = 135
Water per person per day = 52 gallons
(52 gallons water includes use by cattle and industries)

(b) Water for Irrigation use in the canal command area :
Quantity = 8 MAF per year
Population to be served = 4.56 million
Villages to be served = 3,393
Irrigation area = 1.875 million hectares = 4.6 m.acres
= 15% of the cultivable area of state
Irrigation per unit area = 21 inches of water
Conjunctive Use of Groundwater = 2.7 MAF
Estimated Increase in Food Crops = 2.5 mil. tonnes[11]
Estimated Increase in Cash Crops = 1.7 mil. tonnes[11]
Average Increase in Agriculture Productivity = 2.33 t/ha.
Assumed Overall Irrigation Efficiency = 60%

(c) Gujarat's Share of Gross Power At the Dam Site :

16 percent of 3,640 GWH/year [10b] or 582.4 GWH/year for the first thirty years and 104.0 GWH/year thereafter. The above two numbers are equivalent to continuous power production of 66 MW and 12 MW respectively. The net power, after deducting the transmission losses, and usage for pumping of canal water at low points and for pumping groundwater for conjunctive use is not readily available and may well be a net loss and not gain.

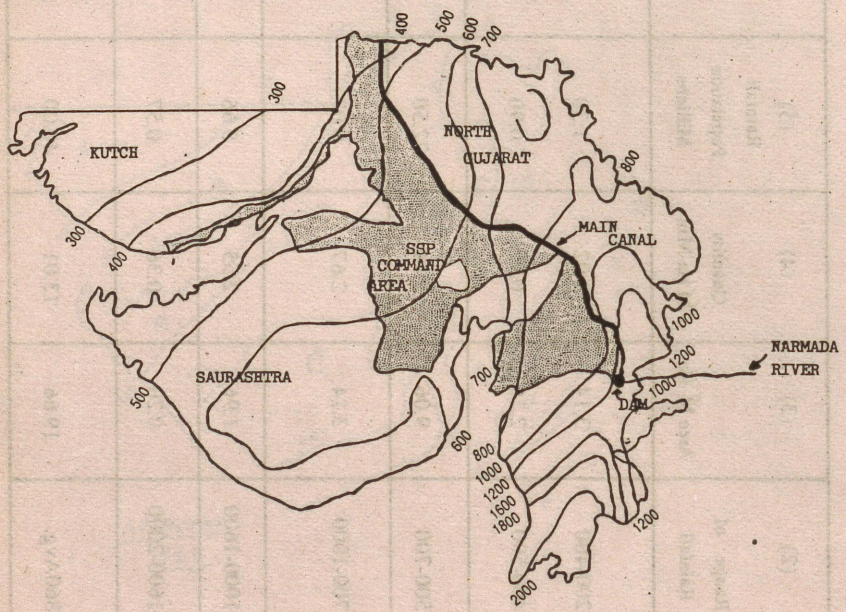
Figure 1
GUJARAT RAINFALL MAP



Irrigation Needs	Area Shown As	(1) Area of State	(2) Range of Rainfall	(3) Area M Ha	(4) Quantity M Ha-Min	(5) Rainfall Population Millions	(6) x (4) (5) Per Capita Rainfall/Day Liters-Gallons	
Exceptionally High to Very High Need	A	16%	200-400	3.14	1.02	1.30	21,496	5,650
	B	11%	400-500	2.16	0.97	0.90	29,528	7,812
High Need	C	46%	500-700	9.06	5.44	22.50	8,624	1,752
Moderate Need Moderate to Low	D	16%	700-1000	3.14	2.67	9.07	8,865	2,134
Need	E	10%	1000-1600	1.96	2.55	5.66	12,343	3,265
Low Need	F	1%	1600-2000	0.20	0.36	0.57	17,405	4,499
TOTAL	-	100%	860Avg.	19.66	13.01	40.00	8,900 STATE	2,357 WIDE

Figure 2
SSP Canal Command Area Rainfall, Need, and Benefit

Figure 2



SSP Canal Command Area Rainfall, Need, and Benefit

Irrig. Need	Average Rainfall mm	Drought Area Category	Area Under SSP ha.	Percent of	
				SSP Area	State Cultivable
Except. High	250-400	Chronic Drt.Area	0.0	0.0	0.0
Very High	400-500	Chronic Drt.Are	57,310	3.0	0.5
High	500-600	Chronic Drt. Area	370,060	20.0	3.0
	600-700	Drt.Area	752,370	40.0	6.0
Moderate	700-800	50% Drt. Area	413,970	22.0	3.3
	800-1000	0% Drt. Area	273,640	15.0	2.2

SSP Command Area avg. 683 mm, 1,867,350 100.0 15.0%

4

water inventory of gujarat

The SSP benefit of 9 MAF water must be examined in light of the total water inventory of Gujarat that consists of 105 MAF rainfall within the state's boundary and 5 MAF water collected in existing large reservoirs which comes from catchment areas outside the state. A rainfall map of Gujarat is shown in Figure 1 which divides the state into six regions from exceptionally high to low irrigation needs. The total average rainfall in the state is 105 MAF or almost twelve times the 9 MAF water to be imported from the SSP.

As seen in Figure 1, the most needy regions of the state are in the north and west, that is zones A,B, and C, where the average rainfall is less than 700 mm. Together the three areas include the regions of Kutch (A, and part B), North Gujarat (northern part of C) and Saurashtra (the balance of B and C). They represent 73 percent of the area of the state and 62 percent of the population. Zones D,E, and F, have rainfall higher than 700 mm and include the regions of mid and south Gujarat representing 27 percent of the area and 38 percent of the population of the state. Most of the water projects are located in the high rainfall areas of Zones D,E, and F, as shown below.

4.1 Reservoir Capacity in Gujarat

The reservoir capacity created in Gujarat since the Independence is shown in the following tabulation.[12]

Name or Type of Reservoir	Capacity Mil.Ac.Ft. (MAF)	Percent of Total
1a. Largest Reservoir Ukai (Zone E)	5.75	44%
1b. Next Ten Large Reservoirs	3.75	29%
1. 11 Large Dam Reservoirs	9.50	73%

2. 120 Medium/Small Reservoirs	2.52	19%
3. 922 Surface Reservoirs	0.98	8%
Total Reservoir Capacity	13.00	100%

Distribution of Reservoir Capacity By Region

Name of Region	Percent of Area	State's Population	Reservoir Dam	Capacity Surface
Kutch	16%	3%	1.8%	1.5%
Saurashtra	40%	40%	11.7%	2.5%
Remain.Gujarat	44%	57%	79.0%	3.5%
Total	100%	100%	92.5%	7.5%

The above information shows that of the 13 million acre-foot reservoir capacity created, 44 percent is in one large reservoir of Ukai. It was built with state funds belonging to all eighteen districts of Gujarat but serves only two districts where the rainfall is the highest in Gujarat and need of water the least. A World Bank report shows that Ukai reservoir's life will be one third of the design life due to high rate of siltation resulting in significant loss of investment. The eleven largest reservoirs represent 73 percent of the capacity, with 19 percent in medium/small reservoirs, and only eight percent in small reservoirs capacity is created in area of Gujarat with higher than average rainfall and only 14 percent in Saurashtra which suffers the most during droughts and recently even in normal years.

4.2 The Potential of Rainwater Harvesting

The 13 MAF reservoir capacity includes the storage of about 5 MAF water coming from outside the state boundary into the large reservoirs of Ukai on the Tapi river and Kadna on the Mahi river. That means, only about 8 MAF rainwater out of a total of 105 MAF falling within the state boundary is actually being collected. Presently most of the rainwater goes to waste. Moderate downpours lead to formation of scattered shallow ponds which evaporate in a short time and heavy downpour cause flash floods. With large scale implementation of decentralized small rainwater harvesting schemes, it would not be difficult to collect 20 percent of the rainwater or 21 MAF. This means almost 13 MAF rainwater or 1 1/2 times the water to be imported from the Narmada river is not being collected.

An average estimate of potential of water use without the Narmada water benefit may be made as follows :

Rainwater collection potential	21 MAF
Out of state water colected in existing reservoirs	5 MAF
Estimated groundwater recharging or resource [13a]	14 MAF
Total potential water use without Narmada	40 MAF

It is often claimed that during the frequent drought years the reservoirs do not get fully filled up. So even taking the worst case scenario of available water during such years as 50 percent of the average, the available quantity of water becomes 20 MAF. Distributing the above total quantity equitably to the population of 40 million, the potential per capita use of water per day comes to 450 gallons during a drought year. This per capita potential of water use is about twice the per capita use of water in Israel [14], and more than the per capita use of water in the rest of India, China and the U.K., and not much less than the use of water in Japan. [15a]

Taking only the existing storage, without the additional potential of 13 MAF, the total water use without Narmada during an average year is 27 MAF. Again, taking only half of this amount for the worst case scenario of a drought year, the available quantity of water becomes 13.5 MAF. Distributing this quantity *equitably* to the population of 40 million, the per capita use of water per day comes to 303 gallons, during a drought year which is more than Israel's per capita use. While in reality, during a drought year, people in large areas of the state do not even get 25 gallons per person per day, and small and marginal farmers fail and move to urban areas. This is because, the present water use is not equitable. A large population of the state has lost access to groundwater due to its depletion during the last forty years as discussed in Section 5.

4.3 Drought Proofing before Narmada Water

Gujarat can learn from Israel about how to deal with scarcity conditions. Israel has equally unreliable rainfall. Israel does well with half the Gujarat's rainfall. Israel's population density is slightly higher than Gujarat's, its desert region is 60 percent of the total which is far larger than Gujarat's desert region of 16 percent (zones A). Israel's per capita use of water is half of the potential rainwater use in Zone C of

Gujarat. Israel does not experience either the flooding or acute scarcity because of proper utilization of rainwater. Israel's live storage capacity is calculated as 150 percent of the average annual collectible rainfall based on a 15 year cycle that includes consideration of consecutive moderate drought years and wet years. The 15 year cycle also includes years of severe deficient years and surplus years. Such a comprehensive water resource planning does not exist in Gujarat.

It is a greater engineering feat to provide water to *everyone* in the state during the severe drought using the rainwater collected during previous wet years than to build SSP. Mahatma Gandhi's ideals of equity and self-reliance are not to be found in Gujarat's water planning to date nor in the SSP. Sardar Patel's common sense and native wisdom are not to be found in the present design of the SSP. Instead, their political descendents are building SSP with the help of the World Bank staff and consultants, Swiss engineers, German cranes, Toshiba turbines, American computer systems, huge amounts of borrowed money, and in the process, displace thousands of people, deprive millions of their share of development funds, divide the country along the regional lines, and enrich a few farmers.

Gujarat has the talent and the resources to solve its own problems. According to a state irrigation engineer [13b], "the crop failure during drought years is due to mainly the failure of rainfall hardly amounting to 50mm during the critical stages of growth of crop. This failure of rains at critical period results in near to total failure of crops. This situation can be saved if farm ponds can be planned where it is economical". An equitable distribution of 50 mm or 2 inches of water to each farmer for drought proofing will require only 5 MAF water which is less than half of the existing reservoir capacity.

It is seen above that Gujarat's problem is not droughts or the shortage of rainwater but of means to store the runoff when it rains and the lack of equitable distribution of available water. As a first step in any comprehensive plan for drought proofing of the state, simple labor intensive rainwater harvesting schemes need to be implemented in villages and farms throughout the state. Instead, the Gujarat government has created capital intensive large and medium dam reservoirs for the past forty years. Experience of non-governmental organizations in Gujarat and other drought prone regions in India show that the only way

equitable distribution of irrigation benefits is possible is by people's participation in the planning of irrigation projects, distribution of their benefits, collection of revenue for cost recovery, and operation and maintenance. Such an involvement of people at the grassroots level in water resource projects does not presently exist in Gujarat. It is a prerequisite to implement rainwater harvesting schemes, to restore the degraded watershed, and to restore the lost lifeline of groundwater.

The proponents of SSP claim there is no alternative for Gujarat but to bring in the Narmada water. The above water inventory of Gujarat shows that there is, and it is the rainwater in Gujarat; its proper collection, storage, equitable distribution, and efficient use.

