India's Dam Shame

Why Polavaram Dam must not be built

Tony Stewart • V Rukmini Rao

First published in 2006

Published in India by
Gramya Resource Centre for Women
12-13-440, Street No. 1, Tarnaka,
Secunderabad 500017
Andhra Pradesh, India
email: gramya.hyd@gmail.com

ISBN 81-903992-0-9

Printed by
Charita Impressions
1-9-1126/B Azamabad
Hyderabad 500020,
Andhra Pradesh, India

Designed by
Edwina Grant

Table of Contents

List of tables

Authors

Dr Tony Stewart BSc (Hons –1st class), PhD, Australian National University, Canberra. Dr Stewart is a senior analyst, researcher with a strong statistical background. For many years he was a consultant (technical expert) in research and development (R&D) across a broad range of industries, including agriculture.

Dr V Rukmini Rao M A, Osmania University, Hyderabad, PhD, Delhi University. Dr Rao is a feminist activist. She was a founder member of Saheli Resource Centre for Women, which spearheaded the campaign to stop violence against women in India. For thirty years she has worked to develop leadership amongst dalit and indigenous women. She has campaigned nationally and internationally on poverty eradication. Currently, as President, Gramya Resource Centre for Women and Advisor, Centre for World Solidarity she supports the voluntary sector in India and South Asia to implement a rights based approach to development.

Executive summary

This booklet argues that the Polavaram Dam Project should not go ahead because it will not deliver the benefits claimed for it, because it represents an extraordinary waste of public money, and it will have disastrous consequences for the people it displaces.[1]

Key points:

- Polavaram Dam is economically unviable.
- It will adversely affect the Andhra Pradesh budget for decades.
- The dam will take resources from other vitally needed infrastructure.
- The supposed benefits of the dam will be a reality only to a few people in Andhra Pradesh.
- Politicians and bureaucrats who do not want to tackle the tougher issues of failing infrastructure and inadequate services hope the dam project will make people feel they are doing something about water problems in Andhra Pradesh.
- Polavaram Dam will dislocate the lives of at least one million people.
- The proposed compensation package is inadequate and will not be delivered effectively.
- Historically, the building of large dams has not helped India.
- Large dams have contributed less than 10 per cent to providing food security.
- Large dams are costly 'white elephants' with a history of cost overruns, non-completion, and inefficiency.
- Large dams have changed more peoples' lives for the worse than for the better.

Large dams

Large dams over 10-15 metres became possible with modern engineering practice in the 1850s.

Prime Minister Jawaharlal Nehru early on called dams *temples of modern India*, but by 1958 he had become disillusioned with the excesses of dam building and began to call them a *disease of giganticism*. Between Independence and the mid-1990s India had 4129 large dams and associated large-scale irrigation completed or under construction.

Nehru's potent symbolism meant that the success of providing enough food for India's millions has always been associated in the collective consciousness of India with large dams. This makes criticism of large dams and large-scale irrigation difficult. It has helped to create an environment where generations of engineers, bureaucrats and politicians could do as they pleased, leading to excesses of cronyism, corruption and an immense waste of public resources.

Despite the effort that went in to so many projects, large dams did not contribute much to food security and only did so at immense cost.

Large dams represent outmoded thinking. What is needed urgently as India's economy expands

[1]There are, of course, other equally valid problems to do with large dams, such as salinisation and waterlogging through canal irrigation; increase in disease; submergence of resources; destruction of environment, culture and heritage; abrogation of constitutional rights; and unanticipated consequences.

is other infrastructure to remedy the problems brought on by rapid growth. In urban areas most basic services are in decay or inadequate. In rural areas there is an urgent need for better agricultural planning, better methods of providing water, and for full watershed development and river basin planning. These are impossible under the existing system where corruption and secrecy hold sway.

Wasting public money on Polavaram Dam will prevent necessary spending on more urgent infrastructure for at least a generation. Once built our children, grand children, great grand children, and their children will have to live with the damaging consequences. It is intolerable that such important decisions are taken without proper, intensive planning and open public discussion.

Large dams discredited

Food security

Detailed analysis using quite different methods shows categorically that the contribution of large dams to increased food grains production and, thus, food security has been less than 10 per cent.[2]

The economic cost of dams

The recovery rate (the percentage recovery of working expenses through gross irrigation receipts) fell from 93% in 1976-77 to 46% in 1980-81 and to a meagre 9% by the end of the 1980s. Thus, the irrigation sector had become a huge fiscal liability with annual operational losses exceeding Rs 3000 crores in 1993-94.

Large dams have been enormously expensive, devouring 15 per cent of total central planned expenditure between 1947 and 1982. Their construction was not efficient. Of 205 major projects begun since Independence only 29 had been completed by 1979-80.

The cost of dams escalated so much from the mid-1970s into the 1980s that they became totally uneconomic. Few new projects were started after 1990. Sadly, with India's booming economy in the new millennium, the idea of building more dams has somehow become attractive once more.

Attempts to stop improper use of public money

Numerous high-powered Central Government committees were set up to address the problem of cost escalation but, despite their harsh criticisms, not much has improved. An inadequate tool – benefit-cost analysis – with a ratio of 1.5:1 went unchallenged as the major assessment criterion for large dam projects. This made good projects indistinguishable from bad ones, led to falsification of data to satisfy the ratio test, and to an environment that promoted secrecy and gross financial mismanagement.

Leadership failure

Indian analysts mention a chain of dysfunctional features that reinforce one another. One respected analyst says the absence of accountability and transparency has harmed the long-term interests of irrigation development. The controlling discipline of engineering and the fragmentation and compartmentalisation at the administrative level, combined with secrecy, have stifled any possibility of innovation. Flaws in appraisal, combined with a weak monitoring system, exacerbate the problem – as well as not separating the good from the bad, there is no mechanism to ensure compliance once projects are underway.

The World Bank is equally scathing. It also criticises the single discipline approach of engineering. It says dams and large-scale irrigation projects are part of a cycle of build-neglect-rebuild. India has failed to face the challenge of operation, maintenance and sound management.

[2]The major contributors to India's achieving food security included the 'green revolution', the introduction of HYV (high yield variety) seeds in the mid-1960's, the rapid increase in fertiliser use, promotion of agricultural research and education, systematic extension, the supply of credit for agricultural purposes and price support.

Evidence abounds, The World Bank says, of the inability of the state water machinery to address even the problems of the provision of public irrigation and water supply services. The gap between the tariff and value of irrigation and water supply services ***has fueled endemic corruption***. Staffing levels are 10 times international norms. Most recent irrigation and water supply projects assisted by The World Bank have financed the rehabilitation of poorly maintained systems rather than new infrastructure

This decline in the quality of public irrigation and water supply services, The World Bank says, would normally have produced social unrest. Instead users at all levels have circumvented the inadequate public system by utilising ground water, often expensively. Groundwater supplies are now beginning to fail.

The distressing story of those displaced

In India tribal people, scheduled castes, the poor and vulnerable are the losers when a dam is built. Their homes and ancestral places are submerged, their livelihoods destroyed and their free access to common resources, such as rivers, grasslands, forests and wetlands is taken from them.

Displacees are never adequately compensated. They do not have resources to fall back on. They suffer major trauma. Malnutrition, disease and death stalk them. Impoverishment is the normal outcome for them.

A reasonable estimate for those displaced by dams and associated development projects in India since Independence is 50 million. Including canal, backwater, livelihood and other non-submergence and indirect displacees the figure is nearly 100 million. Speaking about this, Arundhati Roy says she 'feels like someone who's just stumbled on a mass grave.'

Governments in India call these people 'oustees' (an insensitive and contemptuous label). Personal case stories are heart rending. Yet the best that can be said of the attitudes of successive governments since Independence is benign neglect. Compensation packages, when offered, are rarely fully implemented. The neglect is so ingrained that those at the top confidently announce that oustees will be looked after and routinely feign surprise when their promises aren't realised. This is no longer acceptable.

Efficiency of canals

The efficiency of canals, designed to deliver water from dams, hasn't improved in a hundred years. The amount of water that reaches an irrigated crop is just 30 per cent of that entering the distribution network. Seventy per cent disappears through evaporation and leakage. This contributes to waterlogging and salinisation throughout the canal network.

Interlinking Rivers

The Polavaram Dam Project is the first link in a massive scheme proposed to link 37 of India's major river basins – despite the fact that no plan has been made for any river basin in India. The scheme is an example of excessive ambition and impracticality and it will never be completed.

Unfortunately, a few impractical peninsula components may be constructed before the scheme is abandoned. Eight linking canals cross Andhra Pradesh, and most are not intended to benefit AP but will nevertheless have an impact – all negative – with waterlogging, salinisation and accidental flooding due to water leakage the most likely outcomes.

The Polavaram Dam Project

The project has been developed piecemeal over 25 years under a shroud of secrecy. No information provided by the government can be trusted.

Cost of the dam

The AP Government's official estimate of the cost of the Polavaram Dam Project, Rs 10 850 crores, is unrealistic and already out of date. Evidence suggests the estimate dates from the 1990s. Another unofficial figure of Rs 13 000 crores may be a 2005 estimate.

All such large projects end up costing much more than original estimates. A conservative end cost estimate based on a completion date of around 2015 (however unlikely to be achieved) gives a range of between Rs 33 000 crores and Rs 52 000 crores. Another reasonable but less conservative cost estimate is a range of between Rs 72 000 crores and Rs 86 000 crores. These larger estimates could still increase substantially should the dam take 20 or 30 years to complete.

Cost of irrigation

The cost of building the Polavaram Dam Project would take a staggering 750 years to repay from irrigation receipts, even using the AP Government's unrealistically low official 1990s completion estimate, and not factoring in interest, maintenance and repairs. The capital cost of creating one hectare of irrigation is a massive Rs 372 834 using even the AP Government's unrealistically low project cost.

People ousted by Polavaram Dam

The AP Government's forecast of the number of people who will be disadvantaged by the Polavaram Dam is wrong – at least twice the forecast number will be displaced and four times the number will be affected in a number of ways. Using the AP Government's official publications it is easy to show that at least 500 000 people will be displaced through submergence by the dam and by its canals. Including indirect displacees – those downstream of the dam, those who are secondarily displaced, fishermen whose livelihoods are destroyed and others – the figure for disruption of lives is closer to one million. At most the AP Government will pay compensation for only 177 275 persons displaced by submergence and 60 118 displaced by the canals.

Previous examples of resettlement and rehabilitation in AP

The record of AP governments on resettlement and rehabilitation is appalling.

Case studies show a progression from quite decent treatment of displacees, by the Nizam State, with policies ensuring they shared in the benefits of dam projects, to a significant dilution of benefits. From the 1980s resettlement and rehabilitation in AP was typified by inaction and confusion or, perhaps charitably, by relative neglect – with a minority of people receiving some compensation but never enough.

The AP Government's package for resettlement and rehabilitation in 2006

The AP Government's current plans for resettlement and rehabilitation ensure that delivery will be characterised by the same bumbling confusion, ineptitude and inadequacy that has occurred in AP over decades.

Analysis of the package and plan, which the AP Government says is the best in the country, shows that it is copied from a 'standard model' plan. Implementation plans are sketchy and incomplete. The AP Government doesn't seem to acknowledge that the quality of any promised package is irrelevant if it is not implemented properly.

Conclusion

The Polavaram Dam Project is an extravagant waste of public money that will provide little benefit to few people. If built, it will set the State of Andhra Pradesh back for decades and may prevent AP sharing in the economic prosperity experienced by the rest of India.

In any case, no dam should be built unless those displaced receive just and fair treatment, and compensation – in terms of physical property, livelihoods, location and spiritual well-being – that equals their loss.

Acknowledgment

We would like to acknowledge the assistance and support of V. Gandhi Babu and his organisation Agricultural and Social Development Society (ASDS) a Khammam District NGO and the Natwan Sangam, a Khoya tribal women's organisation from V.R. Puram mandal, Khammam District during the research phase of this project.

Part I

Background

The human race, without intending anything of the sort, has undertaken a gigantic uncontrolled experiment on the earth. In time, I think, this will appear as the most important aspect of twentieth-century history, more so than World War II, the communist enterprise, the rise of mass literacy, the spread of democracy or the growing emancipation of women.

1 Introduction

Streets that are generally unpaved, rough, dirty, filled with vegetable and animal refuse, without sewers or gutters but supplied with foul, stagnant pools instead.

Friedrich Engels is describing urban centres in Britain in the nineteenth century, but the description could apply to the urban decay in any city, town or village you can think of in India today.

India's economy is rapidly expanding and there is a desperate need for infrastructure development to remedy problems brought on by rapid growth. By infrastructure, economists mean roads, power, water and sanitation, airports and seaports, information technology and telecommunications, and necessary environmental conservation. According to traditional macroeconomic thinking these kinds of investments are better made by governments because, if left to private markets, they tend to become 'natural monopolies', inevitably leading to overcharging for services. Unfortunately, in the current global economic environment, governments no longer have the ability to fund all forms of infrastructure and, for better or worse, there is great pressure to privatise.

In rural areas, agricultural planning, expanding on India's agricultural strengths, working out better methods of water provision, and such things as watershed development are essential. But large dam and associated canal irrigation projects are the wrong sort of infrastructure. These projects belong to the past. They caused India severe financial burden in the 1980s and 1990s, when the capital price per irrigated hectare for medium to large projects escalated uncontrollably. This booklet discusses these issues and makes the case for better and more transparent planning from our governments before committing to any new and harmful projects.

1.1 Lack of planning and waste of public money

The twentieth century was the first time humans could have major physical impacts on planet earth. The massive earth and concrete works required for big dams – previously impossible on such a scale – are examples of the many environmental changes that occurred.

Andhra Pradesh has about thirty medium and major agricultural irrigation projects in progress now without any integrated planning, comprehension of the complex issues involved, or any systematic river basin planning. Thousands of crores of rupees of public money are about to be wasted without benefiting anyone much, and without addressing the real problems of agriculture and other infrastructure issues that urgently need solutions.

The lack of coherent, accountable and transparent planning on Polavaram and similar development, we contend, will soon become unacceptable given the current pattern of economic growth and the rapid transformation processes of the new India. All complex water and other infrastructure issues in Andhra Pradesh (and in India generally) need to be examined together to determine what must be done and in what order of priority to benefit all of India. Detailed plans and budgets must be presented upfront and discussed openly in order to ensure real social and economic progress.

1.2 Displacement of people

The other significant topic covered by this booklet is the complete inadequacy of the process and the content of current government plans to resettle and rehabilitate those potentially affected by the Polavaram Dam – particularly those whose homes, way of life and livelihoods will be lost. These potential 'oustees' (an insensitive and contemptuous label) are primarily from poor tribal communities, scheduled and backward castes. It is no longer acceptable to impose such decisions on those who have no power. Without a genuine participative process that is open to public scrutiny, no one can believe that the government intends anything but destruction of the lives of lakhs of people.

1.3 The legacy of poor decisions

The emotional, personal and ideological views of the decision makers are part of the planning for large dam projects. They explain to some extent but do not justify why completely irrational decisions are often made.

Unfortunately engineers, policy makers and politicians rarely ask questions on complex issues objectively. Nor do they adopt a long enough time frame when embarking on large projects. Dams begin with a minimum 30 to 50 year time horizon; they are usually designed to last for a hundred years or more; and may have physical and environmental impacts over several hundred years. It is therefore intolerable to make such important decisions lightly, without intensive planning and public discussion. Otherwise our children, grand children, great grand children, and their children will have to live with the damaging consequences.

2 Dams and diversions in history

The earliest dam known diverted the Nile near Memphis in ancient Egypt 4900 years ago. Other early cradles of dam technology were Sri Lanka, Mesopotamia and China. But there were limits to dams constructed of earth and rock until after 1850, when applied science, engineering, hydraulics and fluid mechanics opened the way for much bigger dams: first in Europe then, at the turn of the century, in the United States. Italy, colonial India and other states built networks of modest-sized dams, others like Egypt built on a heroic scale. A few, like the USA, the USSR and post-colonial India, did both.

In the nineteenth century the purpose of dams was to extend irrigated agriculture. By the start of the twentieth century a subsidiary purpose was to generate electricity. Dams generally only had one major purpose until the 1930s, when the US pioneered river-basin management and multipurpose dams. The Tennessee Valley Authority (TVA) was the first such multipurpose project, inspiring others in the USSR, India and elsewhere. But the primary purpose of most large dams remained irrigation.

> The giant dams [also] served larger political purposes wherever they were built. Communists, democrats, colonialists and anti-colonialists all saw some appeal in big dams. Governments liked the image they suggested: an energetic determined state capable of taming rivers for the social good. Dams helped to legitimate governments and popularise leaders something the United States needed more than ever in the Depression years, and something Stalin, Nehru, Nasser, Nkrumah, and others all sought.

Although not all dam projects are mistakes (particularly smaller ones), all have unintended consequences not envisaged by their builders. This is a root problem and unnecessary today because of modern tools and technologies (global information systems, new project planning and analysis techniques, among many). It is now possible to foresee and plan to avoid future problems, such as salinisation, other land degradation, sedimentation, fisheries decline, resettlement problems, social trauma and reclamation costs.

Dam construction around the world continued to grow from the 1930s with many large projects, such as in Egypt, India and on the Volga in the USSR. 'During the 1960s, more than one large dam (15m or higher) was completed per day on average. The historic climax came in 1968. Although the pace tailed off, dam construction continued, so that by the 1990s about two-thirds of the world's stream flow passed over or through dams of one sort or another.'

> *Their political utility helps explain why so many uneconomic and ecologically dubious dams exist.*

Criticism of large dams grew from the 1980s, particularly with studies conducted by the World Commission on Dams completed in 2000. There is now a huge body of information and case studies on dams and their consequences worldwide.

Part 1 of the Appendix introduces these case studies and discusses one example, the Aswan High Dam in Egypt, which is pertinent to India. It points to the many negative consequences of large dams, such things as negative health impacts, salinisation, pollution, loss of fisheries, shrinkage

of deltas and siltation. The other frightening prospect raised by Aswan is that forty years of modernisation did not bring prosperity and, to the contrary, may yield disaster in the next 40 years.

Part 2 outlines the situation of India pre-Independence and of the Punjab 'canal colonies' and Pakistan post-Independence, including the growing, seemingly insoluble problems of salinisation and rising groundwater that are too expensive to fix. India has also lost huge areas of its irrigated land to salinisation, a fact that is rarely publicised. These lands are also never removed from the statistics on 'irrigation potential'.

Part 5 challenges myths that have grown up around dams and water. The first is that the development of food self-sufficiency in India was primarily produced by large dams. This misconception is so ingrained that Section 6 below is devoted to disproving it in detail. The second myth is the sleight of hand by engineers over policy-makers that water not used is somehow wasted. In debunking this myth, Ajaya Dixit shows that in one hundred years, despite all the improvements of technology, canal efficiency in India has hardly changed. Today the efficiency of India's distribution canals, that is, the amount of water in the canal that reaches the crop is just 30% – meaning 70% of the water is actually 'wasted' through evaporation and leakage. A consequence of this, causing major problems, is salinisation and waterlogging.

3 Post colonial India

3.1 Overview

Independent India also took part in the rising tide of irrigation. In the Ganges Basin the British had begun major irrigation works in the 1820s, again rebuilding the Moghul systems. By 1947, irrigation covered 22 million hectares of India, by 1974, 32 million hectares and by 1990 around 45 to 50 million hectares.

During this period, India accounted for about one fifth of the world's irrigated cropland, neck-and-neck with China the world's leading irrigator. India also developed its hydroelectric potential, especially after 1975. Jawaharlal Nehru, India's first Prime Minister, called dams 'temples of modern India'. According to an analysis of the Central Government's 5-year plans, if one takes hydroelectric schemes into account, dam building accounted for 15% of central planned expenditure between 1947 and 1982. Of 205 major projects taken up since Independence only 29 had been completed by 1979-80[3]. Dams were 'the most prominent ingredient of the development effort following Independence'. River basin planning, and efficient water management techniques did not develop at the same pace as dam construction.

The dam building buoyed India's food production in parallel with the 'green revolution' in the second-half of the twentieth century. But the social and environmental costs were high. Dams and reservoirs displaced many millions of people between 1947 and 1992. In one instance, the Rihand project in Uttar Pradesh in the 1960s, displaced peasants received no advance warning and had to flee for their lives while rising waters drowned their homes. India's tribal populations, often living in hilly areas suitable for hydroelectric development, lacked the political power to resist dam development and often became refugees.

None of India's irrigation or hydroelectric projects after 1947 came in within budget or on time, and few lived up to their promise in terms of electric power, irrigation, or durability. Reservoirs silted up on average two to four times faster than planners promised. Waterlogged lands and salinisation also plagued India, forcing the withdrawal between 1955 and 1985 of 13 million hectares from cultivation, more than a quarter of India's (1996) irrigated area. Many dam reservoirs promoted malaria. Some obliterated forests in the Himalayan foothills or the Western Ghats.

In any other country without the richness of India's water and resources, such actions would have caused devastation.

Political opposition to dam projects was growing. The first notable peasant resistance came in the early 1920s. More followed, preventing some dams. In the 1980s and 1990s popular resistance to dam building stalled some major projects. The resistance to the Narmada irrigation scheme, a gigantic project of more than 30 major dams and over 3000 smaller ones, was the most notable, with 60 000 people rallying against it in 1989.

Disputes with neighbouring countries, particularly Pakistan and Bangladesh, and

[3]These 205 major projects are only a subset of all the large dams constructed in this period, see Table 1.

between states within India also form an important background, particularly in relation to the Interlinking of Rivers project, of which the Polavaram project is a small but essential part and the first link to be attempted. These disputes are discussed in the Appendix, Part 3.

3.2 Period of dam builders

Table 1 shows the progress in construction of large dams and the two post-Independence periods of major dam building: (1) that of the great dam builders roughly from Independence to 1970; and, (2) the period of proliferation from 1970 to 1989. The figures show the incredible number of dams completed between 1971 and 1989 and also how quickly this proliferation subsided. The decline was mainly due to escalating costs.

Although leading politicians like Nehru, and world-famous scientists like Saha and Bhaba were among the promoters of large dam technology initially, not all engineers were in favour, some opposing large dams as inappropriate.

Professor Nirmal Sengupta says 'In their memoirs, the legendary [dam builders] Dr K.L. Rao and Dr Sudhir Sen recall how they were opposed at almost every step by some very senior officials and politicians. Rarely were they in tune with the local [s]tate engineers.'

'Both Rao and Sen described their opponents as people lacking foresight and expertise or as just simply parochial. The facts do not always corroborate their opinions. Objections were raised also because of the low rates of financial returns, problems of submergence and displacement and inappropriateness of designs. In many cases we learn that it was Nehru's personal intervention that settled the impasse in favour of large dams. In later years protagonists like Nehru or Saha, had been far more restrained in their advocacies of large dams.' Nehru's initial ardour for dams did not last and he became critical and withdrew his support because the benefits, the numbers and the budgets of large dams did not stack up against other means of promoting food security.

3.3 Current situation

The World Bank, whose views are normally treated with suspicion, nevertheless had some worthwhile things to say in its presentation to the Government of India in October 2005. The World Bank provided a sobering overview of the current situation:

Table 1 Number of large dams in India, defined by height

Period	Over 15 metres	10-15 metres
Up to 1900	28	42
1900–1950	118	251
1951–1970	418	695
1971–1989	1187	2256
1990 and beyond	56	116
Year not available	74	236
Under construction	461	695
Total	2342	4291

Source CWC Register of Large Dams 1994 (after Rangachari WCD 2000)

An important manifestation of the break-down [of] the current system is the growing incidence and severity of water conflicts – between [s]tates, between cities and farmers, between industry and villagers, between farmers and the environment, and within irrigated areas.

The state has generally responded by proposing new supply schemes (a new dam, a desalination plant or a rainwater harvesting scheme) which will "solve the supply problem". What is becoming increasingly apparent is that in the growing number of areas where water is already scarce, it is a zero sum game. These schemes increasingly solve one person's problem at the expense of someone "downstream". On the more thorny issues where tradeoffs cannot be avoided, the usual response of the state water apparatus has been to hope it rains and, failing that play for time. ("Passing it to the Supreme Court" has become a standard modus operandi for water matters where the administration cannot muster the necessary imagination or political will to act.)

Where inter-state Tribunal awards have been made, they have not helped much. They have taken years to complete, have not followed global good practice, and have stimulated [s]tates to focus their attention on "getting more water next time", rather than on effective use of what they have. The results have been serious economic and fiscal damage. (For example 18% of Maharashtra's fiscal deficit is to pay for the construction of dams whose primary purpose was to lay claims for water from the Krishna in the next Tribunal Award.) In addition, there are no effective mechanisms for enforcing awards or preventing unilateral action or even exit by dissatisfied states. The lack of modern, fair and enforceable inter-state water compacts has also stymied sensible inter-state "win-win" water cooperation.

Part II

Polavaram Dam basics

4 Andhra Pradesh (AP) water background

A 1991 World Bank internal review of irrigation in India [much of which is funded by The World Bank] is scathing: …irrigation and drainage infrastructure is deficient and deteriorating. The principal reasons are poor initial design, poor quality of construction, and inadequate maintenance.

4.1 AP river basins

The Krishna and the Godavari Rivers traverse 1280 kilometres (592 km in AP) and 1460 kilometres (772 km in AP) respectively from the Western Ghats to the Bay of Bengal.

In engineer-speak, Krishna water is over-utilised (i.e. no more is available) and Godavari water is under-utilised.[4]

Table 2 shows that the Godavari and Krishna Rivers account for 84% of the river water available in Andhra Pradesh.

In this text, TMC means thousand million cubic feet – the most commonly used unit in India; one unit is a very very large quantity of water.

On the Krishna River, Andhra Pradesh receives much less than half the available water.[5]
On the Godavari River, Andhra Pradesh receives virtually all the water (more than three-quarters of which comes from tributaries within AP).[6]

Table 2 Estimated water potentially available in AP's river basins (at 75% dependability)

	TMC in AP	Break up %
Godavari	1495	54
Krishna	811	30
All other	440	16
	2746	100

TMC = Thousand million cubic feet; 75% dependability means that this water will be available in 7.5 years out of 10.

4.2 Current state of water projects in AP

This is the first time in my career that I have seen 20-30 projects being taken up at a time, without any clearances having been obtained at all. Vidya Sagar Rao

The current status of existing and proposed water projects in Andhra Pradesh is a mess because the projects are not delivering the amount of water promised and the irrigation infrastructure is 'deficient and deteriorating', primarily because of 'poor initial design, poor quality of construction, and inadequate maintenance'. Yet, staffing levels in the irrigation bureaucracy are 'ten times international norms'.

[4] An illustration of this is that the Krishna has more large dams (over 15m) 28 versus 17, and more on the main stem of the river 8 versus 5, than the Godavari.

[5] Of the estimated availability of 2 060 TMC on the whole Krishna River based on 75% dependability, Andhra Pradesh has been allocated 800 TMC (Tribunal Award, 1976), of a theoretically available 811 TMC. Of this amount coastal Andhra gets more than its fair share (coastal Andhra 388 TMC (catchment share 13%); Telangana 278 TMC (catchment share 69%); Rayalseema 134 TMC (catchment share 18%)).

[6] An allocation of 1480 TMC based on 75% dependability (Godavari Water Disputes Tribunal Award, 1980; as part of this award 80 TMC is meant to be diverted to the Krishna). Of this water, under current and existing projects under construction, in 2003 (excluding Polavaram) about 680 TMC was ear-marked for use.
The allocation of 1480 TMC of Godavari water could be compromised, however, should Maharashtra ever over-utilise its access to the river (above Paithan village).
Of the Godavari water, coastal Andhra is allocated 645 TMC and Telangana 789 TMC (catchment share 21% and 79%, respectively). In terms of cultivable area Telangana has 50 per cent of the state's potential cultivable area, but only 32% of the irrigation potential created in AP is in Telangana.