5

the lost lifeline of groundwater -it must be restored

There are no perennial rivers in most of Gujarat. Historically it is not known how long this condition has existed. Although the natural recharge of groundwater may have declined over the years due to disappearance of forests and perennial rivers, people of Gujarat relied on groundwater during droughts. The limited withdrawal of groundwater by manual or animal effort, assured an equitable supply at relatively shallow depth for all farmers and villages during droughts. The groundwater was a lifeline of the drought-prone state of Gujarat.

5.1 The Lost Lifeline of Groundwater

The small farmers and villages in large number have lost their lifeline of groundwater. This is why there is a desperate water situation in Gujarat. At the time of Independence the number of villages in Gujarat without a permanent and reliable source of water was very small. Today 12,000 villages out of 18,273 are called "no-source" villages. The reason is not successive droughts as politicians and the proponents of the SSP often claim. The reason is excessive groundwater withdrawal with mechanized pumps by farmers who switched to water intensive agriculture with loans and credits provided by the government.

The groundwater depletion has occurred not only in Gujarat but all over India. The country as a whole is running out of groundwater due to over-exploitation. "Hydrologists note that the long-term effects are probably understood, but until the water disappears, it is hardly likely that anyone is going to do anything about the situation."[15b] To its credit, "Only Gujarat has passed legislation and that has yet to be enforced."[16]

In fact, this legislation has hurt the needy more than the greedy as is the case with most regulation in India. "Existing regulations have probably limited ground water access for those who can't afford private financing or don't have the pull to obtain illegal connections. They have done little to slow use by the wealthy. Since most wells are privately owned, regulations are difficult to enforce. They also have strong equity implications."[16]

Instead of owning up to this serious problem and dealing with it, the politicians under whose watch this happened were busy for the last thirty years in uniting the state behind the SSP. The suffering of people during droughts due to the loss of groundwater was used to gather support for the SSP. The depletion of groundwater was blamed on droughts. This tendency to connect short fall of rains to the lowering of groundwater levels is common among politicians who are unable to control the over-exploitation. One engineer felt compelled to address this view in an article [13c] as follows:

"Very often than not the failure of monsoon is connected with the lowering of the water table and also the cause leading to the drinking water crisis. The aquifer which develop over the thousand of years cannot be depleted merely due to the demand of drinking water. The avrice of man resulting in overexploitation of groundwater for so-called development of a region either through water intensive industries or cash crop has led to this crisis."

Another technical article[19] deals with this issue as follows:

"But then the question would arise why in recent drought years, the difficulties of drinking water has been on increase....the difficulties are on increase since Green Revolution in sixties. The Green Revolution was ushered in mostly by large scale activities of the Gujarat State Co-operative Land Development Bank Ltd. The Bank earned great reputation throughout India by its loan programmes to farmers for tube wells, dug wells, diesel and electrical pump-sets. The result has been there is over pumping and water levels are going down in many areas. Criteria for recharge for development of groundwater were adhoc in our State and elsewhere at that time and there were not such detailed investigations as available now. More over there is too much of private development for which there is no control. This phenomenon of decline in levels of groundwater has been at the root of the drinking water

problem which is becoming more and more serious in lean and drought years. Ingress of sea, polluting fresh waters in the coastal areas of Saurashtra and Kutch, wells going dry, tube wells getting defunct are some of the resulting phenomena which are obvious to see."

As a result of over-exploitation of groundwater for unsustainable irrigation and resulting lowering of water levels in wells, the number of no-source villages had risen to about[19] 4,000 in 1965, to 8,000 in 1980 and to 12,000 in 1987 affecting almost fifty percent of the state's population. In addition, the urban areas too suffer acute water shortages. The largest city of Ahmedabad, with its 4 million people, is entirely reliant on groundwater. In 1940s, the water table in Ahmedabad was 30 feet below surface, today it is over 300 feet. The groundwater related problems "threaten the viability of many communities. Institutions must be evolved that meet social requirements for management, are able to address the physical scale of resource problems, and rectify water use incentives"[16]. This issue needs to be addressed more urgently than completing the SSP.

The promoters of SSP have no plans to deal with this serious problem of groundwater depletion outside the canal command area (where drainage and salination problem will occur). During the construction of the new lifeline of SSP, more and more villages will become no-source, and more and more marginal and small farmers will lose their farms to the creditors and move to already overcrowded cities. A prominent citizen of Kutch region of Gujarat wrote a letter in June 1992 to the chief of SSP pleading for urgent help. He explained, "due to frequent droughts the groundwater levels have depleted such that if the present situation continues, within 4 or 5 years the groundwater will be completely depleted. So by the time the Narmada water arrives in Kutch there will be no water in the wells, no population in the villages, and no farmers to till the farms."[17] In addition to demanding much greater share of the Narmada water than is planned for Kutch, he recommended an incessant implementation of rainwater harvesting and groundwater recharging program for the next 15 years.

5.2 The Age-old Lifeline of Groundwater Must be Restored

The presence of groundwater aquifers and their yields are already known because the villages have existed for centuries on reliable groundwater supply. The best approach for water supply in Gujarat is

to promote groundwater recharge schemes with harvested rainwater and imported water (wherever justified) accompanied by groundwater control. Such a major decentralized statewide effort can only be undertaken by empowering villagers and municipalities to plan, implement, operate, and maintain their own schemes with technical and financial assistance provided at their request and to be paid for by the beneficiaries. Instead, the government tends to respond to the crisis by installing pipelines to bring water from another less depleted aquifer or by undertaking a project to bring water by canals from another watershed. The SSP is the ultimate folly.

The feasibility of providing imported Narmada water to villages and farmers by an extensive network of pipelines and canals has not been established. Providing piped water to every village or canal water to every farmer in Gujarat is not feasible. The area under cultivation is more than half the area of the state. The rural population is in 18,273 villages scattered throughout the 73,000 square miles area of the state. It is much simpler to recharge the groundwater aquifers and restore the use of wells under conditions of equitable, productive, and sustainable uses determined by the users themselves. The only successful program of groundwater recharging in the state along these lines was implemented by an NGO in Kutch in 1989 under the direction of a retired director of India's Central Groundwater Board. The conclusion on utilization of the Narmada water in Kutch was as follows.[18]

"Even the Narmada water allotted to Kutch is very meagre to meet the deficit water resources of Kutch district. It should therefore be utilized in a more beneficial manner to get the maximum benefit to the people. This water instead of allowing for flow irrigation, should be used for recharging the depleted aquifers of the coastal area by leaving it in the recharge structures being constructed, and used for meeting the water supply needs, both rural and urban, which will relieve great stress on the deep aquifers of the area which are being overexploited."

The experience of the NGO in Kutch showed that users can be brought together and involved in planning and implementing the rainwater harvesting and groundwater recharging schemes. The groundwater recharge component is essential to induce the users to come together and agree to the criteria of equitable, productive, and sustainable uses of water because, ultimately, the depletion of

groundwater affects everyone, including those who are not presently affected. Kutch is the region of Gujarat with the least amount of rainfall and yet the rainwater harvesting and groundwater recharging schemes of the NGO succeeded when undertaken under the direction of competent engineers. The same approach can succeed in the rest of Gujarat.

In conclusion, appropriate control and usage of the uncollected rainwater, the rainwater collected in existing reservoirs, and the water coming into the state in the two large existing reservoirs is sufficient to solve the water problem of Gujarat in a relatively short time. If in the context of such comprehensive water planning, it is determined by engineers that water import from the Narmada is inevitable, supply of water from a redesigned Narmada project may be considered. But any import of water from any Narmada project must be justified against the substantial long-term gains throughout the state that would result from restoring the age-old lifeline of groundwater and from restoring the environment to its natural state from the degraded one of the present.

6

the outdated design of the narmada project

The planning for the Narmada project began in the early fifties. The project was held up in a long dispute between the three state governments so the construction began only in 1985. However, the present design of the project is rooted in the idea of irrigation development that existed in the fifties. Although the Narmada project is called the Narmada River Valley Development, the development of the entire watershed is not planned at all because, in the fifties, irrigation development meant dams and canals, not watershed development.The design of the Narmada project is now outdated in light of the extensive deforestation and other degradation of the watershed of the river that has occurred in the last forty years.

The development of the Narmada river basin ought to have begun with development of the degraded land to prevent excessive runoff, then by dams starting with small upstream dams first, then medium dams, and the large and megadams only if justified by the hydrology of the basin. Under such a sequence of development and implementation, the remaining project could undergo necessary revisions during its long construction period as more data would become available about the region's hydrology, geology, forests and vegetation, and many other parameters which at the initial design stage are merely estimates based on limited investigations, surveys and data. The river basin is very large, about 38,000 square miles and densely populated, by about 18 million people. Small dams, with practically no adverse social impact, may be environmentally beneficial if properly located and accompanied by watershed development. The 3,000 small dams represent, on the average, only 13 square miles and 6,000 people per dam. Starting the

project with watershed development and then the small dams would have meant social acceptance of the project and a chance to get the people involved who know their land and needs better than the outside planners.

The lack of technical justification for the present design is evident in the following statements from the World Bank Technical Paper Number 110, Dams and the Environment, Considerations in World Bank Projects, 1989 : [9]

"More than 90% of the river's average annual flow of about 41,000 million m^3 occurs during the monsoon season (June through September), so that effective use of its water resources can only be achieved through storage of the flows in reservoirs."

"The creation of large storage facilities is considered a sine-qua-non for harnessing the river's flows."

These quotes aptly sum up the design approach. First it is observed that 90% of the river's annual flow occurs in the three months of monsoon and is not effectively used or is wasted to the sea. Then from this observation, two assertions are offered as a self evident solution from which the present design of the Narmada river basin development, involving two large reservoirs, has evolved. This leap from observation to a solution leaves out the field of engineering altogether from the design process. The design based on such assertions requires careful analysis.

The underlying problem in the above observation is the nature of the observation itself. It is a partial observation. It is more accurate to observe that much of the 90% of the river's flow occurring during the three monsoon months occurs in only a few days during a few severe storms. These flows actually carry not only water away into the sea but also the more valuable silt. Both, the rapid build up of the flow and the silt laden waters, are indicative of severe erosion in the basin. Clearly, the need of the Narmada river basin is to control the flow, reduce erosion and not to impound water in large reservoirs. This more complete observation leads one to a different objective of the project. That objective would be to arrest the flow where it begins, in the degraded catchment area to conserve soil and water.

It would not be a difficult task at all to conserve soil and water in the catchment area. The basin area is about 10 million hectares from

which the 41,000 million m^3 flows originate. This flow amounts to a quantity of only 0.41m or 1.35 foot per unit area. This water can be easily stored underground and in deep surface reservoirs distributed throughout the catchment area if proper flood control and soil and water conservation measures are implemented. More than half the area of the valley is under cultivation. The river basin is populated by 18 million people and the population density is as high as Gujarat. The needs of the river basin people should be satisfied first, before diverting water out of the basin. They can be mobilized to undertake massive reforestation and catchment area development work. The water would then be detained long enough for more productive use by the people in the basin and also control the river flow.

The World Bank's awareness of the problem of the environmental degradation of the river basin and its willingness to help deal with it are evident in the following statements from the same paper[9] mentioned above:

"Given the ongoing trend of forest destruction, the forests of the Narmada valley may not have too many years to survive unless urgent remedial action is taken which addresses the major causes of deforestation and land degradation. Under the proposed Narmada Sagar Project, the Bank would support efforts designed to help reverse the trend of ongoing environmental degradation".

The above statements contain a basis for the redesign of the Narmada project. The watershed development must be the primary objective of the project and it should not be linked to the need to control siltation in the two large reservoirs. The watershed development must be linked to the needs of the degraded watershed and impoverished people of the river basin. The present design objectives of impoundment of water in large reservoirs for extra-basin transfer of the river water are inconsistent with the needs of the degraded environment and impoverished people of the river basin. A reordering of the project objectives and a complete redesign of the project is necessary.