Into this mix have come many proposals and alternative proposals, virtually all of them by engineers, offering unique solutions to the problems. However, there are still no integrated basin plans for the Godavari or the Krishna. There are no multidisciplinary teams searching for an optimal solution.

In this context, a presentation by the Institution of Engineers (Hyderabad) in February 2005 to a meeting of politicians and farmers is useful to clarify some of the issues. The Institution offered a solution which combined three lift irrigation schemes 'designed' to provide 395 TMC of Godavari water primarily for irrigation, but with minor components for drinking water and industrial use. The scheme would provide a usage and amount of water similar to Polavaram (312 TMC) but to locations better suited to the needs of Telangana (Polavaram does not provide water for Telangana).

Lift irrigation is generally not desirable, particularly for large quantities of water because it is expensive and the costs are ongoing, and gravity-fed is always preferable. We are neither recommending nor condemning this particular scheme, but using it for illustration.

In their presentation, the Institution of Engineers stated that existing and ongoing irrigation projects in Telangana are suffering from (1) want of adequate inflows, and (2) drastic reduction in storage capacity due to sedimentation. They did not mention (3) poor engineering design or construction.[7]

Table 3 is a summary of the physical shortfalls in water provision in the Godavari Basin that gave rise to the Institution of Engineers' scheme.

Table 3 Existing and ongoing project shortfalls in the Godavari Basin, AP

Existing projects	**Shortfall (TMC)**
Nizamsagar	38
Singur	14
Medium irrigation (Ghanapur anicut, Upper Manair, Shanigaram, Peddavagu)	3
Under extinguished MI tanks and shortfall in MI tanks	28
Total	**83**
Ongoing projects	
Flood flow canal	20
SRSP stage II	40
Nizamsagar Lift Irrigation	10
Total	**70**

Source Institution of Engineers (Hyderabad)

[7] Of the Singur Project, they say 'the present status is quite sickening. The water received into the reservoir is hardly sufficient to meet the drinking water needs of the twin cities.'

With the Nizamsagar Project the problem is one of sedimentation. The project was constructed in 1931 with a storage capacity of 29.7 TMC, which by 1973 (only 40 years later was 11.8 TMC). Following remodelling the capacity was increased to 17.8 TMC. A lift irrigation scheme with two lifts could restore only 10 TMC more. 'The balance of an additional 28 TMC has to be restored as per the [Godavari Water Disputes Tribunal Award] GWDT; they say.

The Sri Ram Sagar Project (SRSP Stage 1) had a proposed capacity of 112 TMC, against which, they say, the present capacity is only 90.3 TMC. With some playing with yield figures, they show that the deficit is 40 TMC (per the GWTD), but that the yield can be made to just fit the requirement under Stage 1, if the CWC will accept a proposed diversion of 25 TMC to SRSP Stage II and 20 TMC to the flood flow canal. What this means to the initiated is anyone's guess, but the numbers do add up. They continue on with Medium Irrigation Schemes and extinguished tanks in the same manner. Then, they move to shortfalls in ongoing (but not completed schemes). All this information is compiled to form Table. 3.

The total of the three large lift schemes proposed by the Institution of Engineers will provide 395 TMC. Alternatively the Polavaram Dam will provide 312 TMC. But of this, 153 TMC (roughly half) is already committed to make up for the shortfalls of previous projects.

Looking at this proposal realistically, it is difficult to accept the projected figures for these new projects when those for past projects were so clearly optimistic in the extreme. With 70% of water wasted in the canals through a canal efficiency of only 30%, the estimates for hectares under irrigation and potential CCA (cultivable command area created) are equally unrealistic.

4.3 A short digression on sedimentation

In India, government statistics on 11 of the country's reservoirs with capacities greater than 1 cubic kilometre show that all are filling with sediment faster than expected, with increases over assumed rates ranging from 130 per cent (Bhakra) to 1650 per cent (Nizamsagar in Andhra Pradesh).

Rapid sedimentation occurs in both Krishna and Godavari river basins in Andhra Pradesh, but the situation is much worse in the Godavari basin.

Sedimentation always becomes an issue over time, both in the creation of 'backwaters'[8] and in diminishing the capacity of dams. Actual sedimentation rates are difficult to predict, meaning the rates presented in feasibility studies for dams are usually nonsense for a variety of reasons – but primarily because designers don't want to use figures that would put the viability of dam projects into question.

In the case of the Godavari basin and the Godavari River, sedimentation is a major issue because of the turbidity of the waters. In general empirical terms (using the past to predict the future), actual sedimentation rates in Indian dams are on average three to five times greater than predicted. Table 4 illustrates the situation for a few known reservoirs in Andhra Pradesh on various rivers including the Godavari, avoiding extremes like Nizamsagar (see quotation), but showing that sedimentation is an issue everywhere in AP. Sedimentation is also an issue with irrigation canals.

What does this mean? It means that dams in the Godavari Basin are always going to silt up quickly and probably much faster than envisaged. It is unlikely actual irrigation command area values achieved in the first few years will be repeated in future years – and in 50 years the dam will most likely be almost useless because of sedimentation. If achievement of the actual irrigation command area is delayed, as it frequently is with dams in India, then it is unlikely that even the most pragmatic estimates of the actual irrigation area will ever be reached, much less the potential and the cultivable command area estimates.

Table 4 Annual siltation rate and storage capacity lost in 5 reservoirs in AP in 1992

Reservoir	Siltation per annum ha-m	Lost storage %
Sriramsagar (Godavari)	9.07	25.0
Wyra Reservoir (Krishna tributary)	5.54	39.7
Upper Maneru (Maneru in Mellore)	8.53	28.1
Kottapalli Project (Krishna)	13.95	55.7
Kadem Reservoir (Godavari tributary)	9.25	37.0

Source Eenadu, 27 June 1992 (ha-m= Hectare-metres i.e. hectares to a depth of 1 metre)

[8] The 'backwater effect' means that towns, villages and farmland could be flooded eventually by the gradual rise in water levels due to sedimentation in the upper reaches of the reservoir. The coarser, heavier sediments, the gravel and sand, tend to settle out at the upper end of the reservoir, forming a **backwater delta** which gradually advances toward the dam.

5 Polavaram Dam basics

5.1 A problem with information

The facts about the Polavaram Dam Project are shrouded in a veil of unnecessary secrecy. Facts are provided by Andhra Pradesh State governments in dollops, either leaked to the media or given under pressure at various meetings. Information is power, and the government is holding back information to stifle opposition.

The only way to combat the government approach to information is to be sceptical of leaked information until it has been comprehensively substantiated in the public domain. Therefore, except when otherwise stated, the figures used below can be taken only as a general indication of the situation with the Polavaram Dam Project. This is particularly true of figures favourable to the government because inaccuracies, such as in numbers displaced or rates of sedimentation, are never in the wrong direction for the government's case. When statements are made about reducing the height of the dam or decreasing the submersion zone, they should be treated with scepticism until substantiated comprehensively and independently.

The government to date has made no attempt to explore alternatives to this project. Moreover, all of the alternatives proposed have been put forward by engineers working on similar sets of basic assumptions.

None of the proposals, such as that of the Institution of Engineers mentioned above, and others, including the Polavaram Dam Project itself, can be evaluated properly without a complete river basin plan that has been conducted by a credible multidisciplinary team of highly qualified people.

Adding to the current mess by making ad hoc changes, or introducing someone else's favourite plan would only exacerbate the state of confusion. A complete basin plan and full evaluation of all possibilities is the minimum requirement to solving the water problems of Andhra Pradesh.

5.2 Process of project development

The idea of harnessing the waters of the Godavari has been around for a long time. In 1951 Sir S.V. Rama Murthy drew up a grandiose scheme requiring construction of a 130 metre dam near Polavaram and an extensive network of irrigation canals. Interest was revived with the formation of linguistic states and the Polavaram project with a 50 metre hight dam was formulated in 1978. The project was revised in 1982, with the dam, the left main canal and powerhouse estimated to cost Rs 884 crores. The right main canal was added in 1984 at an extra cost of Rs 398 crores. The entire scheme was sent to the Central Water Commission (CWC) for scrutiny in 1985 and, following comments, it was modified in 1986 and resubmitted the following year. After further comments and suggestions a revised project was proposed in 1989-90 with a new estimated cost of Rs 3030 crores. The latest estimate is Rs 10 850 crores, but an unofficial figure of Rs 13 000 crores is also circulating widely.

The retired Chief Engineer for the CWC in Hyderabad said in 2005 that the 1989-90 submission to the CWC had not responded to its 1987 comments. In response, the CWC said they could not clear the project. Inexplicably, with 45 of the 72 comments still not addressed after 20 years the government of AP is digging the canals without CWC permission and without other necessary clearances having been obtained.

5.3 Basic information

We have a disgraceful situation today where all or any of the information on the Polavaram Dam is suspect because of government secrecy, the prolonged time of development of the proposal and, either government departments working on the basis of differing facts or deliberate misinformation.

The current proposal is for a dam 45.72 metres or 150 feet high. The CP(M) has been lobbying, possibly seriously, for a lower dam height. The AP Government has also said the dam could be lower, resulting in less submergence.

Although a lower dam or fewer flooded villages might seem like a 'win' or at least an improvement, they are unlikely to prove so. The current Polavaram project is based on sound or, if not, at least professional engineering specifications. The main irrigation canals are over 170 kilometres long, therefore lowering the dam height means the canals won't work.

Arguments supporting a lower dam will make an already suspect project completely unacceptable in terms of outcomes. Contrary to what the government has told the media, it is not possible to submerge fewer villages unless substantial changes are made to the project.

Experience in India also teaches us that the tail end of the irrigation area rarely gets water. Some of this is due to decisions to give more water to large farmers nearer the head works, but some results from design flaws, leakage and other factors.

A specific water transfer of 80 TMC, of which 35 TMC goes to Karnataka and Maharashtra, is required for the Krishna River. This does not mean it will happen, and it certainly won't if there is not enough water in the canal. There is an even more unsettling converse that in times of water scarcity – authorities could divert more than the 80 TMC to the Krishna, to the detriment of farmers dependent on Godavari water.

The Central Government has also proposed an Interlinking Rivers Project (discussed in detail in the Appendix, Part 4 and briefly in Section 10) of which the Polavaram Dam Project is one of the peninsula links. The Polavaram Dam Project is the first of eight links to be constructed in or across AP.

Should the massive Interlinking Rivers Project be completed there are obvious 'hidden implications' for all farmers everywhere who are dependent upon irrigation water – their water may be 'stolen' when the Central or relevant state government decides it is needed more urgently elsewhere. Adding to this is the potential 'horror' that could result from mismanagement by bureaucrats.

The figures for the Polavaram Dam Project reported by the AP Government and by the Interlinking Rivers Feasibility Study (ILR) differ. The differences in some cases are small but the ILR figures are logical and in one case the disparity is crucial. The difference indicates either incompetence or untruth by one party or the other.

Using the AP Government's figures the dam wall may be either 2310 metres long (AP Govt) or 2160 metres (ILR) with storage capacity either 2100 million cubic metres (742 TMC, AP Govt.) or, according to the ILR, live storage 2129 M cu m (752 TMC); 3388 M cu m dead storage (1197 TMC); 5511 M cu m gross storage (1947 TMC).

The submergence area of the dam is 38 186 hectares according to the AP Government or 63 961 according to the ILR. This is the big difference, and so large it has to be assumed that the ILR may be wrong. But, there are very serious implications. Governments should not always be given the benefit of the doubt. In the case of the

Bargi Dam, the Government of Madhya Pradesh had estimated that Bargi would submerge 26 709 hectares – the actual area submerged was more than three times this.

The annual water supplied by Polavaram will be about 288 TMC to be divided roughly as follows: (1) left canal irrigation, 99 TMC; (2) right canal irrigation, 80 TMC; (3) diversion to Krishna 85 TMC (by way of the right canal) and 23 TMC for industrial use and drinking water. The additional 5 TMC (or as stated 4.7) for Krishna is unexplained (See Vol. 2; cited in Section 11.1), and the total water flow in the right canal will be 165 TMC.

The left canal is 182 kilometres long and the right canal 174 kilometres, irrigating areas of 161 855 hectares and 129 259 hectares (the ILR figure is larger) respectively. The total irrigation area is 291 014 hectares. Using the figures above the left canal is slightly more efficient than the right: 1 TMC will irrigate 1629 ha in the left and only 1615 ha in the right.

The seasonal delivery of water is complex but, not surprisingly, the Polavaram Dam will be capable of supplying abundant water in the Khariff (main southwestern monsoon period), but not much in the Rabi (northeastern monsoon period).

The benefit-cost ratio calculated by the AP Government is 2.89:1. That calculated by the ILR is 1.22:1 for the right canal, compared to the 1.62:1 they claim the AP Government has calculated for the whole project. Because the figures for the project's 'capital cost' and the notional 'annual revenue' created from supplying irrigation are so 'rubbery', all of these ratios are virtually meaningless.

The cost of the project according to the official AP figures is Rs 8194.4 crores for capital works and Rs 2655.9 crores for economic rehabilitation, giving a total of Rs 10 850.3 crores. No base year is given for these estimates. Another unsubstantiated figure of Rs 13 000 crores has some currency; it may or may not be the 2005 estimate. It is relevant to note that the ILR calculated a cost for the right canal of Rs 1484 crores based on 1994-95 prices, whereas the AP Government estimate above includes Rs 1613 crores for the same capital works, an increase of 8.7%. This indicates the year of the estimate is likely to be in the second half of the 1990s. Consequently, a 2005 estimate of Rs 13 000 crores for the project is probably an underestimate. Both figures – Rs 10 850 crores and Rs 13 000 crores – will be used in attempting to extrapolate the project's actual cost.

The hydropower project, a useful but minor purpose of the Polavaram Dam, will have an installed capacity of 960 MW, firm power of 80 MW and peak power of 650 MW. Hydroelectricity is also seasonal depending on the availability of water, hence the low 'firm power' figure. The peak figure produced by hydroelectricity is important because it makes a useful addition to other forms of electricity generation and helps to provide extra power at times of maximum demand.

Before continuing discussion of further aspects of the Polavaram Dam Project, it is necessary to put the complex issues of large dams in India into a broader context to spotlight the difficulties with the Polavaram Project.

Part III

Large dams discredited

6 How have large dams contributed to food security?

Ensuring food security has been one of the major objectives of India's development policy. R. Rangachari says 'Food security, broadly interpreted, means on the one hand ensuring adequate availability of basic food products, particularly food grains, in the country as a whole and, on the other hand, simultaneously making available the necessary purchasing power to have access to these products at household level. Agricultural development based on increases in productivity and income meets both these demands simultaneously.'

He says that food grain production increased from 51 million tonnes in 1950-51 to almost 200 million tonnes in 1996-97, a fourfold increase, and India's irrigation potential also increased fourfold in 50 years from 22.6 m ha in 1951 to about 89.6 m ha by 1997. These figures for 'irrigation potential' are larger than those mentioned in section 3 above because the use of 'irrigation potential' in official statistics is most misleading – the potential is never reached, and even the planned actual area for irrigation is rarely obtained.

Food production and 'irrigation in hectares' are also only indirectly linked because food production is not wholly reliant on 'official' irrigated areas.

Irrigation, however, is the main reason given for the development of large dams. Professor Nirmal Sengupta says irrigation is either the only [or major] objective of at least 96% of the 4291 dams above 10 metres (see Table 1). Only about 4.2% have power generation as an objective, about 1% drinking water, and less than 0.5% flood control, with navigation and industrial water supply also mentioned. Objectives are related to size. Almost all dams intended for flood control are over 30 metres. Almost all very large dams also have hydropower as an objective and a justification.

There is a public misconception that large dams are primarily responsible for producing food security. This is simply not true!

According to Professor Sengupta, irrigated agriculture accounted for around 60% of food grains production in 1993-94. Irrigation projects in India are classified as major, medium and minor. Minor irrigation projects include surface and groundwater as their source, while major and medium projects exploit surface water resources alone. In 1997 'irrigation potential' created was around 92 m ha, versus around 23 m ha in 1951. Major and medium irrigation contributed only 33.8 m ha or 36.8% to the total.

In 1993-94 all major and medium irrigation projects contributed around 22% (i.e. 60 x 36.8) of the total production of food grains. Many major and medium projects include large dams, but not all do, so that the maximum large dams can contribute would be less than 22%.

Many things help produce self-sufficiency in food grains production in India. In particular, the Agriculture Department says its productivity increase measures, like the introduction of HYV (high yield variety) seeds in the mid-1960s, the rapid increase in fertiliser use, promotion of agricultural research and education, systematic extension, supply of credit for agricultural purposes, price support through administered prices, have been major contributing factors.

Sengupta analyses these assertions in detail and comes up with an estimate that 63.5% of the increase in food grains production is due to these activities and not to medium to large-scale irrigation or large dams.

Assuming that most, but not all, major and medium irrigation projects are dam based, Sengupta calculates that the marginal contribution of large dams to increased food grains production is less than 10%. There is some argument about this figure, because the result is unpalatable to those who support large dams, and also to those who would not like to see development since Independence criticised. Close examination of the basis for Sengupta's calculations, however, suggests he is unlikely to be wrong by more than a few per cent. Himanshu Thakkar of the South Asia Network on Dams, Rivers and People (SANDRP), taking an equally compelling but different route, calculated a similar figure of less than 10%.

Sengupta says this contribution by large dams is not insignificant, but it is also not as spectacular as sometimes claimed. Also, as the cost of dam building between 1947 and 1982 was 15 per cent of planned central expenditure, it is inescapably true that dams were an expensive route by which to increase food production.

Sengupta also shows that 'rainfed' agriculture has responded well to measured increases in productivity. This finding goes against another common belief that development of agriculture is only possible if there is some irrigation facility and that HYV (high yield variety) seeds or fertilizers cannot be used under rainfed conditions. However, 'rainfed' is another misleading agricultural label, because areas that are rainfed are not devoid of water management techniques, such as water harvesting, tanks, groundwater use and the like. Measures to increase productivity have clearly benefited both 'irrigated' and 'rainfed' agriculture.

7 How do large dams stand up to financial analysis?

7.1 Attempts to assess large projects and make them accountable

Professor Pranab Banerji of the Indian Institute of Public Administration provides a succinct analysis of attempts by the Central Government to control expenditures on large irrigation and dam projects in Appendix Part 6.

Unfortunately, despite numerous high-powered committees and their harsh criticisms from the 1960s to the end of the 1980s, little happened. An inadequate tool – benefit-cost analysis – and a ratio of 1.5:1 became frozen as the major assessment criterion for large dam projects. This led to an inability to distinguish good projects from bad, to falsification of data to meet the ratio and an environment that promoted secrecy and financial mismanagement.

7.2 Costs of large dams and large-scale irrigation

I have been beginning to think that we are suffering from what we may call a disease of giganticism. Prime Minister Jawaharlal Nehru, 1958

Nehru quite early began to change his mind, and perhaps he regretted calling dams the 'temples of modern India'. The worst financial excesses of large dam and irrigation projects occurred after Nehru's time in the 1980s and 1990s.

Banerji comments on the change in irrigation economics:

> The recovery rate (the percentage recovery of working expenses through gross irrigation receipts) fell from 93% in 1976-77 to 46% in 1980-81 and to a meagre 9% by the end of the 1980s. Thus, the irrigation sector had become a huge fiscal liability with annual operational losses exceeding Rs 3000 crores in 1993-94.

Let's concentrate on dams. The figures are difficult to elucidate because of government secrecy and attempts to hide the true state of affairs by almost everyone involved. Two sets of analysis can be undertaken, firstly by estimating the situation by aggregate figures taken from the Plans and Annual Plans and, secondly, by assembling statistics from actual projects.

Table 5 is adapted from the work of Banerji and shows the estimated capital cost of creation of irrigation in rupees per hectare. It is important to note that the measure is 'irrigation potential' and not actual irrigated land.

Table 5 shows that the cost of creating irrigated land remained constant from 1951 to the 1970s, then grew exponentially to become a massive problem in the 1980s and 1990s, when few further dams were approved.

Banerji says 'The steep increase in capital cost in the 1980s is acknowledged by the Planning Commission. The Ninth Plan document reinforces the findings of other studies that inflation is not the major factor in [this] cost escalation.'

A more recent estimate (1992-93) on a similar but slightly different basis gives a figure for creating one hectare of large-scale agriculture as Rs 70 100. Now these estimates are not specifically related to dams but as most large-scale irrigation projects involve dams the direct figures for dams will be similar and are unlikely to be less (even if the capital costs for hydro and any other non-irrigation costs from the project, such as, flood control, drinking water, industrial water and navigation are removed).

Table 5 Cost (In Rs/ha) of creation of 'irrigation potential' (Major and medium projects)

	Adjusted to 1980–81 prices rupees/ha	Cumulative increase from base 100
1st Plan (1951–56)	8620	100
2nd Plan (1956–61)	9289	108
3rd Plan (1961–66)	10 289	119
Annual (1966–69)	**8313**	**96**
4th Plan (1969–74)	11 060	128
5th Plan (1974–78)	9074	105
Annual (1978–80)	**14 111**	**164**
6th Plan (1980–85)	18 771	218
7th Plan (1985–90)	31 475	365
Annual (1990–92)	**29 587**	**343**

FROM BANERJI

Another approach to the same question is to look at the costs across a number of specific projects. The Government of India naturally became concerned by escalating costs of irrigation and dams during this time and convened a number of committees to look at the problem, as shown in Table 6.

There is also information from other studies but the broad picture is the same. Two rough estimates are available, then, to assist in analysis:

(1) The cost of creating an irrigated hectare of land in 1992-93 prices is Rs 70 100;

(2) The cost escalation for most large dam projects is around 300-400% (on the basis that large dams are likely to run over more than medium agricultural projects not involving dams) based on 1980s and 1990s experience, which can legitimately be applied to the 1990s and beyond.

This situation has continued to the present because the reforms mooted in the 1970s, 1980s and 1990s never really happened in any

Table 6 Central Government committees on cost escalation in irrigation and dams from approved estimates

Year	Committee	No. Projects	Cost escalation %
1973	Expert on rising costs of irrigation and multipurpose projects	64	108
1979	Large dams	41	254
1983	Public accounts	159	232
1983	Desai	5th Plan all irrigation 6th Plan all irrigation	320 270

MODIFIED FROM BANERJI

systematic way. Crude benefit-cost is still used to appraise dam projects. The only thing that changed markedly was that far fewer large dams were built. Even today, the emphasis is still on completing large projects rather than on starting new ones, but this may change as the Indian economy expands.

Looking at individual dams, the cost overrun situation appears much worse as shown in Table 7.

Table 7 Inflation adjusted cost over-runs for dams (initial to final official estimate)

Dam	Cost overrun %
Bargi	784
Nagarjunasagar	652
Sardar Sarovar	714
Selaulim	660
Sriramasagar	694
Srisailam	575
Tawa	557
Tehri	2,900

Source Patrick McCully

Ignoring Tehri, averaging the other projects produces a cost overrun of 662%. This massive cost overrun calculated from directly available figures for seven large dams, and even the lower cost escalation figure of 300-400% mentioned above, are disgraceful and an indictment of Indian large dam building. The 1.5:1 benefit-cost ratio requirement must account for this situation in part, but it is hardly responsible for the overall problem.

8 Failure of planning, management and accountability

8.1 What Indian analysts say

Banerji refers to the Achilles heel of the irrigation power structure as gross financial mismanagement, but a picture is emerging of a general planning and management malaise to do with large dams and irrigation.

What are the planning/management issues?

Ramaswamy R. Iyer, the former Secretary, Water Resources, Government of India says the problem is a whole series of interlinked dysfunctional features, some of which are interdependent. Many other expert commentators say the same. The various Central Government committees mentioned above have tried to address the situation but have failed to achieve reform.

Banerji says the study of direct costs and benefits:

> … brings out the enormous lethargy and resistance to change in the irrigation sector. It took seventeen years after Independence for a shift from financial appraisal to quasi-economic appraisal. … The procedures established in 1964 continued almost without change till about 1990, by which time the cost definition was widened and IRR [internal rate of return] calculation was added. But … despite the Desai Committee recommendations in 1983, the shift to full economic appraisal has not materialised.

He continues:

> Yet there was no change because appraisal exercises were not taken seriously. The problem was tackled through data misrepresentation – costs were grossly underestimated and benefits overestimated. The actual costs showed that the project data were, by and large, fictitious. The entire appraisal process developed into a huge systematic exercise in self-deception.
>
> One reason for this mistaken practice is that the benefit-cost analysis has never been used as a tool for assessing alternatives and therefore never been central to the planning process. [Its] only use [has been] for accepting or rejecting a project.

He concludes by saying:

> In short, the absence of accountability and transparency has harmed the long-term interests of irrigation development in India.

Ramaswamy R. Iyer says that the major feature of project planning for dams since Independence has been the dominance of irrigation to the detriment of other purposes. He also mentions problems of accountability and transparency and says government secrecy has transgressed a right of civil society – its right to know how its money is spent. He says the controlling discipline of engineering, the fragmentation and compartmentalisation at the administrative level, combined with secrecy have stifled the possibility of interdisciplinary, integrated and 'holistic' planning. The innate conservatism of the system has made innovation, that is, the weighing up, assessing and choosing of alternatives, impossible.

Flaws in appraisal and decision-making, combined with a weak monitoring system, Iyer says, exacerbate the whole process. The system cannot differentiate between good and bad projects. Even worse, once started there is no mechanism for ensuring compliance.

Iyer also mentions that the approval process is based on each single unique project, which (1) mitigates against considered choices from an array

of alternative propositions, and (2) makes broader assessments, such as, river basin planning, completely impracticable.

The World Bank is equally scathing about planning and management in India's water sector.

8.2 What The World Bank says

The World Bank made a presentation on water to the Government of India in October 2005 entitled *India's water economy: bracing for a turbulent future*. At the time, articles in the press, other interested parties and NGOs condemned The World Bank for pushing privatisation too vigorously. What most commentators don't seem to realise is that The World Bank is obligated to do this because its articles of agreement make promoting private investment a core purpose. This, of course, makes any proposal from The World Bank that favours privatisation extremely suspect. Nevertheless, putting aside considerations of bias, The World Bank does present a reasonably sound critique in its report. One also cannot accuse The World Bank of being anti-development, a 'knee jerk' aspersion often cast at those who would oppose dams and large irrigation projects.

8.2 .1 The World Bank's analysis

The World Bank report opens by saying 'India faces a turbulent water future. The current water development and management system is not sustainable: unless dramatic changes are made – and made soon – in the way in which government manages water.' It praises India's achievements since the 1950s in building dams, which it calls 'Type 1' infrastructure, 'the temples of modern India'. But says India has failed in developing the 'Type 2' and 'Type 3' challenges of maintenance, operation and management.

The report goes on to say:

> The uni-functional ("build") and uni-disciplinary ("engineering") bureaucracy adopted the command-and-control philosophy of the early decades of Independence, seeing users as subjects rather than partners or clients. The Indian state water apparatus still shows little interest in the key issues of the management stage – participation, incentives, water entitlements, transparency, entry of the private sector, competition, accountability, financing and environmental quality.
>
> Evidence abounds of the inability of the state water machinery to address even the problems of the provision of public irrigation and water supply services. User charges are negligible, resulting in lack of accountability and insufficient generation of revenue even for operations and maintenance. The gap between tariff and value of irrigation and water supply services ***has fueled endemic corruption***. Staffing levels are ten times international norms, and most public funds are now spent feeding the administrative machinery, not maintaining the stock of infrastructure or providing services. There is an enormous backlog of deferred maintenance. The implicit philosophy has been aptly described as Build-Neglect-Rebuild. …

Most recent irrigation and water supply projects assisted by The World Bank, for example, have not financed new infrastructure, but the rehabilitation of poorly maintained systems.