7

unsustainable irrigation development in india

India's race to remove poverty through a centrally planned, capital intensive, large-scale development program is being lost. While pockets of affluence have been created, the country as a whole suffers increasing rural and urban poverty, overpopulation and overcrowded cities, and continued environmental degradation. According to one Indian expert in water, irrigation and sustainable development, the "carrying capacity of the degraded rural ecosystem is insufficient to meet even the bare subsistence needs of the rural population, and consequently, rural poor are obliged to migrate seasonally or permanently for jobs"[3] to the urban areas. The continual migration of poor villagers to the cities has resulted in the growth of slums. The presence of vast areas of slums engulfing pockets of affluence in the cities is a living proof of failed development policies. It is this recognition of failure of SSP style irrigation development projects that compels a re-examination of the Narmada project.

7.1 The Poor Performance of India's Irrigation Sector

The World Bank has played a major role in developing the irrigation policy of India since the Independence in 1947. This policy emphasizes higher productivity per farm by water-intensive irrigation requiring similarly high inputs of fertilizer, pesticides, energy, technology and capital. Almost 90 percent of the irrigation investment in the public sector has been in the major and medium (M&M) dam projects. The poor performance of M&M projects in India is both visible in the field and documented in various studies. The Bank's 1991 India Irrigation Sector Review (IISR)[4] is one such study that reveals that the irrigation sector in India is *in crisis*. Problems are identified in four

areas: productivity is low, operation and maintenance costly and unsustainable, lack of capital cost recovery and profitability, and poor management.

The Bank attributes this poor performance not to its own flawed policy but to its poor implementation by an inefficient and corrupt bureaucracy in India unable to work with world-class technology. The Bank and the Indian government have not investigated whether the policy itself was flawed and not its implementation. A careful evaluation of the Bank's IISR indicates that it is the "high external input" policy, not its implementation, that has failed. It was a poor imitation of a policy that was seemingly successful in the U.S.. This irrigation policy has failed in India because it was not well thought out to reflect the completely different environmental, demographic and meteorological conditions in India.

As a result of following the water-intensive irrigation policy the irrigation benefits have not reached a large number of farmers as seen in the following table.

India's Irrigation Planning

Type of Irrigation	Method of Irrigation	% of Area Under Cultivation		Present Status
		1950	1985	
1. Modern of Water-Intensive	Dam/Canal	5.9	11.3	Unsustainable
10 to 60 inches	Tubewell	0.0	8.1	Unsustainable
	Sub-total	5.9	19.4	Unsustainable
2. Traditional or protective	Tanks	2.6	2.4	Neglected
Irrigation	Dugwells	4.3	6.2	Many Defunct
2 to 10 inches	other	2.1	1.8	Neglected
	Sub-Total	9.0	10.4	Neglected
A. Irrigated Agriculture Total		14.9	29.8	In Crisis
B. Rainfed Agriculture		85.1	70.2	Neglected
	Total	100.0	100.0	

In 1950, the farm area covered by irrigation was 14.9%. In 1985, after thirty-five years of the present policy, only 29.8% are is covered

by irrigation and 70.2 % area remain at the mercy of unreliable monsoon. Due to rapidly depleting groundwater resources and unsustainable surface irrigation schemes this gain may be lost unless a major overhaul of the policy is undertaken.

7.2 High Siltation Rates of Dam Reservoirs in India

The substantial differences in demographic, economic, environmental, geographical, historical, and cultural conditions of the two countries were not given much consideration in the design and planning of large dam projects. No attempt was made to examine alternative decentralized scattered in many villages. The causes of recurrent droughts and floods were not examined to develop lasting solutions that remove those causes. The causes of poverty were not examined with a historical and cultural perspective so as to provide the people the means to remove their own poverty by proper management of their own land, water, and energy resources.

The effect of unexamined transplant of Western technology in the Indian setting is evident in the high siltation rates of Indian dams. World Bank Technical Paper Number 127, Watershed Development in Asia[7] provides siltation rates of eight dams in India with the following statements:

"The deposition of eroded material in reservoirs and irrigation systems is a major management problem throughout the region, yet a relatively small percentage of the total number of watersheds have such infrastructures. It is clear that sedimentation imposes a high cost in terms of shortened investment life, high maintenance requirements and reduced services.... Comparisons of the design and currently estimated lives of reservoirs in India show that erosion and sedimentation are not only severe and costly, but accelerating (Table 1.6). It is now obvious that the original project estimates of expected sedimentation rates were faulty, based on too few reliable data over too short a period." Table 1.6 of the World Bank Technical Paper is reproduced below:

Table 1.6: **Siltation of Selected Indian Reservoirs**

Reservoir	Assumed Rate	Observed Rate	Expected Life as percent of Design Life
	(acre-feet per annum)		%
Bhakar	23,000	33,475	68
Maithon	684	5,980	11
Mavurakshi	538	2,080	27
Nizam Sagar	530	8,725	6
Panchet	1,982	9,533	21
Ramgange	1,089	4,366	25
Tungabhadra	9,796	41,058	24
Ukai	7,448	21,758	34

The above table should have included figures on the assumed ratio of benefit/cost and the actual ratio to dramatize the fact that these projects have not been beneficial for India. The last reservoir in the table, Ukai, is in Gujarat, less than fifty miles south of Sardar Sarovar. It too was World Bank-funded. The table above shows that its expected life is only a third of design life. It is the largest reservoir in Gujarat and represents 40 percent of the total reservoir capacity created since the independence in 1947. It represents a major investment and a significant loss. Who in the World Bank is accountable for this bad investment decision? After this track record, it is irresponsible of the Bank to promote a project that is three times larger with promises of doing better this time. Instead, it is high time that the Bank and the Indian government recognize (a) the lack of technical feasibility and economic viability inherent in large dam projects in the degraded and heavily populated watersheds of India and, (b) the need for development of degraded watersheds for re-establishing the common resource base of water, fuel, food and fodder that was lost in the recent past by protective irrigation.

7.3 Water-Intensive Irrigation Dictates Large Dam Reservoirs

The water-intensive irrigation policy of the Bank and the Indian government calls for large amounts of irrigation water, sometimes as high as 60 inches to maximize the production per acre with similarly high inputs of pesticides, fertilizers, energy, technology and capital. It dictates that water be brought from a source outside the farm's local watershed, because the average rainfall of 20 to 40 inches cannot provide that high quantity of irrigation water. This is possible only by

transporting water to the farms by long canals originating at a distant large dam reservoir. The Bank's policy, not the unreliable monsoons, thus created the need for the dam reservoirs in India. The technology to build large dams obviously did not exist in India so it was imported from the U.S.. This was followed by similar import of other technologies for producing fertilizer, pesticides, tractors, pumps, generators and so on. This policy created a whole new market for the Western products and technology. A farmer has no role to play in this development scenario other than move out if he is in the way of a dam or a canal or wait for 25 years for the bounty of water promised by the planners. This policy has not worked because it is inconsistent with the demographic conditions of India.

The population density of India is about one person per acre or ten times that of the U.S.. The population is scattered in several hundred thousand villages. The total cultivated area is 43 percent of the land area. About 75 percent of people depend on the agriculture sector for their livelihood which include 80 percent of India's poor. The fact that after forty-five years and massive development funds expended on the M&M projects so much poverty remains in India points to a need for the overhaul of irrigation policy. The average farm size of about 8 acres is very small. Although the disparity in land holdings is very high, (the bottom 25 percent of farmers holding less than 4 percent of land, the top 25 percent holding 60 percent of the land) the average farm size of the large farmers is only 40 acres. These small farm sizes and extensive cultivation of the land dictate a policy quite different from the policy that may work in the sparsely populated U.S. where even small family farms tend to be over 100 acres.

In India, the availability of manual labor per acre is higher than in the U.S.. So the policy for India must emphasize reliance on manual labor and minimize dependence on machines. Similarly, in India the acreage under cultivation is very high. So the policy must emphasize wider distribution of scarce resources such as fertilizer, water, energy and capital to cover maximum acreage. In human terms, it means all farmers should be helped by the irrigation policy not just a favored few; that is, the benefit should be equitably distributed. The irrigation policy therefore cannot be based on the Western objectives of maximizing inputs for maximum production (or profit) per acre, but on the Gandhian principles of equity and self-reliance.

In short, the past agriculture performance cannot be sustained in the future, and the country's irrigation practice of high external input monocropping agriculture needs to be re-evaluated. The reason for the lack of cost recovery is that most of the farmers cannot afford the expensive external inputs. They have lost control of their farming because they are being controlled by those supplying the external inputs. It is this irrigation practice that leads to all other problems cited in the Bank's IISR. In spite of these problems accumulated for over forty years, the Bank does not propose a new approach to irrigation and energy planning. The Bank appears merely interested in rescuing the investment in the failed approach rather than a fresh start. The first statement of the IISR is: "In many respects Indian irrigation is at a crossroads". However, the Bank is not taking another road, that of sustainable agricultural development, but promoting the same unsustainable irrigation development policies with technological and management fixes. Continuing on the path of failed approach by technological and management fixes will not rescue the M&M projects and serve the other eighty percent of farms. Indian experts outside the government and involved with alternative irrigation and energy strategies are not as optimistic about continuing on the same path. "A dead end seems to have been reached in the process of increasing food productivity by extending areas growing high yielding crop varieties requiring large inputs of water, chemicals and energy."[3a]

India's demography requires that more emphasis be placed on expanding the traditional irrigation practice of low level of external inputs so as to provide benefits to all the farmers. Based on experience in China and of many non-government organizations (NGOs) in India it is known that low external inputs provided equitably to all farmers will in the end show higher aggregate inputs provided to a few farmers for higher productivity and profitability per farm.

The above detailed review of the Bank's irrigation policy illustrates the flawed irrigation benefit of SSP. The SSP will provide 21 inches of water to only 15% of the cultivable area of Gujarat at a time when 60% of the area is under rainfed conditions in need of 2 to 6 inches of protective irrigation. The areas under canal irrigation are faltering, and the areas under groundwater irrigation are rapidly losing the resource. The state's limited funds are better invested in providing protective irrigation to all farmers from the existing sources and by

undertaking statewide decentralized schemes of rainwater harvesting, groundwater recharging, afforestation and other measures of soil and water conservation. This has not been done in the past forty years which is why there is water scarcity in Gujarat.

7.4 Meteorological Conditions Dictate Protective Irrigation

Most of India receives rain in one season, the monsoon. Although the average rainfall of 40 inches in India is higher than the global average of 30 inches, the one-season rain is highly unreliable. If it does not rain at a critical period of the crop for want of only 2 inches of irrigation water. This is the main reason for the poverty of India's farmers and for India's food problem. So the irrigation need exists not because the rainfall is insufficient but because the rainfall is unreliable. The quantity of protective irrigation water required to protect a farm from a total failure may be 2 to 10 inches depending on the total average rainfall and its reliability.

Such protective irrigation is required by most farmers in most parts of India, including Gujarat, irrespective of the quantity of rainfall due to the unrealiability of the monsoon. It is not difficult to provide such protective irrigation by traditional irrigation methods that rely on locally available water resources such as farm ponds, village ponds, groundwater, lift irrigation from rivers, small reservoirs behind check dams or small dams. The principle behind the traditional protective irrigation is very simple, conserve the water where it rains and when it rains, for use where and when it is needed. The principle is technologically sound as well because it seeks to store rainwater as close as possible to where it first falls and as close as possible to where it is needed thus minimizing energy required to transport the water from where it is to where it is needed.

The methods employed to keep these local water resources replenished with rainwater are simple too. Decentralized projects of watershed development, rainwater harvesting, groundwater recharging, afforestation required to check and channel the runoff for local storage and use all required direct participation of beneficiaries because they are labor intensive. The government has no choice but to involve people. They are low cost and low-tech projects. Men, women, and youth can be trained to implement the project. An element of self-reliance gets introduced in the process rather than reliance on imported technology, foreign experts, and large amounts of borrowed money as has been the case with the Bank-funded M&M projects.