The sector is facing a major financing gap. On the "supply side" there are ultimately only two sources of financing – tax revenues and user charges. The budgetary allocation to the water sector is falling, as are payments by users. …

8.2 .2 How water 'users' have coped with this failure

The World Bank reports further:

> This decline in the quality of public irrigation and water supply services would normally be expected to produce social unrest and political pressure. But to the (temporary) rescue of

> Indian society came a simple and remarkable transformational technology – the tubewell. With large areas of India having substantial and easily-accessible aquifers, people were able to ignore the inconvenience of poorly functioning public systems and become self-reliant using groundwater. In many ways this "era of the individual coping strategies" has been remarkably successful.

It makes these comments on the ways water users have coped:

- Irrigators have either drilled individual tubewells or relied on others' tubewells (giving rise to elaborate informal water markets). This has happened on a massive scale, with 20 million tubewells now installed, and groundwater now accounting for over 50% of irrigated area.
- The urban middle class have learned to make do with irregular, unpredictable and often polluted public water services. They have developed coping strategies which include investments in household storage, purchasing of bottled water for drinking, installation of household water purification systems, purchase of water from vendors and, like their rural counterparts, private wells to tap the groundwater. Although the costs are high – six times higher than the average payment to the utility in Delhi, for example – this works for the middle class. 80% of domestic water supply in India now comes from groundwater. …
- Industry, too, has coped by self-providing, mostly from groundwater. Where aquifers are either not available or exhausted, industries resort [to] very-high cost "captive" alternatives (including reverse osmosis treatment of wastewater and desalination) to keep their factories running.
- In many ways this private, self-provision strategy has been a success, and has underpinned spectacular gains in agricultural production and the rise of thousands of towns and cities. This has bred an attitude among many – political leaders, industrialists, irrigators and common people – that "we have muddled through okay, and we will continue to muddle through".

The World Bank goes on to say that this is a dangerous complacency, because:

> … already about 15% of all aquifers are in critical condition [and the] number will grow to 60% in the next 25 years unless there is change. About 15% of India's food is … produced using non-renewable, "mined", groundwater. [And] since aquifer depletion is concentrated in many of the most populated and economically productive areas, the potential social and economic consequences of "continued muddling through" are huge.

The World Bank is not trying to offend the Government of India by this analysis, indeed it is desperately trying not to because India and China have become good risks for strategic investment. In a rare display, The World Bank is acting almost as a supplicant to India. However, it can not condone the monolithic, inefficient and corrupt existing system, nor does it want to encourage further investment in dams and other grandiose schemes when what is really needed is leadership and reform in management and the less glamorous areas of operations, maintenance and efficiency.

8.3 A digression on privatisation

The World Bank makes the extremely important observation that endemic corruption has been fuelled by the gap between what users pay and the value of water and irrigation infrastructure. Certainly government secrecy, the huge monolithic agricultural and water bureaucracy, and the lack of accountability provide the ground for corruption, but it is the gap – the large unaccountable chunks of money – by which farmers and contractors can reap extraordinary profits that perpetuate the system. The current problem with the non-privatisation of agricultural water in India is that water is provided to all virtually for free. This means that large and medium-sized farmers are being massively subsidised by the public at large.

For this reason, and this reason only, it may be worth examining some form of partial privatisation and other alternatives as potential solutions. The only way to eliminate endemic corruption, which permeates the system at all levels, is to starve it of funds.

The World Bank and macroeconomists would probably try to sell the idea of tradeable water rights as the proper way to privatise agricultural water. However, wherever this has been introduced in the developed world it has been a disaster. Very large farmers and corporate 'agri-businesses' have a huge advantage in this arena and generally end up with the bulk of the water rights. The alternatives to be explored in India will be complex, and 'simple-minded' macroeconomic solutions must be avoided, but the purpose is clear enough – medium-sized and large farmers need to pay a sufficient price for their water so that any gap is no longer an incentive to 'fuel endemic corruption'; this needs to be balanced by ensuring that the genuinely needy do not have to pay a premium, if anything at all, for agricultural water.

9 The distressing story of oustees

9.1 What happens when people lose their homes and livelihood?

'I was involved in research on real estate some years back in the most desirable suburbs in a wealthy first world city, perhaps the equivalent of Jubilee Hills in Hyderabad or Vasant Vihar in New Delhi. Even amongst rich buyers with secure incomes and backgrounds, moving house is both emotional and traumatic,' says one of the authors of this booklet.

How much more so is it with tribal peoples or scheduled and backward castes thrown out of their homes and the places where they live and feel they belong? These are people who may know little of the world outside their own villages.

Commenting on displacement, Shekhar Singh et al. say:

> Most people have a strong attachment to their homes, especially when these are ancestral homes. The forced abandonment of one's home is always traumatic and cannot be compensated for by an alternat[ive] house .... displaced populations would most likely have had free access to the water and other resources of the river, including the riverbed land and the fish. They might have had access to common grasslands, forests, wetlands and to a host of natural resources, from which they derived not only subsistence resources but also incomes.

Displaced people are never properly compensated. There is the loss of familiar surrounds. There is loss of preferred livelihoods. There is the trauma, uncertainty and insecurity of the unknown.

Poor people, non-literate people, scheduled castes and tribal people are much more vulnerable to these things. They do not have resources to fall back upon. They will become alienated by any move. There may be conflicts with host communities. There are complex and vexed issues of eligibility, who is to be compensated? There are gender issues. Women are not traditionally treated as possible landowners or farmers in India. Women may also be affected disproportionately because of their greater dependence on common property. Because women in India are much less mobile than the men, the breakdown of village and social units affects them much more severely. Also compensation money, when it is given, always goes to the men, which can be a major problem for the family, especially when it is used to *drown the pain*.

Patrick McCully of the International Rivers Network says that researchers working on resettlement are unanimous that giving land-for-land is far more successful than cash compensation. Compensation received for land may also be inadequate because corrupt officials or other middlemen skim off a cut for themselves.

For many rural people, especially the poorest the submergence of the commons, including all communally shared resources, is one of the worst losses to a reservoir. Yet these losses are rarely compensated.

McCully says traditional community elders and leaders are often marginalised by displacement. Sickness and death rates usually increase markedly after displacement, especially among the young and the very old. Malnourishment tends to increase. He says one of the most severe long-term problems faced by oustees is indebtedness.

Impoverishment of oustees also means that they cannot fulfil their traditional obligations, such as marriage ceremonies, festival offerings and the like.

> The great majority of those displaced by dams [many whose rights were not even considered] have statistically disappeared, swallowed up by the slums and the camps of migrant labourers. In India, perhaps three-quarters of the millions of dam oustees were given no replacement land or housing; at best they received a small sum of cash compensation, often they got nothing at all. And numerous studies show that even those Indian oustees who were "resettled" invariably ended up impoverished, demoralized and bitter. "Submerged destitutes" is the sadly apt name given to the people displaced by Rengali Dam in the [S]tate of Orissa by their new neighbours at their resettlement sites.

And yet governments believe they can dictate these things from above, without involving those who are intimately concerned with the displacement and aware of all the complexities.

9.2 How many people?

Arundhati Roy has commented on displacement in these terms:

> According to a detailed study of 54 Large Dams done by the Indian Institute of Public Administration, the average number of people displaced by a Large Dam is 44 182. Admittedly 54 Dams out of 3300 is not a big enough sample. But … it's all we have … let's err on the side of abundant caution and take an average of just 10 000 people per Large Dam. 33 million … That's what it works out to … What about those that have been displaced by the thousands of other Development Projects? … Fifty million people …I feel like someone who's just stumbled on a mass grave.

'The number of people who are forced out of their homes by dams is staggering,' says Patrick McCully. 'It is, however, difficult to give even a reasonably accurate estimate as the industry and their government sponsors have rarely bothered to collect reliable oustee statistics.'

Many different figures have been given for the numbers of people displaced by dams since Independence. They range from a laughable two million; McCully, an activist, says 14 million; others say 20, 33, 40 or 50 million direct displacees. The authors of a study commissioned by the World Commission on Dams estimated 57 million based on 4291 dams and averages for hectares submerged and people per hectare. While the authors believed these figures were too high to be absolutely relied upon, their work and that of others suggests that respected, independent studies should put the figure at the higher rather than the lower end of the range.

If 50 million is a reasonable estimate of submergence displacees in India since Independence, then including canal, backwater, livelihood and other non-submergence displacees suggests that dams and related projects since Independence have displaced around a 100 million people in total.

Arundhati Roy's comment that she felt as if she'd 'just stumbled on a mass grave' is hardly an over-statement.

All this displacement and human misery is too high a price for the poor economic benefit gained from large dams, as mentioned above – an increase in food productivity of just 10% at immense financial cost (15% of planned central expenditure to 1982).

Table 8 provides figures from a number of projects to demonstrate how 'oustee' numbers are systematically underestimated before projects begin.

Table 8 Original and revised estimates of 'oustee' numbers and % change

Dam project	Original estimate	Revised estimate (year)	Increase %
AP Irrigation II	63 000 (1986)	150 000 (1994)	238
Gujurat Medium Irrigation II	63 600 (19??)	140 370 (1994)	221
Madhya Pradesh Medium Irrigation	8000 (1981)	19 000 (1994)	238
Sardar Sarovar	33 000 (1981)	320 000 (1994)	970
Upper Indaravati	8 531 (19??)	16 080 (1994)	189
Nagarjunasagar	8 239 (1960)	28 000 (1989)	294

Source Patrick McCully; Nagarjunasagar figures from Thukral

The Sardar Sarovar figures are probably the closest to a real estimate of displacement for any project because it is arguably the most researched and debated project in India's history. Eliminating Sardar Sarovar on the Narmada River from calculations, however, and using the mainly official government statistics in Table 8, 'oustee' numbers are at least 236% underestimated by governments and others involved at the outset of any project.

Patrick McCully says of these figures and others 'The main reason for the consistent underestimates is almost certainly that it suits project authorities and lending agencies to distort the figures to make projects look more viable.'

The figures and official statements, however, tell only part of the story of the human tragedies that have unfolded in India because of large dam and other development projects. Detailed analyses of Bargi, Hirakud, Nagarjunasagar, Ukai, Pong, Sardar Sarovar and many other displacements help to tell the real story (see *Notes and references*).

9.3 What about government compensation?

Personal case records of displacement are often heart-rending. Yet the political, bureaucratic and administrative process is so ingrained in India that those on top can confidently deliver pronouncements and then feign surprise when promises are not matched by reality.

According to N.V. Gadgil, Minister in charge of India's multi-dam Damodar Valley Corporation Project in 1948 '... every person who will be uprooted from the soil ... will exchange his shovel for a decent cottage, darkness for light and fanaticism for faith...'

There has not been a positive example of displacement compensation and sensitive implementation by any government in India since Independence.

Nirmal Sengupta says 'Years later, as a Central Minister, [the famous dam builder] Dr. K.L. Rao visited Bhakra[-Nangal] Dam, which was commissioned in 1963, and wrote about his visit as follows:

> The Bhakra Project was completed in all respects and the Prime Minister dedicated it to the nation on 22 October 1963. There was a large gathering and everybody felt happy that the dam would confer immense benefits for all industrialists and agriculturists. It is curious to observe how we handle our projects without sparing a thought for the affected people. When the Bhakra dam was built, the village of Bhakra, situated on the

> banks of the Sutlej, was submerged and the people built their houses on the adjacent hills. The project resulted in great suffering to the people of the village, but nobody took note of the peoples' representations. It was many years later, during one of my visits to the dam site, that I found that the new village of Bhakra had neither drinking water nor electricity, though surrounded by blazing brilliant lights. This was indeed unfair and I asked the Bhakra Management Board to supply both power and water to the village. Even then, there were objections. The Management Board thought that this was not a proper charge on the Project. This indeed was an absurd approach which I overruled. I hope that in future proper amenities are made available in the rehabilitated villages.

This is the rule rather than the exception. Over time protests against such treatment increased and were usually suppressed with violence, for example at Hirakud in 1946, Pong 1970, Chandil 1978, Icha 1982 and, more recently, the ongoing Sardar Sarovar saga on the Narmada River.

After 20 years of struggle involving hundreds of thousands of people, as Medha Patkar of the Narmada Bachao Andolan says in a recent interview '… the major achievement [has been] mass empowerment … not limited to the Narmada Valley. In Sardar Sarovar despite the state's games of lure and scare, the people have not run away. We have not yet changed the paradigm … but we have made a difference.'

Central and state governments claim compensation packages have improved considerably. Rangachari and other water engineers, bureaucrats and politicians cite the Sardar Sarovar rehabilitation package as a vast improvement on past practice. They do this without irony, virtually denying the years of protest and the pain and suffering necessary to bring such changes about.

Yet, Medha Patkar does not claim a victory in this sense because, as with many things in India, a promised good package is irrelevant unless it is honoured. The relatively standard package offered in India is rarely implemented, or honoured only in part, so that all the problems arise again and again and are not addressed.

Even the best packages – with a more flexible definition of those who are 'project affected', with timely consultation allowing some participation by those affected, and having implementation mechanisms that (at least on paper) seem well-thought-out and sensitive – are insufficient. They are insufficient because they still do not embrace the complexity of individual cases, women's or cultural issues, or difficult common and group resource issues. They do not devolve decision-making to those at the 'grass roots' who actually understand the circumstances of each individual involved – delivery is still top-down and the ultimate decisions remain in the hands of the elite.

Unfortunately, there will always be a mismatch between apparent government intent and what actually happens with major projects unless they involve:

- Timely discussions as the first step in project development, that is perhaps 10 years before dam construction, involving all of those likely to be 'project affected';
- Adequate planning;
- Proper and complete compensation and sensible mechanisms for implementation;
- Full accountability for the money spent and post evaluations over a number of years.