8

unsustainable agriculture benefit of SSP

The SSP is exempted in the Bank's IISR from any criticism on the four areas of concern expressed for other projects: low productivity, unsustainability, lack of cost recovery, and poor management. The SSP is in fact praised as a model for other projects to follow in rectifying deficiencies in these four areas. The IISR furnishes no insight into this optimistic evaluation of SSP. The World Bank staff has consistently taken a favourable view of the SSP without an in-depth review. As is now evident from the Morse commission report, the Bank staff has accepted the assurances and assertions of project authorities in assessing the SSP. For example, the IISR takes a positive view of SSP on the issue of resettlement and rehabilitation and environmental impact yet the Morse commission found such serious flaws that the Indian government chose to withdraw the loan application than subject the project to a further scrutiny. It is with this background that the technical aspects of SSP require a closer scrutiny to see how the four issues of productivity, sustainability, cost recovery, and management are addressed.

The issue of poor management is dealt with in the SSP by a clever management fix. The project is taken out of the inefficient and corrupt Irrigation Department under the control of state legislature and assigned to an autonomous authority outside the democratic control of the state government. The Morse commission report makes it abundantly clear that this authority failed to implement the non-technical issues of resettlement and rehabilitation. As to the technical issue of environmental impact assessment and amelioration, the Morse commission report is most unsparing in its criticism of the project. Statements such as, "There appears to have been institutional numbness

at the Bank and in India to environmental matters", and "well after canal construction and started...we did not expect to find so many deficiencies, inconsistencies, and contradictions in basic information...", fill the pages of the report. It is not possible to accept that this clever management fix for SSP will result in more efficient management of the project than documented by IISR for other projects.

The issue of low productivity is dealt with by a clever technological fix. This technological fix is the state of the art computer system that will automatically control water delivery on a volumetric basis and thus raise the productivity from a "low" productivity achieved in other projects in Gujarat to a "good" productivity achieved in Punjab. This is further discussed in Section 8.1 to show that the project cannot be justified without this clever technological fix.

The IISR does not deal directly with the issues of sustainablity and cost recovery for SSP but using the data of the IISR, it is shown in Section 8.3 that the SSP is not likely to be profitable. Cost recovery and sustainability will be as serious problems as on other projects. The issue of long-term salination problem is not addressed at all as discussed in Section 8.2. In short, the SSP is cast in the same mold as the past irrigation projects and the agriculture benefit will remain unrealized for SSP as it was with other projects.

8.1 Deeper into the Dead End with SSP

The SSP is an unscientific attempt to overcome the dead end reached in Gujarat in expanding the irrigation sector. According to the World Bank's IISR, the crop productivity in India may be classified as follows: (a) "very low" for rainfed farms because of unrealiable rainfall, (b) "low" for canal irrigated farms everywhere except Punjab, because of "suboptimal distribution of water (timing, reliability, and spatial distribution)" [4f], (c) "good" for canal irrigated farms in Punjab because of supply-based "warabandi" (rotation) system of volumetric water distribution coupled with access to groundwater [4g], and (d) "good to excellent" for farms irrigated through private tubewells or dugwells because farmers have the control of timing and distribution of irrigation water.

The above qualitative classifications of productivity are quantified for the productivity for cereals (in units of tons per hectares) as: (a) 0.8 for rainfed farms, (b) 2.0 on the average for canal irrigation, (c) 3.0 at

most per crop for canal irrigation in Punjab, and (d) 4.0 for groundwater irrigation. The last three figures are for the high input monocropping agriculture which has been the center piece of irrigation planning in India. In comparison, with low level of inputs the Chinese "have extensively attained yields of 3 to 5 tons of grain/crop/ha."[3b] Clearly, there are three avenues open for raising the productivity: (1) to raise the productivity to at most 3 t/ha by following the Punjab model of high external input and volumetric delivery, (2) to follow the Chinese model of low level of inputs to raise the productivity to 3 to 5 t/ha and at the same time increase the area receiving irrigation, thus raising the total output even more, (3) to follow the same Chinese model but with giving access to groundwater to all farmers coupled with program of groundwater recharging. Strangely, the SSP follows the Punjab model rather than the third option that is most suitable for India.

Table 3 shows how the 21 inches of irrigation water augmented by another 6 inches of groundwater per unit area may be used "to have maximum project benefits."[10f] The table shows that cash crops, paddy and wheat together will use 78% of the water; the traditional drought resistant crops of coarse cereals, groundnut, pulses, vegetables will use the balance of 22%. The overall irrigation efficiency assumed is 60% which is the reason why the productivity will be raised from "low" to "good". That is, the increase in productivity of 1.2 t/ha (from 0.8 to 2.0 t/ha) achieved in other projects in Gujarat will be raised to 2.33 t/ha by the computer system in SSP which assures the volumetric delivery of water. The IISR dwells at length on this issue because the Bank is promoting this technological fix for other projects in India to raise the productivity from "low" to "good".

The SSP's benefit to cost ratio of 1.99 is based on this assumption of doubling the increase in productivity from 1.2 to 2.33 t/ha. The project cannot be justified by the past performance of other projects in Gujarat, because the increase in productivity of only 1.2 would reduce the benefit to cost ratio to about 1.0. So without the volumetric distribution of water, the doubling in productivity cannot be justified, and the project cannot be justified. Rather than changing the irrigation policy from that of water-intensive irrigation to protective irrigation, the Bank is promoting this expensive technological fix of an imported computer system to be paid for by the money borrowed from the Bank.

There is no basis for the assumption of 60% efficiency or doubling of the increase in productivity because the SSP does not replicate the Punjab's successful "warabandi" system. Attempts to introduce warabandi in eastern and central India have mostly been unsuccessful because farmers there do not have the training and discipline of Punjab's farmers to successfully maintain the rotation and not take water out of turn. In addition, for the SSP it is claimed that the "manual operation of large canals lacks capacity to respond quickly to variations in demand and many a time there will be late deliveries with consequential reduction in yield or considerable waste of water on account of delayed adjustment and maloperations."[10j]

Compared to Punjab, the total volume of SSP water is far greater, the volume of water per unit area is much smaller, and the canal system is far more extensive. The total length of canal in SSP is expected to be an unprecedented 45,000 miles. These conditions have dictated the use of a new automatic computer-based water delivery system. Under "the Sardar Sarovar project, irrigation water in Gujarat will be essentially supply-based, but a quick-response, remote control system will respond to rainfall variations at the block level (500 ha)."[4h] This technology has not been tested anywhere in India. It has been used in some form and at a smaller scale in California. So the claim of increase in productivity attributed to this technology is not based on any proof of past performance in India. The system is not even tested on a small scale anywhere in India and yet, it has become the sole savior of the project. The doubling of the increase in productivity is based on the assumption of overall irrigation efficiency of 60%. Such a high efficiency cannot be assured by any control system except the one selected for the project. So the automatic control system is not there to enhance profitability of an already profitable venture. It is there to breath a new life into a failed irrigation policy. It cannot survive without a life support system of high-technology.

As we have seen before, the present irrigation development paradigm started with blind adoption of Western technology. Forty years later, it is sought to be continued with another blind adoption of Western technology. This approach has failed in India as a whole, including Punjab where it has brought social and political instability and violence. This approach will fail in SSP. A megaproject wholly dependent on untested high-technology cannot succeed in a down to

earth and decentralized field of agriculture. The people who are proposing the technology as the savior of the project are not the ones who developed it. The engineers of Gujarat had no part in developing, producing, assembling, installing, operating or maintaining this technology in California. They have no basis to claim with any certainty that the technology will function as planned. This high-technology is being promoted by the Bank in a country where telephones, invented over a hundred years ago, do not function properly. A design is being promoted by the Bank that involves 45,000 miles of canals in an area where a much smaller network of roads do not function properly. The SSP canal density in Gujarat is three times the density of interstate highways in the U.S. for which the U.S. federal government does not have funds for repairs and maintenance.

The second and third options of sustainable development with low external inputs is not investigated. Instead of taking this road to avoid the dead end, the Bank is promoting this technological fix that will take Gujarat's irrigation deeper into the dead end.

8.2 The Potential Loss of Groundwater to Salination

Another factor of serious concern is the role assigned to the conjunctive use of groundwater. As in Punjab, the conjuctive use of groundwater is essential for the success of the project in achieving the increase in the productivity. The studies of quality and availability of groundwater have not been completed. The estimate of 2.7 MAF or 6 inches per unit area of groundwater is based on water table data from the years 1970-79.[10g] Considerable overdraft of groundwater has occurred since that date. It is not clear whether the 2.7 MAF per year is sustainable without further depletion of groundwater. Even if the quantity is available, the cost of pumping will be much more than previously calculated lowering the benefit to cost ratio.

The problems of drainage and salination have not been seriously addressed as yet. The Narmada control authority has issued in December 1991 a document titled "Anti-waterlogging and Anti-Salinity Measures in the Command Area of Sardar Sarovar Project." This nine-page document contains no technical information on anti-waterlogging and anti-salinity measures. The first six pages contain text book type of generalizations on measures with no project specifics given and no references cited. A laundry list of eleven measures is given

on pages 7 and 8. These measures are claimed as "being adopted" to prevent waterlogging and salinity. It then concludes on page 9, "It will be thus seen that *all* precautions *have been* taken..... to ensure.....waterlogging and salinity do not occur..." (My underlines). This document does not inspire any confidence that the two issues have been given any serious consideration to date. It reads more like a propaganda document written to assure the believers than answer the doubters.

In contrast, consider the ongoing debate in Arizona about long-term effects of salinity from the use of water imported from the Colorado river. This debate on salinity in Arizona is presented in an eight-page newsletter[26] which provides a wealth of information on the topic. The following is a brief summary of this debate. The salinity of Colorado river water has doubleded over the years due to human activity such that 1 acre-foot (AF) of water contains, 2,000 lbs of salt. This amount of salt has no where to go but underground. The usual salinity measures only flush this salt down further underground to keep the root zone from going saline. The salt will travel downwards at the rate of ten feet per year and settle in groundwater which is now at 500 feet below ground. Over a long period of time, the groundwater will become saline. How long is this long period is the issue of the debate; some claiming it to be 60 years and others projecting 500 years, at which time they hope "the technology may be available to handle the problem". However, both the sides concede that "the eventual, long-term effects of saline water use in Arizona is not readily known".

The Narmada river runs through more densely populated region than the Colorado river or rivers in Punjab. Its salinity too will increase over the years after the river flow is controlled by the project. The state of Arizona is perhaps five times larger in area and has one-tenth the population of Gujarat. Arizona will import only 2.8 MAF water against 8 MAF that Gujarat will import. Thus the long-term effects of salinity problems for Gujarat can be many times more serious than for Arizona. The Arizona newsletter states, "salinity is a matter of some concern, with historical consequences of great magnitude, nothing less than the fall of civilizations. For example, the civilization of the Fertile Crescent of the Tigris-Euphrates Rivers, its fields gradually salting up for over 2,000 years, eventually collapsed. Its agriculture became increasingly untenable because of salty soils.... the lesson to be learned from such

examples as above is that salinity build up is a gradual, historical process". There does not appear to be an awareness among the SSP proponents on the long-term effects of drainage and salinity.

Gujarat has survived on rainfed farms and well-water irrigation for a long time. In the context of Indian civilization, 60 or even 500 years is not a long period. The planning for a megaproject such as SSP cannot be based on short-term considerations. The watershed degradation and the groundwater depletion are of relatively recent occurrence in comparison with the long history of Indian civilization. They are reversible if a long-term view of the problem is taken and the temptation of quick technological and management fixes, exemplified by the SSP, is avoided. If the present design of the SSP is not abandoned, Gujarat may potentially lose its groundwater resource in the command area to salination. The quality of groundwater has already deteriorated in most areas outside the command area because of the depletion and neglect in recharging. On the other hand, if a long-term view of the problem is taken, the Narmada water can be used for groundwater recharging and for restoration of degraded watershed to permanently solve Gujarat's water problem.

8.3 The Unaffordable Cost of the SSP

The total cost of the SSP in 1987 prices is as follows:[10h]

Item	Rupees in Billion
1. Main Dam	7.25
2. Main Canal	12.26
3. Hydro Power	6.91
4. Canal Distribution System	21.86
5. Command Area Development	6.04
6. Groundwater Conjuctive Use and Drainage	3.00
7. SSP's Share of the Narmada Sagar Project	0.61
Total Rs.	57.93 Billion

This cost is to be shared between the irrigation and power benefits as follows:[11c]

State	Irrigation	Power	Total
	(In Billion Rupees)		
Gujarat	45.20	1.81	47.01
Rajasthan	1.41	-	1.41
Maharashtra	-	3.06	3.06
Madhya Pradesh	-	6.45	6.45
Total Rs.	46.61 B	Rs. 11.32 B	Rs. 57.93 B

In October 1988 [1d], the project cost estimate was Rs.64.06 billion in 1986-87 prices. Presumably it includes additional Rs.6.13 billion for inflation between the 1987 estimate date and october 1988. At the rate of inflation of 6% up to 1990 and of 8% after 1990, the project is estimated to cost Rs.90 billion upon completion in ten years.

The above costs are challenged by the opponents of the project. Each item estimated above may be a gross underestimate. The actual costs will only be known upon completion of the project. Cost overruns on public projects is a common phenomenon around the world. In addition, costs of certain items are missing in the above estimate. For example, the cost of distributing water for domestic and industrial use outside the command area is not included because it is to be borne by the Water Supply Board. It may run into tens of billion rupees as reported by the government to the Morse team. Other examples are the treatment of catchment area, resettlement and rehabilitation, mitigation of environmental impact, the conjuctive groundwater development in the private sector, and so on. It is clear that the above costs are highly questionable. However, even if one accepts the above costs, the benefit to cost ratio of 1.99 is difficult to justify.

The *value* of benefits estimated in 1987 was Rs.14 billion per year as follows : [10a,11b] (a) Rs.9 billion for increase in agricultural production, (b) Rs.4 billion for increase in power generation, (c) Rs.1 billion for increase in domestic water supply. Note that these are gross values of benefits, not the net profits. The costs of other inputs (seeds, fertilizers, pesticides, labor), operation and maintenance (O&M), interest and depreciation must be deducted from these benefits to obtain the net profit. The primary costs of interest and O&M are calculated as follows:

(a) The annual interest at 8% on Rs.46.61 billion capital cost attributable to irrigation would be Rs.3.73 billion.

(b) The annual operation and maintenance (O&M) cost for the SSP canal system was estimated in 1987 [10i] at Rs.369 per hectare. This estimate is very low and not based on the experience of the past projects documented in the Bank's IISR. The net annual loss due to O&M costs is Rs.23.5 billion [4c] for an irrigated area of 15.9 million hectares [4j] or Rs.1,500 per hectare for M & M projects. So the actual O & M costs per hectare must be well over Rs.1,500 per hectare. Taking Rs.1,500 per hectare as the O & M cost against the irrigation

benefit, the total O&M costs for Gujarat for irrigation in 1.8 million hectares is Rs.2.7 billion.

(c) The cost to the government for subsidizing power for the conjuctive use of groundwater may be calculated using the figures in the IISR. The power subsidy primarily for pumping groundwater is Rs.14.6 billion [4c] for an irrigated area of 11.3 million hectares [4j] or Rs.1,300 per hectare. The SSP groundwater contribution is 2.7 MAF water against 8.0 MAF canal water or 25 percent of total of 10.7 MAF. At 25 percent of Rs.1,300 per hectare, the SSP power cost for conjuctive groundwater use amounts to Rs.325 per hectare or a total of 0.59 billion for 1.8 million hectares.

The annual costs to the government for interest (3.73 billion), O&M of canals (2.7 billion), and power subsidy (0.59 billion) add up to Rs.7. billion against the value of agriculture accruing to farmers of Rs.9 billion. The cost to farmers of other inputs (seeds, fertilizer, pesticide, labor) can be very significant raising the total cost from Rs.7 billion to well over Rs.9 billion reducing the benefit to cost ratio of the agriculture component of the project to less than 1.0. It is recalled that the estimated value of agriculture of Rs.9 billion in itself is questionable. It is based on an assumption of doubling of the increase in productivity achieved hitherto from other canal irrigation projects in Gujarat. Also, this comparison of costs and benefit is based on 1987 prices. The past experience indicates that the costs of the project will rise at an inflation rate higher than the value of agriculture benefit. Considering these uncertainties and assumptions, it is difficult to see how a benefit to cost ratio of 1.99 can be derived from these numbers.

The project does not have a social justification to merit a state subsidy because it does not alleviate poverty. In fact, this project will create a permanent subsidy from the government to the farmers of Rs.7 billion a year or about Rs.4,000 per hectare per year as is the case with the other M&M projects. The unrecoverable capital cost of SSP is Rs.26,000 per hectare using the government's estimate and may be much higher by the time the project is completed. In contrast to these high unrecoverable capital cost and annual cost of SSP, the corresponding costs of watershed development are low and recoverable. The capital cost per hectare for labor-intensive watershed development is about Rs.4,000 per hectare or less than what it would cost the

government annually for SSP. It is better to invest Rs.32 billion for watershed development to provide "protective" irrigation to the 80 percent farms (8 million hectares) which are without canal irrigation than to implement SSP at a cost of Rs.47 billion to provide "water-intensive" irrigation to only 15 percent farms. The annual recovered cost from the watershed program and the balance of Rs.15 billion may be used for groundwater recharging program using imported water from the existing large reservoirs and the redesigned Narmada project. This alternative is presented in Section 10.

Table 3

Estimated SSP Irrigation Water Demand of Crops
Assuming overall Irrigation Efficiency of 60%
(Expressed in % of Total Irrigation Water)

Zone in Figure No.1	Kharif Crop or Monsoon Paddy	1	Rabi Crop or Winter Wheat	2	Summer Crop 3	Two Season Cash Crop Cotton	4	Perennial Cash Crop 5	Total
B	0.0	0.4	0.3	0.3	0.1	0.8	0.1	0.4	2%
C 600mm	0.0	3.3	5.0	3.3	0.0	3.0	0.9	3.7	19%
C 600mm	3.5	2.8	7.9	2.4	0.2	14.0	0.7	3.9	36%
D 800mm	6.2	0.6	4.7	2.0	1.0	4.1	0.4	2.7	23%
D 800mm	4.3	0.1	2.9	0.9	0.9	6.1	0.6	2.6	20%
Total	14.0%	7.2%	20.8%	8.9%	2.2%	28.0%	2.7%	13%	100%

Kharif Crop 1 : Coarse Cereals of Jowar + Bajri, & Groundnut
Rabi Crop 2 : Vegetables, Pulses, Oilseeds, Jowar, Spices
Summer Crop 3 : Bajri, Groundnut
Two Season Cash Crop 4 : Castor, Tobacco
Perennial Cash Crop 5 : Fruit, Others (+ Sugarcane only 1%)

9

the lack of truthfulness in claimed drinking water benefit

In this critique of the project so far, many assertions, "facts",judgements, and even motivation on some issues have been questioned. However, the claims on the drinking water benefit seem to have crossed a line where the issue is no longer a matter of controversy or judgement but a matter of truthfulness. The drinking water benefit is so little, the alternatives so simple, and the associated misery of the people so great, that the proponent's attempt to use this benefit on paper to justify the project crosses the line between controversy and lack of truthfulness.

The drinking water benefit is less than 1 MAF or less than 12 percent of the total benefit of 9 MAF. The total allocation of 1 MAF is to be shared between domestic and industrial uses. This 1 MAF benefit is less than 1 percent of the total average rainfall of the state. As stated before, an estimated 13 MAF rainwater goes to waste uncollected, so the drinking water problem can be easily solved without the SSP. There have been many case histories of rainwater harvesting to solve the drinking water problem for villages in Gujarat. In the mid-eighties, an NGO completed rainwater harvesting ponds for seven villages. They were in the most difficult area of coastal Gujarat to construct such ponds due to seawater ingress. Upon seeing the professionally made video of the villagers building the ponds the World Bank provided funds for fourteen village ponds. Similar rainwater harvesting efforts of an NGO in Kutch, an area of least rainfall in the state, was described in a previous section including an urgent appeal from a prominent citizen from the Kutch area for a program of rainwater harvesting there.

These rainwater harvesting schemes cost very little in comparison with the cost of the SSP. For example, the World Bank funding for the fourteen village ponds was 12 million rupees. At this rate, all 12,000 no-source villages can be helped to address the drinking water problem in three to five years at a cost of 10 billion rupees. This work is not being taken too seriously by the government which plans to spend over 90 billion rupees for the SSP to help these villages.

The SSP proponents have used the drinking water component of the project as a means to exaggerate the importance of the project. The sheer numbers of "25 million people in 8,215 villages and 135 urban areas" look very formidable for anyone not looking beyond the numbers to oppose the project. Without the drinking water component the project would be difficult to justify only as an irrigation project because drinking water scarcity outside the SSP canal command area is more severe and has the higher claim for development funds. By adding the drinking water component to the project, the SSP proponents have been able to make the claim that the project benefits most of the state.

The evidence of the lack of truthfulness about the claim of drinking water benefit is in the lack of planning to deliver the benefit and the arbitrarily increased number of beneficiaries. During the last six years, the dam construction has proceeded full speed ahead in violation of many conditions but detailed planning for drinking water supply has not even begun. However, during the same period, the number of projected beneficiaries has escalated from 8.3 million people in 4720 villages and 121 urban areas in 1989 to 15 million people in 7,234 villages and 131 urban areas in 1991 to 17 million people in 8,215 villages and 135 urban areas in 1992. This increase in the number of beneficiaries is not matched by any increase in the quantity of drinking water allocated from the project nor has any other project parameter changed. As a result, the per capita benefit is a meagre 52 gallons per day to be shared by industries, people, and a large population of cattle, sheep, and goats. This indiscriminate increases in the number of beneficiaries in a period of two years leaves an impression that it is politically motivated especially when there exists a potential for a much larger benefit from rainwater harvesting schemes which are not being funded.

Whenever the issue of rainwater harvesting outside the SSP command area comes up the government is in a bind. This area outside the SSP command is more drought prone and has less rainfall than the

command area. If the government accepts that rainwater harvesting is a solution for this area, then the government must also accept that it is a solution for the SSP command area as well, and the whole case for SSP simply vanishes. The government has no choice but insist that the drinking water to areas outside the SSP command must come from SSP, even if it takes more money and more time than other alternatives the beneficiaries suggest.

The repeated emphasis on merely the large number of beneficiaries of SSP, coupled with not releasing proper facts to the beneficiaries themselves about the quantity, timing, method of delivery, their share of cost, and potential alternatives indicates a lack of truthfulness in the claims of the SSP drinking water benefit.

10

a sustainable alternative to SSP

The alternative to SSP [25] outlines in this Section seeks to develop and equitably distribute local resources of water and energy for sustainable development of the rural economy with locally available technology and finances. Where locally available resources are deficient, they would be augmented by external inputs of water, energy, technology and finance (including water and power from Narmada) and create surpluses of food, fuel and fodder to pay for the external inputs. In contrast, the present design of SSP begins with an idea of importing a large quantity of water from Narmada; seeks to distribute it inequitably for unsustainable development using imported high-technology and huge amounts of borrowed money; ignores the development of locally available resources of water and energy, and creates a permanent financial burden for the state.

The suggested alternative is rooted in a commitment to equity and self-reliance for sustainable enhancement of the productivity land with efficient use of water and energy. The focus is on demand management through the initiative of users and their participation in mobilization of resources for development. What is presented here is only a perspective to show its promise. Evidently, much detailed work is needed for developing and implementing the alternative. It is hoped the proponents and opponents of SSP will work together in developing this alternative.

10.1 Self-Reliance in Water Resources

Self-reliance in water resources is proposed to be achieved in three phases spanning fifteen years.