Since Independence, the displacement and destruction of vulnerable non-literate people, particularly scheduled tribes and scheduled castes (despite constitutional protection) has been a callous abrogation of human rights that could be

labelled a crime against humanity. Those in charge can no longer claim as a valid defence that they were unaware of the excesses of their subordinates. Bureaucrats and politicians cannot claim a lack of information: the World Commission on Dams, The World Bank and numerous other authorities have issued guidelines, case studies and research on how displacees or 'oustees' ought to be treated, much of it based on Indian experience.

No more dams should be built until governments in India confront the problems of displacement and implement processes to address the problems properly and humanely.

10 Interlinking rivers

The idea of linking India's river basins has been around since the 1970s but was generally dismissed as impractical until it re-emerged in 2002. The Interlinking Rivers Project proposes linking 37 river basins – with 30 links, 14 in the Himalayas (requiring international agreements with upstream states China and Nepal) and 16, the peninsula component, along the eastern coastal fringe of India. Apart from the excessive ambition and complete impracticality of the peninsula component, and the fact that there has never been a river basin plan for any of the affected rivers, the relevance of the project to Andhra Pradesh is immense.

First, the Polavaram Project is the first link to be constructed and thus has physical and political implications far wider than AP irrigation. The transfer of Godavari water to the Krishna will be the first inter-basin transfer. Once the link is in place the managers of the water can choose to transfer no water to the Krishna, the amount specified, or much more; and this is true of every link in the system.

Second, of the 12 peninsular feasibility studies currently posted on the Internet, 8 cross AP (in other words, at least half of the 16 peninsular links are relevant to AP). The presence of such major river linking canals is likely to have a profound negative effect on AP, particularly coastal Andhra (these canals are not generally meant to provide irrigation in AP). Waterlogging and salinisation due to water leakage and accidental flooding are amongst likely outcomes.

This raises important questions: What is known of the consequences of such links? What detailed long-term planning has been done in AP to prepare for these links? What emergency plans exist? The answers, of course, are nothing is known, nothing has been planned, nothing is understood!

The Interlinking Rivers Project is discussed further in Part 4 of the Appendix.

Part IV

Polavaram Dam analysis

11 Documents and projections

One of the biggest irrigation fiascos in India is the Bargi Dam, which submerged nearly 81 000 hectares of farmland and forest to irrigate a projected area of 440 000 hectares. Although the dam was completed in 1986, seven years later only 12 000 hectares were receiving irrigation water (3% of the planned area).

11.1 Available documents

There are five major relevant policy documents on Polavaram that are somewhat available, but not yet openly in the public domain. Seen in various forms by activists and others over the years they are: (1) the initial feasibility study of Polavaram 1981-1982; (2) the initial displacement survey (Reddy, 1996); (3) the Taskforce on Inter-linking Rivers feasibility report on the Polavaram project; (4) the AP Government's displacement policy (G.O. No. 68); and (5) Volume 2 of the environmental impact assessment. Further documents will emerge from time to time, but all should be treated with great caution.

11.2 Irrigation provided by the project

The major and defining purpose of the Polavaram Dam Project is the Cultivable Command Area (CCA) of 291 014 hectares, that is, the area to be irrigated by the project (with the addition of 80 TMC transfer to the Krishna, also for irrigation). There is also a hydropower scheme. This does not require the dam because 'run-of-river' schemes are equally efficient for hydropower. However, 'add on' hydropower schemes are often used to justify projects whose irrigation potential does not match that planned.

In the case of Polavaram, a large amount of the command area in coastal Andhra is already irrigated, which will make evaluation of the effectiveness of the irrigation hard to measure. In other major irrigation schemes in India, the CCA expectation is never met precisely. In a number of projects the results are satisfactory, some only achieve three-quarters of CCA expectations, in others only half and, in a few, much less than half. At this stage, it is not possible to define where Polavaram will fit in this array of project outcomes. It is important to recall that the canals will be only 30% efficient and that this will lead to waterlogging and salinisation.

Key issues that will impact on the proportion of the CCA irrigated are as follows:

(1) How quickly sedimentation of the dam and the canals becomes a problem;

(2) How the water flow is managed in various seasons and under drought conditions;

(3) Whether the design and modifications deliver sufficient water reliably;

(4) How much impact water loss, waterlogging and salinisation have on the canal network;

(5) Whether water is managed by giving large, 'cash crop', irrigation at the head of the canals priority or not (this is more efficient in terms of canal and economic productivity, but is unfair to the majority of farmers and will decrease the proportion of the CCA irrigated and yield little tail end water);

(6) Whether the Krishna transfer water (80 TMC) is delivered or not, or if under certain circumstances the government decides to deliver more water to Krishna farmers; this will have a profound impact on water delivered to the CCA.

11.3 Project and irrigation cost

11.3.1 Cost of building the dam

The AP Government's own total project cost of about Rs 10 850 crores thought to be from the 1990s and the 2005 estimate of Rs 13 000 crores give a broad starting range to calculate how much the Polavaram project will cost at, say, 1 January 2006 prices.

Assuming the project will be finished completely by 2015 (highly unlikely, if not impossible), and using the crude average cost escalation figure from Table 6 of 300-400%, then in 2015 the completed Polavaram Dam Project would have cost between Rs 33 000 and Rs 52 000 crores. Using the higher cost overrun average of 662% discussed earlier and calculated directly from available figures for seven large dams, the project cost in 2015 would be between Rs 72 000 and Rs 86 000 crores.

Although these figures cannot be taken as absolutely factual, they demonstrate the extraordinary degree of cost escalation that is likely to occur with the Polavaram Dam Project. The outcome will be worse if the construction process is inefficient. The key point is that the project will cost much more than the figures the government is quoting, particularly because its estimates appear to be eight to ten years old.

Should Polavaram, however, follow the example of other large dams and take 20, 30 or 40 years to complete (of 205 major projects taken up since Independence only 29 had been completed by 1979-80) then the burden to taxpayers will be enormous. This burden is for an irrigation project that in 20 to 40 years time will still only address the needs of a few large farmers in coastal Andhra, will prevent or delay the development of necessary infrastructure, and will prevent or delay necessary irrigation reform. Despite any arguments to the contrary, the cost will never be recovered.

11.3.2 Cost of creating irrigation

The cost of building the Polavaram Dam Project would take a staggering 750 years to repay from irrigation receipts, and this is using the AP Government's unrealistically low official 1990s completion estimate of Rs 10 850 crores, and not factoring in interest, maintenance and repairs.

Again using the AP Government's low 1990s estimate of Rs 10 850 crores to complete the project and dividing by 291 014 the number of hectares ostensibly created (a number that is too high). The capital cost of creating one hectare of irrigation comes to a massive Rs 372 834.

In comparison, one hectare of new irrigation cost around Rs 14 000 in 1980, and Rs 70 100 in 1992-93 (see section 7.2).

This large cost for creating one hectare of irrigation comes after loading the odds twice in the AP Government's favour – a too low completion cost and a too high divisor or number of hectares. A third factor biasing the estimate in the AP Government's favour is that the calculation assumes that the Polavaram CCA is not currently irrigated (although parts most definitely are).

The figure of 750 years is calculated by dividing the capital cost of creating one hectare of irrigation, Rs 372 834 by 497. Rs 497 is the current average annual water rate farmers pay per hectare.

Using another quite reasonable 2005 estimate of 13 000 crores as the cost of building the Polavaram Dam, the cost per hectare of new irrigation now becomes Rs 446 713, which is still heavily biased in the AP Government's favour. The actual cost per hectare will be much higher.

12 Facts on displacement

The adivasi families displaced by Bargi Dam in Madhya Pradesh, the first dam to be built across the Narmada, were promised two hectares of replacement land each when their fields were submerged in the late 1980s, even though many of their previous holdings had been much larger than this. The promise, such as it was, was not fulfilled, and most of the 114 000 oustees were given only house plots and pitifully low amounts of cash compensation. Because of incompetent surveying, many of the resettlement plots were in fact still in the submergence zone, so the oustees were, without warning, flooded out a second time when the reservoir finally filled in 1990.

The main statistical information on the submergence that would result from construction of the Polavaram Dam comes from the second volume of the Government of Andhra Pradesh's environmental impact study (called Vol. 2 hereafter). Unfortunately, the document appears to have been put together hurriedly. There are questions about the reliability of the information it provides for a number of reasons, including the meagre description of the methodology used to derive the statistical information. The second part of the document is a resettlement and rehabilitation (R&R) plan (discussed below).

Some information does help gain a better understanding of the dam's likely impacts. For example, the report states that 277 villages will be submerged, but then in all its tables only 276 villages are listed. This information does point to the general scale of impacts, but anomalies mean there has to be much checking and interpretation of the figures to gain confidence in the basic veracity of the information.

12.1 Statistical information

According to the environmental impact study (Vol. 2), 276 villages and hamlets will be affected by the project, involving 44 574 residential households (and 28 336 cattle sheds; 69 255 productive trees), involving a total population of 177 275 persons at an average family size of 3.98. Of these persons, the report suggests 53.17% were scheduled tribes and 12.58% scheduled castes based on information extrapolated from the 2001 Census of India. Reddy 1996 see *Notes and references*, found slightly less scheduled tribes (47%) and slightly more scheduled castes (14.4%.)

The area of submergence is 44 763.84 hectares, of which 33 186 hectares is in Andhra Pradesh, based on the dam's 150 foot contour or full reservoir level. The AP submergence zone consists of 22 882 ha farmland, 12 081 ha poramboke (common land or government land), and 3223 ha reserved forest. The report also says 15 105 additional residential households and 9489.31 ha of land will be affected by the major canal infrastructure.

Another salient fact, inadvertently revealed by the report, is that the numbers quoted do not relate to the population of the submergence area, but to an artificial group defined by the government as 'total affected families' made up of 'project affected families' and 'other affected families'.

The researchers did not survey caste-wise as they said they intended to. They had to deduce information on caste from the 2001 Census, and in doing so revealed that: 'The total population of the Project Affected Villages [is] 236 834 according to 2001 census.'

While the figure of 236 834 is a good guide to the affected population in 2001 numbers, the population has grown since. But there is a problem with the figures in any case. If the population of affected villages is 236 834 and the 'total affected' population is 177 275, why are the remaining 59 559 or one-quarter of the population (25.2%) of these villages not 'project affected'?

Looking carefully again at the numbers displaced, according to the 2001 Census – statistically reliable with 'no axe to grind' – the population of the submergence area is more than 236 834 in 2006. It is therefore certain that at least 236 834 people are going to be displaced if the Polavaram Dam is constructed, whatever the government says.

The report also says 15 105 households will be displaced by the canals. Using the family size figure of 3.98, the 15 105 canal displaced households represent a population of 60 118. But, the total project affected persons mentioned above under-represented the actual population, so adjusting by the same amount indicates that there will be 80 316 canal displacees and, therefore, that the actual displacees from the submerged reservoir and those displaced by the canals is 236 834 plus 80 316, or 317 150.

Table 8 showed the extent to which displacee numbers are underestimated. Apart from the implications of that trend, there are other factors that suggest 317 150 is an underestimate of the number who will be displaced if the Polavaram Dam is constructed:

(1) 3.98 may underestimate average family size; Reddy 1996 found 4.21, which would add about 33 500 people.

(2) No account has been taken of the effect of backwaters, wave heights or periodic flooding on submergence. Reddy 1996 reported that a government document suggested the 160 foot contour – rather than the 150 foot – had been considered a better measure to account for this effect (see 12.3). A very rough calculation using the ratio 160:150 – probably a large underestimate – adds another 21 000 people.

(3) If one adds the estimate of 317 150 people above to the figures mentioned at (1) and (2) of 33 500 and 21 000, the total number of displacees now becomes 371, 650.

(4) Population increase since the 2001 census applied to the displacee numbers would produce a total of well over 400 000 displacees.

(5) No mention has been made of people downstream. According to Patrick McCully people downstream experience some of the most serious long-term social effects of dams. These people are never considered for displacement compensation, yet they unquestionably are displaced, lose their livelihoods and become destitute when their river becomes an intermittent drain.

(6) No mention has been made of fishermen on the river or of estuarine fishermen. Fishing industries are always a casualty of dams.

(7) No mention has been made of indirect displacees. They are the people displaced by villages built for dam workers, by reforestation projects to 'mitigate' for forest or wildlife refuges submerged; those who lose land or livelihood through the subsidiary canal network; and those who are displaced to make settlements and land available for direct displacees.

Taking these things into account and using the multiplier from Table 8, which indicated that displacement numbers escalate by at least 236% in the long-term as other things not envisaged

come into play, would more than double the numbers forecast to above 900 000. Indeed, taking (5),(6) and (7) into account 1 000 000 would be an underestimate.

Taking a conservative approach, it is reasonable to state with confidence that a minimum of 500 000 people will be displaced directly through submergence by the dam and its canals if the Polavaram Dam Project is constructed.

12.2 Case studies of resettlement and rehabilitation (R&R) in AP

It is worth considering the previous experience of R&R by displacees in Andhra Pradesh to see whether those threatened by submergence are being unfair when they protest against the AP Government's plans for the Polavaram Dam.

Subba Reddy in his 1996 report for the AP Government provides an excellent review of past experience. Nizamsagar 1925-1931 and Thungabhudra immediately before and after Independence are two projects where the R&R was designed and carried out primarily by the Nizam State.

In the case of Nizamsagar, 40 hamlets (home to about 13 500 persons) were submerged. R&R was carefully planned and the new settlements were in the irrigation command area, neatly laid out. Land was given to each family equal in extent to that lost. Help was given with building materials, proper house designs were supported, and cash grants were provided for agricultural implements, manure and other essentials.

In the case of Thungabhudra 65 hamlets (in coastal Andhra, Telangana and Karnataka) were submerged, but the R&R was similar to Nizamsagar. The declared and achieved objective was to see that the quality of life of oustees did not deteriorate but was actually improved by relocation (not accomplished elsewhere in post-Independence India).