Phase 1

The first phase must begin immediately and may extend over five years. It includes rainwater harvesting for immediate relief of the

drinking water problem in the 12,000 no-source villages and for immediate provision of supplementary irrigation for rainfed farms. At the end of this phase local water resources should be fully developed and equitably used to prevent involuntary migration to urban areas. The focus in the first phase should be on:

- Formation of user's groups, organizational development and institution building for decentralized planning and implementation of local water resources.
- Initiate small watershed development in Kutch, Saurashtra, and north Gujarat.
- Initiate necessary changes in the pricing, policy, financing and cost recovery beginning with awareness programs and technology development for the sustainable farming and energy generation.
- Create incentives for saving water, for waste recycling and energy conservation.
- Encourage shift to sustainable agriculture through an appropriate package of capital and employment assistance.

Phase 2

The planning for the second phase to begin as soon as possible but implementation may extend up to ten years. It includes conservation of water from the existing irrigation systems where it is wastefully and suboptimally used. For example, Tapi, Mahi, and Tawa projects together can contribute more than 2 MAF/year from conservation alone. In these projects, yields are declining due to waterlogging caused by wasteful use of water. In addition, this phase should include equitable distribution of water from the existing reservoirs for urban areas, industries, and for irrigation to areas of low rainfall; the restoration of lands affected by the drainage and salination problems; improvements in the existing infrastructure; shift in farming practices to integrated farming for crop, horticulture, and biomass consistent with the biomass strategy for self-reliance in food, fuel, and fodder. At the end of the second phase, uses of locally available water and water supplied from outside the watersheds from the existing large systems should be well integrated. The entire state should be essentially drought proofed.

Phase 3

The planning for the third phase should begin within two years but the implementation may extend from ten to fifteen years. It includes the

distribution of water obtained from the redesigned Narmada project as well as from redesigned projects of rivers south of Narmada. This water will be distributed for restoring the lifeline of groundwater and the degraded watershed throughout the state. The storage reservoir behind the incomplete dam will be limited since more than two-thirds of the capacity will be in the surface and subsurface storages in the canal command area. It is anticipated that this water will be pumped to most regions of north Gujarat, Saurashtra, and Kutch. Such pumping will require energy from the redesigned Narmada project as well as from the renewable sources discussed in the energy alternative.

At the end of the third phase, the depleted groundwater should be recharged to levels where the pumping energy required is brought down to affordable levels and the quality of groundwater should be restored. The entire state should be essentially free of poverty. In contrast, the Narmada project would just begin to deliver water in the severely drought prone area in fifteen years, assuming no further delays in the project schedule.

10.2 Self-Reliance in Energy

The dead end reached in further development of the irrigation sector is also true for the energy sector because the state electricity boards are unable to extend the network or improve service due to heavy recurring financial losses. Equitable and efficient water use is not possible if pumping energy is not available at affordable cost to the small farmers and small industry. A major overhaul of the present energy policy of reliance on non-renewable resources is also required along with the overhaul of water policy.

Self-reliance in energy will be achieved with renewable energy sources of hydropower, biofuel, solar, wind, and tidal. In the alternative energy development scenario, initially there will be a neeed to draw energy from the existing large hydropower and non-renewable systems until energy self-reliance is fully achieved. Cost effective renewable energy development will be achieved through the participation of users in electricity distribution in operation and maintenance of the dispersed energy facilities. Self-reliance in energy is aimed for all sections of the society, rural as well as urban; and for all uses domestic, agricultural, and industrial. Such an integrated development is not on the agenda of the Narmada project planners.

Gujarat is well endowed with the renewable energy sources of solar, wind and tidal. In addition, the potential of biofuel as an energy source has been overlooked in energy planning in India although it is a major energy source in the rural areas. These sources have not been developed so far mainly because of failure to involve the dispersed rural population in energy conservation and in development of an integrated energy system using local renewable resources in conjunction with external resources.

The solar/biofuel cogeneration will play an important role in the energy self-reliance alternative. Energy users will participate in creating a biofuel surplus for use in solar/biofuel cogeneration. In the cogeneration system, the electrical energy production becomes viable by using biofuel (and natural gas if available) for superheating the steam and thereby raising the efficiency of steam plants of 2 to 4 MW in size.

The periods of comparatively high winds in Saurashtra and Kutch are in summer and the initial part of monsoon. Consequently, windmills are not very useful for irrigation for pumping. The wind pumps may be used for pumping water from waterlogged areas. Most of the existing irrigation pumpsets are underutilized in the months from March to August which are periods of high wind. The electrical pump motors can be reversed to turbine generator and used with wind mills for energy generation.

Another worthwhile prospect is the integrated wind tidal energy system. Here, the wind pumps would lift water from tidal basins located at elevations between the mean and high tide levels to higher level basins at about 5 meter above the high tide level. The tidal power generating units can then also operate during low tides by drawing water from the higher level basins.

In the final integrated energy system, hydropower units will be used for energy storage and peaking during post-monsoon periods to stabilize the production of other sources. Self-reliance in energy from local resources will require that hydropower be drawn during the monsoon months from the large power generating systems and equivalent energy be returned to the system during the post-monsoon months from the local renewable energy sources.

10.3 Energy Planning for Self-Reliance in Water Resources

Large amounts of electrical energy and diesel fuel are consumed throughout India for energizing pump sets for groundwater withdrawal. In Maharashtra for example, the total installed capacity of pumps equals the total generating capacity of 5,000 MW. In Gujarat, 30 percent of electricity is consumed by the pump sets. The depletion of groundwater and deterioration of its quality in Gujarat are so serious that they cannot be ignored any longer. While Gujarat as a whole is not a water-deficit state as believed by the Bank staff and its consultants, large areas of Gujarat will need water pumped from other watersheds (including Narmada) to help recharge the aquifers and improve the water quality. This is expected to be a long-term process. Even after groundwater has been restored to sustainable levels, energy for pumping will be required on a continuing basis.

The following table provides an estimate of energy required to achieve self-reliance in water resources and the potential of generating the required energy from various renewable sources.[25a] It includes a relatively small contribution of the Narmada river hydropower in the long-term scenario. It is developed after an assessment of available technologies by those familiar with capabilities of India's scientists, engineers, and entrepreneurs.

Energy Source	Installed Capacity (MW)	Operation Hours/year	Energy GWH	Percent of Total
1. Narmada Hydro (Monsoon Only)	1,200	1,800	2,160	12%
2. Wind/Hydro (Up to 200 Units)	800	2,200	1,760	10%
3. Wind/Tidal (Up to 60 Units)	600	2,200	1,320	8%
4. Thermal Cogen.		2,400		
a. Solar		2,100	5,040	29%
b. Biofuel		1,650	3,960	23%
c. Fossil		1,250	3,000	17%
Total	5,000	3,448	17,240	100%

Each energy source identified needs to be further studied and developed with the participation of users and in a scientific manner as

part of a comprehensive development of the sustainable alternative to the Narmada project.

10.4 Out of the Dead End with Alternative to SSP

It is anticipated that a major development effort will be required to undertake pilot projects for developing renewable energy systems particularly wind/tidal, solar/biofuel, and wind/hydro, and for testing the viability and social acceptability of the technology. There is no doubt that India produces world-class engineers, scientists, and entrepreneurs to successfully undertake such a development effort if given a chance by India's planners. However, the centralized, bureaucratic planning of the last forty years has ignored the issues of equity and self-reliance thus precluding their participation in the development process. Instead, there has been a tendency to rely on technology fashioned by others suitable for conditions elsewhere, creating dependence on external technology and finances without creating sustainable agricultural or industrial production base and surpluses to pay for external inputs.

The costs of new technologies developed in India utilizing local resources are likely to be much lower than their counterparts in developed countries. The enormous size of the potential market in India as well as in other countries, will ultimately drive the prices down even if the initial costs are high. So this perspective is offered, not for any cost-benefit analysis based on insufficient experience and inadequate date. It is offered as an alternative to the paradigm that has already proven prohibitively expensive and a failure. It is offered as a way out of the dead end the current paradigm has brought the country into. It is offered to respond to the repeated assertions by the SSP proponents that there is "no alternative" to the SSP for Gujarat.

11

closing remarks

"We are not going to spend the next hundred years in arriving gradually, step by step, at that stage of development which the developed countries have reached today. Our pace and tempo of progress has to be much faster." - Prime Mininster Jawaharlal Nehru, Address at opening of 1956 session of the Economic Commission for Asia and the Far East, Banglore, India, February, 1956,[27a]

"We may not be deceived by the wealth to be seen in the cities of India....It comes from the blood of the poorest....I know village economics. I tell you that the pressure from the top crushes those at the bottom. All that is necessary is to get off their backs." - Mohandas Gandhi, Amrit Bazar Patrika, June 30, 1944,[27b]

The fundamental differences between Jawaharlal Nehru's and Mahatma Gandhi's approaches to India's economic development are well known. Echoes of the long-forgotten dialogues between the two great men of India's independence movement about the future course of India are heard in the debate for the past seven years between the proponents and the opponents of the SSP. Ironically however, the people of Gujarat who sided with Gandhi two generations ago, are now united in favour of the SSP which is born out of Nehru's vision of India's development. It is not well known however, that after sixteen years as India's first Prime Minister, Nehru realized that the process he set in motion has not worked and made the following speech on December 11, 1963:

"These days I am increasingly thinking about Gandhiji's methods. The context in which I think of him may appear somewhat strange. Because, I am an ardent supporter of modern

industries and choose the best machines and the most efficient technology. Looking at the condition of the country today, however fast we may progress in the direction of an industrial era - and we will progress-yet, it will always be true that most of the people of the country will remain untouched by the progress. For a very long time the modern development will not benefit them."

"So we will have to search for a different method of production in which all people can directly participate. It is possible that their tools may be inferior to modern technology, yet we will have to use these tools, otherwise these people will become unemployed."

"We will have to always remember this. We will have to plan for the extreme poor of the country and fully strive to remove their misery. Today I am endlessly worried about this fact, much troubled by it."[28]

Around the time of the above speech, Nehru's attempts soon after Independence to introduce science and democracy in India had shown results. The country was becoming industrially and agriculturally self-sufficient. The universities were turning out graduates in science and engineering by the thousands. Democracy had survived and taken strong roots though still remaining a ballot-box democracy. The country was ready for the next phase, that of participatory development and democracy at grassroots level. The model of development adopted after Independence needed a major change for this next phase. The notion of development through technical and financial assistance from abroad needed to be replaced by technical innovation and investment through savings at home. Unfortunately, this change did not occur. Nehru died six months after the above speech.

The alternative to SSP proposed in this article is in keeping with Nehru's call "to search for a different method of production in which all people can directly participate" and "to plan for the extreme poor....to remove their misery". This article is written with a hope that the people of Gujarat will begin to question the SSP. The Narmada project should be suspended, not as a concession to the opponents but because it is in Gujarat's interest to do so. Any attempt to continue the project by using police force against the opponents may work for a time but the project will ultimately fail.

This article is written to urge the opponents of SSP to now focus their opposition to the substantive issues of development that they have helped bring out in the open during the struggle of past six years against the SSP. The alternatives to the SSP, although conceptually simple, require serious political debates and political changes. This debate was not possible in India because the World Bank gave this project a credibility it did not deserve. Now that the World Bank is at least officially out of this project, the opponents too need to redirect their struggle. They have won their battle in Washington against the involvement of the World Bank. Their struggle has made its mark nationally and internationally. The people they wish to help will be better served by continuing this struggle rather than carrying out the call of drowning in the reservoir if the project continues by police force. People in the lower submergence area may have to leave their homes but if they continue their nonviolent struggle against the SSP style development from elsewhere, ultimately they may prevail even in India.