Nagarjunasagar, built over more than 20 years, from 1957 to 1969, displaced 5000 families. It saw a considerable dilution in the R&R policy. Compensation in cash or land came six years after the displacement commenced. The pretence of making oustees share the benefits of the project was given up. Land supplied was a fixed five acres, regardless of the amount lost. There was some offer of entitlement to buy land, but less than that lost. The land allotted was reclaimed forest with no possibility of an irrigation facility. Even in these circumstances, the supply of land for purchase was too little for the demand.

Sriramsagar, involving 91 hamlets – 1 lakh acres of land and 1 lakh persons – commenced in 1964, but went through a series of phases. In 1965 the AP Government adopted a new R&R policy. A displaced person who opted to move to a government relocation centre was allotted up to a maximum of 5 acres dry land or 2 acres of wet land. No land was offered for sale. A family not opting to settle in the required location was paid a cash grant, ranging from Rs 500 to Rs 2000, and then left to fend for themselves.

In the second phase, 27 more hamlets were to be submerged in 1978. No relocation centres were established. The government, following a recommendation from the Chief Engineer, moved away from relocation centres to cash grants. A government order in March 1980 provided for an ex-gratia payment of 50% of the computed amount of compensation due, up to a maximum of Rs 1000 for land loss and Rs 5000 when both land and houses were submerged.

Since then, some R&R in AP has been carried on within this framework and, in some cases, relocation centres and some cultivable land were provided.

Srisailam, constructed from 1976 to 1981, ousted 22 000 families. Those families were dealt with in a manner that could be described, charitably perhaps, as well intentioned neglect. A study in 1986-87 showed that compensation treatment varied between districts and, more specifically, whilst large to medium-sized farmers received 65% of what they were due, the landless and most vulnerable received only 5.6% of the compensation.

This is typical of AP and India in general. Politicians and high officials express surprise at the inadequate implementation of their plans, but do nothing to ensure fair outcomes. A 1988 study of Srisailam showed two major problems that produced increased poverty amongst displacees: (1) a reduction in the quantity of land owned by farmers and (2) the rapid disappearance of cash compensation (47% to pay loans and 43% on food and other necessities for short-term survival).

Construction of the Lower Manair Dam, a subsidiary project of Sriramsagar, commenced in the second half of the 1980s and was completed in 1994. The government initiated no rehabilitation program. 13 000 families resettled on their own initiative. No land was given, except 316 acres across four hamlets in one instance. Government documentation on this is confusing and misleading. Some token efforts may have been made in some instances. Nothing was monitored.

The Singoor (Singur) Project on the Manjira River was completed in 1986, and was marked by a great deal of government confusion and no coherent rehabilitation process. In one place, where there was a relocation centre, settlers started building but were subsequently asked to move to another site with no infrastructure or facilities. At another place the M.R.O. (sub-district officer, under the Collector) chose one site but the Town Planning Department approved another. At the time moneylenders were charging 60% interest on loans to finance house building, as no government money was forthcoming. In 1988-89 an evaluation showed that 61% of eligible families had received no compensation, and the remaining 39% had received only part compensation. Most people had no idea what they should expect. Displaced families who lost their land could buy only 30% of the land area they had held previously.

A general change in thinking on R&R at national and even state levels has occurred to some extent due to pressure brought to bear by the Narmada River protests, the World Commission on Dams, and even The World Bank. Policies on displacement have often been drawn up and packages introduced – but implementation remains illusory in many cases. Against this background, no informed person could help but be suspicious of any Andhra Pradesh Government's promises on R&R.

12.3 Extra problems – backwaters, wave height and periodic flooding

Backwaters are caused by heavier sediment being deposited at the back of a reservoir, where the water enters, and they create more submergence over time. Wave action (caused by wind) also creates major submergence problems at certain sites. Similarly, when reaching a reservoir, floodwaters back-up and cause extensive temporary submergence. It is not easy to assess the impact of these things before the dam is built.

Subba Reddy 1996 used a three volume Report from the AP Agriculture Department as a starting point for a survey of submerged villages. The report stated at page 177 that 'a fixed contour of 160' is to be followed for estimate purposes, and if submergence level goes above 160' contour, temporary compensation is to be paid.' The real impact of this becomes clear on the following

page: 'the actual submergence levels, considering the backwaters, wave heights and periodicity of floods have yet to be finalised.' All reports to date have used the 150 foot contour line to define the submergence expected from Polavaram.

The truth is that the expected submergence level should at minimum be 160-foot (48.77 m), but it may need to be higher.

12.4 AP Government R&R package

According to a 2004 paper on the participative irrigative management (PIM) agricultural reform in Andhra Pradesh:

> In South Asia, policy making and implementation is characterized by strongly legalistic and administrative approaches, with a top-down nature. …Implementation in this view requires hierarchical authority, trained staff and close supervision.

The paper analyses as a case study the capture and modification of the program to suit the vested interests of a small rural elite group comprising farmers, contractors and agricultural department field officers. The process is identical in general terms to what has happened in other cases of submergence, and is inevitable with the Polavaram R&R.

The Government of Andhra Pradesh published a *Policy on resettlement and rehabilitation for project affected families* in April 2005 (G.O. No. 68).

The AP Government through the Chief Minister continues to claim in the press (late 1995 and early 2006) that the R&R package (G.O. No. 68, 2005) offered is the best in the country (e.g. *The Hindu*, 30 December, 2005). In reality the package is very similar to the relatively 'standard model' floating around the government bureaucracy in India. It is a quasi-legal document outlining amounts of compensation, definitions and administrative structures. The second half of the Vol. 2 document provides the 'R&R plan', that is, fleshes out the policy in G.O. No. 68, provides a budget and predictably focuses on organisation and management, training of government officers (a titbit for displacees), monitoring and administrative procedures. There are at least nine government agencies involved. The structure, management, coordination and monitoring procedures appear weak. Therefore, there is plenty of room for confusion, 'buck passing', siphoning off of money and general inaction.

The whole package and the details for implementation are sketchy. What is aggravating about G.O. No. 68 in general terms is not that it has been patched together from a 'standard package', but that it is missing about three-quarters of the content necessary for implementation. In other words, there are fine vague phrases about what is intended, there are some legalistic definitions, there are some specific compensation items and some basic administrative structures, but there is nothing whatever on how the program can be delivered.

The National Thermal Power Corporation (NTPC), New Delhi by contrast formulated an R&R policy in 2005 based on the same 'standard model' which is recognisably similar. While this document is longer and denser, it is also clear and succinct. It hangs together logically, in a way that G.O. No. 68 does not. Where the NTPC policy stands out is in its guidelines and mechanisms for implementation. They are specific, but flexible, and are designed to deal with complex issues. The policy also prescribes mechanisms for participation, and in particular appears to treat villagers with dignity and as partners in the process, rather than as 'objects'.

This is not to say that the NTPC policy is ideal, nor that the words on paper will actually be implemented in the field, but it is many years

ahead of G.O. No. 68. Implementation is where the Government of Andhra Pradesh misses the point completely. No matter how good the content of any R&R policy is, if the process is not implemented properly then the quality of the promised package is irrelevant.

No AP Government has achieved quality R&R. Since 1980, R&R implementation has been characterised by bumbling confusion, ineptitude and inadequacy. The current AP Government's R&R package G.O. No. 68 and plan for implementation are destined to produce the same outcomes.

As argued by the World Commission on Dams in 2000, The World Bank and many other authorities and agencies, it is no longer acceptable to treat 'oustees' as a nuisance. As N. Subba Reddy said in 1996 of the Chief Engineer, the Government of Andhra Pradesh's approach to R&R is backward and not consonant with contemporary thinking at international and national levels.

Apart from financial and economic considerations, human dignity and human rights must have a place in the thinking of government. Until 'oustees' are treated as valuable human beings, whose homes, land, livelihood and way of life are valuable, then no dam should be built. Until they are given as much caring attention and compensation, in terms of physical property, livelihoods, location and spiritual well-being, to make up for their loss then no dam should be built. That is the bottom line.

Appendix

1 *Case studies around the world*

There are numerous case studies of dams and diversion projects around the world that illustrate issues and teach lessons. The disappearance of the Aral Sea in the Soviet Union is perhaps the most notorious. It is an extreme example of diversion irrigation in a desert to grow cotton: an awful lesson of where extreme ambition and unwillingness to face basic facts can lead to ecological and economic disaster. Other case study dam projects are the Kariba in Zambia, the Tarbela in Pakistan, the Three Gorges Dam in China, dams on the Volga in Russia and the Colorado in the USA (see Notes and references). However, for the purposes of this brief introduction, one case study the Aswan High Dam in Egypt is particularly pertinent to India and illustrates all of the issues involved.

1.1 Egypt, the Aswan High Dam and the Nile

Herodotus wrote that Egypt was an 'acquired country' the gift of the Nile. Over the past ten thousand years silt and water made a long ribbon of the Egyptian desert habitable and also built the Nile Delta (the richest agricultural part) gradually over the continental shelf. The prominence of Egypt in human history was due to its unique geography. Northeast winds allowed sailing upriver, while the Nile's flow helped to waft craft downstream. More importantly the annual flood (prompted by monsoon rains in the Ethiopian highlands) brought water and 1 millimetre of silt on average to the river's banks and floodplain. Sometimes the floods were too heavy bringing destruction and sometimes when the monsoon rains were too light a 'low Nile' could bring famine. Thus the gift had strings attached.

Improvements on the Nile gift came about 5000 years ago with irrigation canals, later supplemented by mechanical devices – water wheels and shadoofs (a lever arrangement with a bucket on a long pole).

One would expect that tampering with the bounty of the Nile gift, particularly the silt, would not be undertaken lightly. Nevertheless, attempts were made in the nineteenth and early twentieth century but these were relatively benign. It was only when in 1952 Colonel Gamal Abdul Nasser (1918-1970) and his fellow Free Officers seized power in Egypt, determined to rid the country of residual British influence and the shame of poverty and weakness, that the Aswan High Dam was born. The Aswan High Dam near the Egyptian border with Sudan was not as hydrologically sensible as dams higher up the Nile, but Nasser was rightly suspicious of schemes in other countries beyond his control. One consequence however was a location in one of the highest evaporation zones on earth (18% annually).

Nasser saw the Aswan High Dam as an heroic symbol for his revolutionary regime and for Arab nationalism. It would provide a reliable water supply for Egypt and enough hydroelectric power to transform the country into a modern industrial state.

It was the height of the 'green revolution' and consequently the dam did help to revolutionise Egyptian agriculture: providing flood control, permitting more systematic use of the water and allowing two to three crops a year. The Nile below Aswan became a mammoth irrigation ditch. The hydroelectricity supplied one third of Egypt's needs between 1970 and 1990. In these respects, the dam fulfilled all of Nasser's expectations, but it did not make Egypt prosperous and independent.

The dam markedly improved on one half of the Nile's gift but it revoked the other. The Ethiopian soil subsidy stopped arriving in 1963 (98 per cent withheld by the dam). Without the silt Egypt became heavily reliant on chemical fertilisers (and pesticides), which made it one of the world's heaviest users. Much of the electricity produced at Aswan went to fertiliser factories. And the country was sitting on a long-term time bomb. Ten thousand years of a working system squandered for nationalism, jingoism, but certainly modernisation.

Today, however, less than fifty years later, the Egyptians are in a policy double-bind. The dam is filling up with silt and they need the silt downstream, but they can't do anything about it. The population has grown as a consequence of the modernisation of Egypt, and as Marq de Villiers says: 'they cannot destroy the dam but neither can they tolerate it'. He also says: 'this is not a view shared by the people who manage the dam or by many of the people who share its water.' But, this form of denial is common, even in India.

1.2 Ecological consequences

'There is no doubt where ecologists stand on the Aswan High dam,' says Mark de Villiers. 'In their view it is an unmitigated disaster.' But also, remember the silt foregone and the sediment trapped. The dam is steadily silting up, and the evaporation problem is growing as the waters become shallower. Egypt increasingly needs more water than it gets, and the potential for conflict with the Sudan, Ethiopia and other countries, which also use the water, is growing. The possibility of catastrophe for Egypt is omnipresent.

Let's forget the lurking Leviathan of the silt under the waters of Lake Nasser – the 600 kilometres long reservoir held back by the dam.

The initial benefits of the dam were the control of the consequences of the costly Nile floods, provision of irrigation water throughout the year and generation of electricity. The downside, not immediately obvious in the midst of the 'green revolution', was that with the loss of the silt Egypt needed to use fertilisers and

pesticides instead for its cash crops. As mentioned, it became one of the heaviest users of chemical fertilisers in the world and the fertiliser factories consumed a large proportion of the electricity generated.

Subsequent pollution by fertiliser nutrients and pesticides and the lack of scouring by floods created a water hyacinth weed problem that was costly to control and indirectly caused ongoing health problems in the population. The water hyacinth, irrigation ditches and stagnant water all made ideal habitats for the snails that form part of the lifecycle of the schistosome parasites that infect humans through the skin and cause Bilharzia, a particularly debilitating disease. Infection rates rose 5 to 10-fold among rural Egyptians with the transition to perennial irrigation, and after 1975 approached 100 per cent in many communities.

The Nile descends only 87 metres from Aswan to the Mediterranean. The lack of flooding and constant irrigation raised the water table and caused drainage problems and waterlogging. Salt tends to be retained in the soil causing salinisation problems. This became so acute that Egypt hired international experts to find a remedy, but there was no financially practical solution. At the same time, the population had doubled since the dam was built, partly because of the 'green revolution' boon to agriculture. In a country with a million more mouths to feed each year in the 1990s, menaces to agriculture were serious matters.

In the delta, the lack of silt caused the delta to shrink slowly and to sink; salt invaded groundwater and seawater intruded as much as 50 kilometres. Marq de Villiers explains the situation in the words of Egyptologist Paul Theroux: 'the delta is among the world's most intensively cultivated lands, with one of the highest uses of fertilisers and the highest levels of soil salinity. It is sinking affecting groundwater. Egypt's precious soil is being buried beneath Cairo's relentless sprawl. The coast is eroding and chemical pesticides are killing marine life.'