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references

1. Bhoomiputra magazine, Huzarat Paga, Vadodara 390001, Gujarat, India, (a) Page 3, February 16, 1991, (b) Page 22, April 16,1991, (c) Page 19, May 1, 1991, (d) Page 3, April 16, 1991.
2. A Booklet titled Sardar Sarovar Project on the river Narmada, March 1992, Published by Sardar Sarovar Narmada Nigam Ltd.
3. Sustainable Development Alternatives and the Large Dam Controversy, By K.R.Datye, Consulting Engineer, Presented at the 2nd December 1991 Symposium on Large Dams Vs.Small Dams, organized by Central Board of Irrigation & Power, New Delhi, (a) Page 1, (b) Page 6, (c) Page 3.
4. India Irrigation Sector Review, Volume I - Main Report, June 27, 1991, The World Bank (a) Page 37, Paragraph 4.25, (b) Page 21, Paragraph 3.2, (c) Page 22, Paragraph 3.4, (d) Page 13, Paragraph 1.56, (e) Page 1, Paragraph 1.2, (f) Page 1, Paragraph 1.3, (g) Page 33, Paragraph 4.8, 4.10, (h) Page 34, Paragraph 4.16, (i) Page 19, Paragraph 2.13g, (j) Page 2, Table 1.1, (k) Page 7, Table 1.2.
7. Pages 7,8 of World Bank Technical Paper Number 127, Watershed Development in Asia, Strategies and Technologies, 1990, John B. Doolette and William B. Magrath, Editors.
8. The Last Tree - reclaiming the Environment in Tropical Asia, By James Rush, 107 Pages, Asia Society, New York, NY
9. Annex on Narmada Projects, World Bank Technical Paper No.110, Dams and the Environment, Considerations in World Bank Projects, 1989, John A. Dixon, Lee M. Talbot, and Guy J.-M. LeMoigne.

10. Planning, Construction, Operation and Maintenance of Canal System of Sardar Sarovar (Narmada) Project, National Seminar on February 13-15, 1988, The Institution of Engineers, Gujarat Centre, Ahmedabad. (a) Pages I1/2 and 3, (b) Page I2/3, (c) Table on Page T1/2 and Table 2 on Page T1/21, (d) Page T1/2, (e) Page I1/8, (f) Pages T1/3 and 4, (g) Page T1/20, (h) Page I1/5, (i) Page T4/19, (j) Page T4/29.

11. Continuing Education Seminar on Sardar Sarovar (Narmada) Project, 14th June, 1987, The Institution of Engineers, Gujarat Centre, Ahmedabad. (a) Page L2, (b) Page L17, (c) Page L28.

12. From Gujarat Samachar Newspaper, Circa 1988.

13. All India Seminar on Strategies for Drought Proofing and Management, February 6-7, 1987, The Institution of Engineers, Gujarat Centre, Ahmedabad. (a) Page 3, (b) Page 16, (c) Pages 158-160, (d) page 24, (e) 30-31.

14. Arid Zone Settlement Planning, The Israeli Experience, by Gideon Golany, Pergamon Press, and Water Quality Management under Conditions of Scarcity, Israel as a case study, Academic Press, 1980.

15. Worldwatch Paper 62, Water: Rethinking in an Age of Scarcity, (a) Table 4, (b) Page 51.

16. Groundwater and Electricity Comanagement: Generating New Options, Marcus Moench, Pacific Institute - VIKSAT Collaborative Project, Thaltej Tekra, Ahmedabad 380054.

17. Correspondence with Babubhai Patel About the Narmada Water (My translation from the letter in Gujarati language: Narmada Pani Ange Babubhai Patel Sathe Patravyavahar), by Julubha Jadeja, Published in Pagdandi, June 1992.

18. Ground Water Resources of Kutch District and Necessity for its proper Management, by K.C.B.Raju, Sri Vivekanand Research & Training Institute, Mandvi, Kutch.

19. "Combating Water Scarcity", Shri Nandubhai K. Patel, Retired Chief Engineer, December 7, 1986, 12th IWWA Annual Day, Bhaikaka Bhavan, Near Law Garden, Ahmedabad 380006.

20. Landless Farmer's Dilemma (In Gujarati : Jamin Vihona Khedutoni Samasya), by Indukumar Jani, July 1987.

21. Ukardi Integrated Rural Development Project, First Annual Report, Ukardi, Taluka Viramgam, District Ahmedabad 382140, Gujarat, India.

22. News Item "State govt. grilled for false promises", The Times of India, Ahmedabad, September 25, 1992.

23. Sardar Sarovar - The Report of the Independent Review, Resource Futures International, Inc., Ottawa, Canada.

24. Worldwatch Paper 73, Beyond Green, Revolution : New Approaches for Third World Agriculture, October 1986: Table 2

25. The contribution of Mr.K.R.Datye in the development of a sustainable alternative to SSP is acknowledged. This brief outline is the result of several hours of discussions in person in Bombay and New York. This work may be expanded using the following documents: (a) A technical note (21 pages) from Mr.Datye titled Narmada Valley Development, outline of the Suggested Alternative Plan (b) Reference 3 listed above, (c) The Takari Scheme & Development Alternatives for Energy and Water Resources in Krishna Basin, K.R.Datye, Unpublished Proposal, (d) Energy Self-Reliance and Dispersed Industrialization, K.R.Datye, (e) A "Biomass Strategy" for Watershed Development, Best possible Use of Local Rains for Sound Socioeconomic and natural Resources Development, J. Lundquist, K.R.Datye, M.Falkenmark, to be Published by the International Water Resource Association, (f) Development of Village Ecosystems, An Approach Based on Equity, Productivity, and Sustainability, Unpublished Draft, Bharat Patankar, K.J.Joy, and K.R.Datye.

26. Arroyo, Volume 5, No.4, February 1992, Water Resources Center, University of Arizona, Tuscon, AZ 85721

27. Asian Drama, An Inquiry Into the Poverty of Nations, Gunnar Myrdal, 1968, (a) Page 716, (b) Page 754.

28. Bhoomiputra magazine, Huzarat Paga, Vadodara 390001, Gujarat, India. March 16,1992 (MY translation from Gujarati. Original must have been in Hindi or English).

previews & interview with shri ashwin shah

INDIAN EXPRESS, JULY 1, 1993

NBA's alternative Narmada plan unveiled

—by Angana Parekh

NEW DELHI - Long accused of opposing the Sardar Sarovar Project (SSP) without providing an alternative, the Narmada Bachao Andolan led by Medha Patkar has now prepared a viable option to the Rs.13,000 crore project which, say experts, can solve the water and energy problems of Gujarat within 15 years at a fraction of the cost of SSP.

(Meanwhile in a major break-through, the Centre and the NBA leaders on Wednesday reached an understanding on forming a group of officials, experts and eminent personalities to resolve the controversy over the Narmada project after two days of discussions, reports UNI.)

The alternative plan calls for freezing the construction of SSP at the current level, redesigning it and using the water impounded in the half-completed dam not for irrigation or drinking water but for groundwater recharging in Gujarat.

According to Ashwin Shah, a US-based civil engineer who has formulated the alternative plan, the answer lies in rainwater harvesting, groundwater conservation and recharging, control over cash crops, and harnessing alternative energy sources such as solar and wind energy.

The plan has been endorsed by four international experts : Robert Chambers of the University of Sussex, Coen Reijntjes of the Netherlands' ETC Foundation, Peter Lehman of Humboldt State University (US) and Sandra Postel of the World Watch Institute (US).

It advocates the building of farm ponds, village ponds, strict control over exploitation of groundwater and contour grading to conserve as much rainwater as possible.

Blaming the government for actively encouraging farmers to draw up water through tubewells which has led to the water table falling steeply to as low as 1200 feet in some parts of Gujarat - Shah points out that at the time of Independence there were hardly any villages that did not have a permanent source of water. Now, thanks to the indiscriminate proliferation of tubewell irrigation, two-thirds of the State's 18,275 villages have been declared nosource villages.

Shah quotes a Ford Foundation report which says that the groundwater control law has been only selectively implemented and has benefitted rich farmers while harming poor farmers who have been prevented from building tubewells.

"It is not correct to say that Gujarat needs SSP because it is a drought-prone State. The average rainfall in Gujarat is sufficient to meet all its needs. The global average rainfall is 30 inches and Gujarat's average is 27 inches," Shah points out. "What is needed is groundwater recharging. This has been extensively - and successfully - practised in the dry western states of the US, including California."

Dams are not the answer to Gujarat's water problems, he argues. In spite of several large dams, the problem persists. In Gujarat, there is no relief in sight even after the construction of 131 dams, he says.

The problem is largely man-made due to the neglect of existing surface reservoirs and failure to create more such reservoirs to store rainwater, deforestation, leading to excessive runoff of rainwater, excessive withdrawal of groundwater, increasing acreage under water-hungry cash crops; and inequitable distribution of available surface and underground water. None of these problems would be addressed by the Narmada project.

. The present design of the Narmada project is centred around the two mega dams : SSP in Gujarat and Narmada Sagar dam in Madhya Pradesh. Instead, says Shah, there should be watershed management and the 3,000 small dams and 130 medium dams planned along the river should be used to store water and generate power as done on the major rivers of China.

Contesting Gujarat's claim that the project has progressed too far to be redesigned now. Shah holds that in reality, the project has just begun. Construction has started on only one mega dam (SSP) of the Narmada project.

THE INDEPENDENT, JULY 2, 1993

Welcome dialogue on Narmada

THE decision arrived at on Thursday by representatives of the central government and leaders of the Narmada Bachao Andolan to form an informal group of officials, experts and eminent personalities for reviewing the Rs.9,000 crore Narmada project is to be welcomed. Given the hardening of positions-especially vis-a-vis the Sardar Sarovar Project-on the part of both the Gujarat government and the NBA, the Centre's intervention to break the deadlock and facilitate a dialogue was certainly in order. What is significant about this development is that representatives of the Madhya Pradesh and Maharashtra governments, along with the union minister for water resources, Mr.V.C.Shukla, are party to the understanding to review the project's parameters. But the Gujarat government's refusal to participate in the meetings has put a damper on the future of all-round consensus. The Gujarat government still maintains that the NBA's review demand is unacceptable 'in principle'.

The contrast between the stand of the Gujarat government and the positions taken by Maharashtra and MP is largely due to the fact that the former has already invested nearly Rs.2,000 crore for construction of the SSP dam. The Gujarat government has argued that under the circumstances, the very idea of a review is unthinkable and wasteful. For Maharashtra and MP, the Narmada project does not become a real issue untill the SSP, which is the first leg of the project and its largest component, is completed and becomes operational. Until that happens, the main issue confronting the two states is that of rehabilitating the SSP's oustees. Despite the obstacles, there has been some progress on other fronts. Since the Gujarat chief minister continues to maintain that to stop work on the SSP would mean cutting off the state's lifeline, some NBA supporters have now drawn up a provisional blueprint aimed at better utilising the capital already invested in the project so as to put it on a sounder ecological footing.

An alternative plan, conceived by Mr.Ashwin Shah, a US-based civil engineer, envisages stopping the construction work immediately and redesigning the project to use the water impounded in the half-completed dam for recharging the water table in Gujarat rather than for canal irrigation. To resolve the state's chronic water shortage it is necessary to harvest rainwater and conserve the groundwater which has been severely depleted by the state's rich cash-crop farmers, who indiscriminately pump out the water from tubewells. As a result, the water table in some parts of the state has dropped so steeply as to be virtually inaccessible to the poorer farmers and the populace at large. Along with this, it has been suggested that the SSP's unutilised funds should be diverted to refurbish the state's smaller dams and related water management projects.

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INDIAN EXPRESS, JULY 5, 1993

Alternatives to SSP

— Dr.Dileep V. Mavalankar, Ahmedabad.

(A letter to the Editor)

Sir, - It is surprising to know that the Narmada Bachao Andolan which is opposing the big dam (SSP) as a Western capitalist move to destroy the indigenous culture and environment of India has come up with an alternative to SSP which is developed in New York and supported by 'experts' from the United Kingdom. United States of America and Europe (IE. July 1)

The logic of alternative is difficult to understand. As reported, the plan suggested by the NBA is to divert Narmada water for charging the underground aquifers rather than for irrigation. And what we do with 'charged aquifers' - I assume pump out the water for irrigation or drinking? The proposers claim that this has been tried in USA. But what is the proof that it will work in India." The most absurd argument made was that average rainfall in Gujarat is 27 inches which is only three inches less than the average rainfall in the world. Hence lack of rain is not a problem in Gujarat. This shows sheer lack of understanding of the variation of

rainfall in Gujarat where southern parts of the State gets more than 60 inches, the north and west get less than ten inches. The basic idea of the Narmada dam is to take water from the areas where it is in excess to the area of water shortage instead of allowing it to flow in the sea.

The NBA also claims that it has the technology to solve the water problem in north Gujarat, Saurashtra and Kutch but it will only reveal it if the SSP construction is stopped. If they really have an 'impressive' alternative with them it is very unpatriotic and inhuman not to make it available till the construction of the dam is stopped. NBA could have spent last five to six years in solving the problem of water in these regions at least on experimental basis in one taluka. Then people would have more faith in the agitation. The Union Water Resources Minister has rightly asked NBA to come out with alternatives. The alternatives should not only be in the minds, they have to be planned on paper and implemented, tested and proved on the ground. The government should challenge the NBA to test out their suggested alternatives in small area and prove its feasibility and cost-effectiveness, and only then demand review of the SSP on which dozens of years of planning and work has been done. Like last year let this monsoon not pass away in the drama of 'Jala Samadhi' by the "samarpit" squad of NBA in Manibeli, rather let it be a real test of the NBA's alternative water conservation plans in some remote village of Kutch or Banaskantha.

THE INDEPENDENT, JULY 12, 1993

Expert offers alternative to SSP

—*Nauzer Bharucha*\ Bombay

GUJARAT will be self-sufficient in water within 15 years if Ashwin Shah's alternative to the Sardar Sarovar Project is implemented within the next two years. This America-based civil engineer recently presented a technical overview of the controversial SSP and a proposal for a sustainable alternative, at a far lower cost and with many more benefits than those projected by the SSP authorities.

Shah, who is on the staff of the American Society of Civil Engineers in New York, wrote the paper in order to provide a third alternative with a view to reconcile the differences between the opponents and proponents of the SSP, and secure an optimal solution for Gujarat's water problem, especially for its 12,000 'no source' villages.

In an hour-long interview with The Independent, Shah spoke about his concern for his home state and unfolded his three-phase plan to solve Gujarat's water problem. He also categorically stated that he had not come here to support the Narmada Bachao Andolan. The NBA had not adopted his alternative plan as reported in a section of the press, he clarified.

What motivated you to undertake a technical review of the SSP?

This paper was prepared on request of Professer William Fisher of Columbia University who had organised a two-day seminar on the project where the NBA, Gujarat government officials, along with World Bank representatives, took part. The conference, however, ended in a stalemate as I had predicted. As an engineer, I felt that on such a mega-engineering project, although government bureaucrats, economists and social activists were debating, there was no engineering point of view present.

After the conference, Fisher decided to compile a book on this issue. He realised that it would be incomplete without a third alternative, so he told me to write a chapter.

The SSP has been projected as the lifeline of Gujarat? You seem to have doubts about the project as presently conceived?

What does lifeline mean? Large areas of Gujarat are facing severe water shortages. So one is not interested in this project or that project but to look comprehensively at the state's water problem. When you study Gujarat's water shortage and then you see the SSP's cause and benefits, it is very clear that it is not the lifeline of Gujarat. This does not mean that the Narmada water is not needed for Gujarat. It will be only part of the total solution to solve the problem.

What solutions have you offered?

My proposal is in three phases. Since there has been a

frightening drop in the state's ground-water level, the first solution is to basically collect all rainwater which has the potential for providing immediate relief for the drinking water problem to no-source villages and supplementary irrigation for marginal small farmers. Proponents of the dam say that rainwater harvesting and work on the project can be done simultaneously, but the problem is that there are no enough funds and secondly there are serious problems in the SSP as presently conceived. So, in order to make the Narmada water really a lifeline of Gujarat, the present plan has to be redefined and redesigned substantially.

The second phase includes restructuring of existing reservoirs whose water use is not efficient and have maintainence and water problems. This phase also includes equitable distribution of water from existing reservoirs for urban areas, industries and for irrigation to areas of low rainfall. The third phase will involve bringing in water from the Narmada whereever required. This water will be distributed for restoring the lifeline of ground water and degraded watersheds throughout the state.

In my plan, the most severely affected regions of Saurashtra, Kutch and north Gujarat will get water on priority basis and not areas which are presently targeted. We would also set up a mechanism of Water User's Association which is the best way to assure equitable distribution of benefits, cost recovery, operational and maintenance of systems. No water would be delivered to any area unless the Water User's Association is formed, unless it has policies developed and agreements reached as to who is going to draw how much, how the system will be maintained and how government will recovery the money. Unlike the SSP, there will be people and government participation.

Is there any lesson for Gujarat from a country like Israel in rainwater harvesting?

Israel has probably half the rainfall of Gujarat, its population density is much higher than Gujarat, and its per capita rainfall is also lower than Gujarat. But Israel has a water management project that looks at 15-year water needs and its availability. In that 15-year cycle they look at their existing rainfall data, the most deficient rainfall, most

severe drought as well as the wet years and then see how much rainwater can be collected and compare it against the needs in that period. So they do not draw more water then allowed on the basis of that calculation.

There is no such comprehensive plan in India, hence one sees water levels depleting. Our green revolution success was due to this exploitation of ground water.

You have said that the SSP should be redesigned. But is it possible to do so at such a late stage and wouldn't expenditure incurred already be wasted' if your proposal is considered?

Since the present plan of the SSP is not a proper use of Narmada water, it is all the more reason that the project be stopped. The government has claimed that it has spend Rs.2,500 crore till now and they estimated in 1987 that the project would cost Rs.9,000 crore. But if you look at the 1987 estimate of dam and portion of the main canal, it should not have cost more than Rs.1,500 crore. We are proposing that if the project is stopped now than in any redesign of the project we will incorporate the incomplete dam and canal. So it will not be a total waste. Besides, we are confident that costs are bound to be lower than what will be spent on the SSP.

What is the time-frame for your alternative?

We are looking at a 15-year time frame. In the first phase there will be a significant effort of training people and using experience of NGOs. This could be done in the first five to seven years. The second phase of restructuring reservoirs will take probably 10 years. Redesigning shall begin within a two year time frame and the design may be implemented around the tenth year. And by the 15th year, Narmada Water should have reached all regions.

FRONT LINE, JULY 15, 1993

A critical study

—Praveen Swami

ASHWIN SHAH, of Indian origin, is now with the American Society for Civil Engineers and has worked on several major construction projects. His interest in the Sardar Sarovar Project (SSP) grew out of a concern with the shortage of water in his home State, Gujarat, and his conviction that the dam would aggravate, rather than solve, the problem. In 1991 he presented a critical analysis of the situation to the World Bank's Independent Review. Now, in a new study, he has attacked key aspects of the SSP, and suggested concrete analysis. The document is likely to be crucial during the review of the project. Points from the study:

1. **Origins of the problem:** Scientific examination of the water problem shows that drought is not the cause of water shortage in Gujarat. The State's average annual rainfall is 105 million acre-feet, more than enough to meet its needs - in fact, rain brings 12 times the amount of water to be supplied by the SSP. The problem, therefore, is manmade: the rainwater is not stored; deforestation has resulted in excessive rainwater runoff; and groundwater is being used in an unsustainable way by rich farmers to grow cash crops, rather than crops suited to local conditions. The number of villages in Gujarat with no permanent water source was practically nil in 1947, but by 1987 it was 12,000 out of 18,273.

2. **Water benefits of the SSP :** The Government's claim that the dam will benefit drought-affected area is untrue. It is based, in a sense, on statistical fudge - based on the assumption that areas that receive less than 25 per cent of the normal rainfall once every five years are 'drought affected'. But this does not mean there is a need for any massive water import into the area. In fact, the water will be hogged by large farmers in the upper reaches of the canal, who will use it to boost their production of water-intensive cash crops. It will not help the poor in the least. As for drinking water, it will not even reach Kutch and Saurashtra for at least 20 years. Even in the other

districts it will not make water available outside the canal command area. Therefore, the solution lies in different lower-cost, decentralised projects, such as scientific rainwater harvesting.

3. **Sustainability of the dam :** All dam reservoirs will eventually silt up-and then become useless waterfalls. In India this problem is acute. The siltation data on which the life of SSP is based is massively understated, and this has been a chronic problem with all Indian dams. The Ukai dam, for example, will last only 34 per cent of its initially estimated life, the Tungabhadra 24 per cent, and the Nizam Sagar a pathetic 6 per cent. And then, several studies have shown that the kind of irrigation benefits provided are also ephemeral. In the case of the SSP, problems like waterlogging and soil salination will render much of the irrigated soil unusable in the long run.

4. **Costs :** The estimated final cost of the SSP will be about Rs.7,000 crore, if one includes factors like power subsidy, interest on capital, operation and maintenance of canals, and cost over-runs. Now, if one factors in further costs, such as cost to farmers of seed, pesticide, fertilizer and so on, the total cost rises to more than Rs.9,000 crore against a maximum estimated benefit worth Rs.9,000 crore. In a sense, therefore, the project amounts to institutionalising a subsidy to rich farmers. This subsidy will be about Rs.4,000 per hectare per annum, and an unrecoverable capital cost of Rs.26,000 per hectare. It will therefore be lost-making.

5. **Alternatives :** The solution is to develop and equally distribute local resources of water and energy. One suggested water resource plan involves three phases. *Phase One* would mean a five-year water-harvesting project to create drinking water sources in the 12,000 dry villages. *Phase Two* would involve both stopping unsustainable groundwater use, and the improvement of existing water supply mechanisms. *Phase Three* would involve building a system to recharge groundwater, as has been done in dry areas like southern California and Israel. Alternative energy resources would also be promoted, with emphasis on making villages and communities as self-reliant as possible. The situation is desperate, and this plan will help meet people's needs as quickly as possible.

"..... The alternative to SSP proposed in this article is in keeping with Nehru's call "to search for a different method of production in which all people can directly participate" and "to plan for the extreme poor... to remove their misery". This article is written with a hope that the people of Gujarat will begin to question the SSP. The Narmada project should be suspended, not as a concession to the opponents but because it is in Gujarat's interest to do so. ...

This article is written to urge the opponents of SSP to now focus their opposition to the substantive issues of development that they have helped bring out in the open during the struggle of past six years against the SSP. The alternatives to the SSP, although conceptually simple, require serious political debates and political changes. ..."

- Ashvin Shah.

Mr. Ashvin A. Shah is a professional civil engineer employed by the American Society of Civil Engineers in New York. At ASCE he manages the Society's codes and standards program which involves developing standards for design and construction in the various branches of civil engineering. Mr.Shah's prior professional experience includes design and engineering of power plants, industrial facilities, aerospace and defence facilities, and special structures. Mr.Shah practised as an engineering consultant in Bombay during 1964-1967 before going to the U.S. in 1967. Mr. Shah earned a Bachelor of Engineering degree with distinction from the Gujarat University in Ahmedabad, India in 1959 and a Master of Science degree from the University of Illinois in 1961.

"The paradigm of development India is pursuing today is seriously flawed, because it slights both biomass and information, and instead pursues production of cumbrous, man-made objects — like huge dams and gigantic mines. It is slighting biomass for the process of development, is entirely insensitive to environmental damage and has therefore led to the creation of huge tracts of biologically unproductive lands, for instance, through waterlogging under irrigation projects.

"Civilization progresses analogously by experimenting with many, many different ways of doing things. That is why technologies advance rapidly in an open society, but stagnate in a closed, dictatorial set up. While India can be proud of having nurtured a democratic tradition over forty-five years, its whole development process has unfortunately remained closed. It is a process in which a self-serving alliance of politicians-bureaucrats-contractors makes all developmental decisions with no role for broader public participation. Our narrow, closed door development process fails to generate a vigorous base of alternate development proposals, essential to genuine progress.

"The ongoing debate on the Narmada project is a welcome sign that the Indian society is responding to this challenge, that it is creating mechanisms for subjecting development projects to proper scrutiny, for throwing up alternative proposals. Only when such a new open system really takes roots will we launch ourselves on a path of genuine progress. Only then will we begin to make a transition towards an information-based society. This insightful analysis of the Narmada project by Ashvin Shah is a significant and most welcome contribution in this direction."

– MADHAV GADGIL
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