Another result of the nutrient ooze from the silt no longer reaching the Mediterranean was destruction of the sardine and shrimp industries that had employed 30 000 Egyptians. The lack of the silt also had a further profound effect on the Mediterranean as a whole. John McNeill says that the most serious long-term consequence of the Aswan High Dam may be on the altered waters and biota of the Mediterranean (in conjunction with the effect of the Suez Canal). With saltier waters new species from the Red Sea have replaced many of the original species of marine life and this colonisation has spread as far as Sicily, impacting on all nations of the Eastern Mediterranean.

John McNeill also says that the dam swamped and corroded Egypt's cultural heritage (a largely unrecognised issue in India). Part of that heritage now lies under Lake Nasser, but irrigation, rising water tables and penetration of salt have also had a major impact on countless monuments downstream.

International issues are rising to the surface too. In 1959 a military coup in Khartoum helped Nasser to obtain the necessary water agreement with the Sudan. The new government was quite happy to punish the Nubians and the resettlement issue was not a problem for Egypt. The Khartoum Government, however, had to use the army to force some 50 000 Nubians to relocate whose towns and villages stood to sink beneath Lake Nubia (the Sudanese portion of the Reservoir). According to one author, twenty years later the Nubians still wanted their riverside homes and date palm groves back.

Water was plentiful when the dam was built, but with the growing population and shortages evident at the beginning of the new millennium, the agreement with the Sudan and the intentions of Ethiopia and Uganda are a growing worry and a potential source of conflict. Egypt has stated its willingness to go to war to prevent anyone upstream tampering with its water flow.

Marq de Villiers elaborates on the general issues raised by the Aswan High Dam case study. He says: 'Ironically, it has been reliably shown that malnutrition often follows dam building rather than the expected bounty from newly irrigated lands. Reasons are complex but stem partly from the failure of engineers to understand the ecological benefits of flooding.' Egypt is an extreme case. One would have thought the benefits of the natural sequence of flood and silt here should have been 'blindingly' obvious. de Villiers says: Local people have developed flood-dependent agriculture over centuries, the broad and reliable array of local foods is replaced by irrigated monoculture cash crops, often aimed at export markets. Thus introducing an economic version of floods and droughts, as world prices fluctuate.

Marq de Villiers also mentions that dams alter the flow and in warm climates the temperature of water downstream. They almost always lead to elevated salt levels in the surrounding soils, sometimes infecting groundwater. He mentions delta problems in other major rivers around the world, especially the feature that dams radically alter the nutrient and saline mix in downstream deltas. In addition to the sardine industry in Egypt, he cites the effect on other fisheries which range from major declines – dams on the Niger dropped catches by a third, in south Florida by 40 per cent, in San Francisco Bay by four-fifths – to catastrophic ones in the USSR, Canada and the USA. Dams filling with silt are also problems elsewhere. He mentions the Hoover Dam in the USA and an extreme case the Sanmexia Reservoir in China, which was completed in 1964 and taken out of commission four years later because of the build up of silt. Deforestation and poor agricultural practices dramatically increase erosion and siltation. Dams also, by removing sediment, increase the flow rate of rivers and may also be the cause of flooding, making the floodplains downstream more, rather than less, susceptible to flooding in some cases. Nor are dam collapses unknown and decommissioning of dams becomes a problem as dams age. For some reason decommissioning is never planned for when a dam is built. It is someone else's problem (and cost)!

2 *Colonial India – the Punjab*

The story of India and water in the twentieth century is a magnificent one, with many achievements, mistakes and the odd disaster. It deserves an epic movie or series of the proportions of the Mahabharata, with heroic struggles against odds, symbolism, villains and tragedies. The challenge for India in the twenty-first century is to put aside the hyperbole, to learn from the lessons of the past and to grow beyond the methods of the nineteen fifties.

The Indus and its major tributaries arise in the western Himalayas and flow through the arid lands of eastern Pakistan and northwest India to the Arabian Sea. The region where the rivers flatten out known as the Punjab, 'the land of five rivers', is the largest and one of the oldest irrigation systems on earth. The Indus is about 3000 kilometres long, has three times the flow of the Tigris-Euphrates and is the equivalent of two Niles. People have used its waters for irrigation for 4500 years.

The modern scheme began in 1885 when the British Colonial Government of India undertook to rebuild and extend some of the Moghul waterworks of the sixteenth to eighteenth centuries in the Western Punjab. They did so and much more. Engineering skill and endless toil turned the desert and steppe of the Punjab into wheat fields and created 'canal colonies' based on the network of irrigation canals. Settlers from far and wide came into these 'colonies' replacing scattered camel and cattle herders who had previously paid almost no tax. By 1947 this scheme extended over an area of about 14 million hectares, the size of Greece, and permitted the largest expansion of agriculture in the history of British India. More importantly for the British it created taxpayers as the social transformation matched the ecological one. Revenue was always important for the British in India and it rarely matched expectations.

The British regarded the Punjab scheme as a signal success. It created one of the wealthiest peasantries in Asia, raising two crops a year on the Punjab's sandy loam. By 1915 the Punjab provided more tax revenue for the crown than any other district in India. And, it created loyal subjects too. Punjabis volunteered in droves for service in World War I because veterans could expect irrigated land in return.

Pakistan expanded the irrigation network after 1947 and promoted export crops, such as oil-seed and long-staple cotton. In 1990, Pakistan had about 16 million hectares under irrigation, but salinisation the curse of irrigation schemes was a major problem. Salt had sapped the yields of Punjabi wheat from at least the 1860s before massive irrigation aggravated the problem. By the 1960s the problem had grown acute as repeated floodings caused waterlogging of soils and left behind

dissolved salts. The raised water table meant the groundwater carried the dissolved salts into the roots of the crops, checking plant growth and eventually killing the plants.

Fortunately, for Punjabi farmers, Pakistan mattered to the United States as a Cold War ally. The Kennedy Administration duly dispatched technical experts who recommended pumping to lower the water table and protect the crop roots from salt. Foreign aid as in India also paid for the building of thousands of tube wells. But this only delayed the problem, rising groundwater and salinisation continued to haunt eighty per cent of the Punjab canal colonies into the 1990s, when foreign aid for drainage schemes dried up.

3 Disputes with neighbouring countries and between states

India's two major international water disputes began shortly after Independence. Both were initiated by India as the upstream riparian country. The first began in 1948 only a year after partition when the East Punjab cut the water going to the West Punjab. The Pakistanis were furious. Telegrams flew between leaders but good sense prevailed and the water was restarted. With the intercession of The World Bank a deal was brokered in 1960, which has remained in place. India was allocated the waters of the eastern of the five rivers the Sutlej, the Beas and the Ravi, while Pakistan received the waters of the Indus itself, the Jhelum and the Chenab.

The other dispute was much messier and also goes back almost to Independence but primarily to 1951 when the new Indian Government announced that it was going to create a barrage dam across the Ganges at Farakka. Its purpose was to resuscitate channels and divert water through a canal to the Hooghly to serve Calcutta and prevent its port from silting up. East Pakistan complained but after a series of inconclusive meetings India went ahead and started construction in 1962. Then, the 1965 war, politics and the separation struggle intervened. An interim agreement was brokered in 1964, but the people of Bangladesh weren't happy. India went ahead and diverted water in 1976 at the start of the dry season, which led to massive protests in Bangladesh. The new Janata Government brokered a 1977 agreement. Indira Gandhi signed an MOU in 1980 to continue the agreement but this expired 18 months later with nothing done. Relations over water got worse, but suddenly in 1997 a formal Ganges Treaty was signed against all expectation.

The lessons to note are that (1) India as an upper riparian state was the instigator in each case and (2) the Ganges dispute took nearly fifty years to resolve.

With water becoming one source of global conflict in the new millennium. It is not likely that water agreements between India and her neighbours will become any easier. Both Nepal and China have alerted India over decades that continued access to Himalayan water unimpeded is not guaranteed. The political situation in Nepal for the next few years may make lasting agreements difficult. Who knows how China might react in future, except that her water needs are growing.

Internally the water conflicts have been more severe. The internal Punjab dispute began in 1955 when Delhi allocated the waters of the Sutlej, Beas and Ravi between Rajastan and the Punjab, with a paltry amount going to Kashmir. The dispute became much more heated when the Punjab itself was divided in 1966 into the Sikh Punjab and Hindu Haryana. Water is always central to the conflicts. Haryana occasionally cuts off Delhi's water as a reminder. The disputes simmer on.

In South India the dispute between Karnataka and Tamil Nadu over the waters of the Cauvery has not descended to armed struggle, but it has been equally bitter on other levels, destroying families and livelihoods.

4 Interlinking rivers

Medha Patkar speaks of the 'disease of giganticism' in a recent article; 'as Nehru called it three years after Bhakra-Nangal, which no one quotes him on,' she says. Nehru would not have supported the interlinking rivers project. Gandhi would have been appalled.

Our scope here is limited, but for a good entry into the debate see *Notes and references*.

The interlinking rivers project is one of those grandiose impractical examples of hubris that catch the imagination of some to the potential detriment of us all. The comment in the introduction of the impact on generations upon generations is even more pertinent here. This is the type of project that could have sunk the Roman Empire.

The great dam builder Dr K.L. Rao in 1972, by then the Irrigation Minister in the Central Government, proposed the idea initially as a 'back of envelope' calculation, the 'Ganga Cauvery link'. It became a 'garland canal' proposal in 1977 by Captain

Dinshaw J. Dastur an airline pilot who flew up and down the Himalayas repeatedly. Both plans were rejected as technically unfeasible and too costly to contemplate. In 1982 the National Water Development Agency (NWDA) was set up to carry out pre-feasibility studies. This organisation beavered away in total secrecy for twenty years to little effect. In 1999 a national commission set-up to review the NWDA reports saw: 'no imperative necessity for massive water transfers in the peninsula component' and that the Himalayan component would require further study.

In 2002, the President of India mentioned river linking in his Independence Day speech. In October, a Supreme Court case brought by a private individual, of the type deplored by The World Bank, surprisingly recommended that the government act and formulate a plan to link major rivers by 2012. In December, the government, seemingly delighted by the Supreme Court ruling (that in other circumstances it might well have ignored) set up a Task Force to examine interlinking rivers (TFILR) and to prepare feasibility reports. The impetus appeared to die somewhat after the Task Force reported in 2004. But, the plan is firmly back on the agenda in 2006.

What is the Interlinking Rivers Project? Why is it so implausible?

The proposal is to link 37 major rivers through 30 links with dozens of large dams and thousands of kilometres of canals (moving water of which 70 per cent might not arrive). Of the 30 links proposed 14 are in the Himalayas (and require international agreements with upstream or upper riparian states – China and Nepal) and 16, the peninsula component, are located around the coastal fringe of eastern India.

The purpose is admirable to transfer water from areas of surplus to areas of water deficit and to provide a permanent solution to the paradox of droughts and flood. A fine idea, but give a non-expert five minutes to study the proposal and obvious questions begin to arise. For example, the cost will be in excess of one million crores. It is the biggest water diversion project ever contemplated on planet earth. Will Nepal and China agree to the Himalayan links? How can the Peninsula links provide water to areas of scarcity? When almost all the links and their command areas are in the lower river basins and coastal belts, which are already reasonably well-irrigated. Let's not even get into flood control.

What happens when we get to the practical issues (outlined in Section 8), the gross financial mismanagement, the planning and management malaise, the secrecy, and the lack of transparency and lack of accountability? What happens? Firstly, there has never been a proper river basin study and integrated river basin plan in India's history. So, what are the implications of the project for each of the 37 river basins covered? No-one knows!

What is likely to happen, when large canals are diverted towards river systems where there is insufficient water, because the existing dams in the river basin are silting up, the canal infrastructure has decayed, there is inadequate money for operations, the services aren't provided and the backlog of deferred maintenance is immense? What about the inter- and intra-state water conflicts, and the Tribunal awards? A few issues might be resolved by interlinking, but are all 'lose-lose' or zero sum games according to The World Bank. What happens to the river basins that can't afford to lose the water, where half the rivers no longer flow and many are 'fetid sewers'?

What alternatives have been canvassed and costed? What multi-disciplinary teams have worked on the project? What independent experts have evaluated the project in line with other alternatives? What about the growing gap mentioned by The World Bank between the cost of services and user payments? Capital costs per hectare of providing irrigation from large projects (given in sections 7 and 11) are already far beyond the capacity of any user (even the largest of farmers) to pay. The per hectare cost of the interlinking rivers project will be much higher.

The World Bank mentions the endemic corruption that this gap produces. Unhealthy links between politicians, government employees and contractors do exist, and then there are the international dam building cartels. What is the potential for corruption in such a huge project?

What about other infrastructure during the implementation? Given the history of large projects over the past sixty years (remember the 29 major projects that had been completed by 1979-80 of 205 projects taken up since Independence), will other infrastructure be in abeyance and under-funded for the next fifty to sixty years? Will taxpayers and citizens tolerate this?

5 Debunking Myths

There are two myths associated with the increase of irrigation and the expansion of agricultural food production that need to be challenged.

5.1 That food security, dams and irrigation are the same thing

The first myth is related to food security. The idea of India as a newly independent nation having fought hard to achieve separation from Britain was marred in part by Partition and the terrible massacres in the Punjab. Symbols were important then. The famines of the nineteenth century and early twentieth were prominent in the minds of the new leaders. What better aspiration than for a new poor nation

to aspire to be self-sufficient in food. Water is holy in India, none more so than the holy waters of mother Ganga. It was clever of Nehru to combine the two and call dams the 'temples of modern India'. (A decision he came to regret.) Everyone knows that water is essential to agriculture. In a country where the intermittent waters of the monsoon and sometime lack of water is omnipresent, associating the waters of life with India's national aspiration on food was a potent symbol.

Then, actually achieving food self-sufficiency was remarkable. Unfortunately, the potent symbol and the achievement became fixed in the public mind and were not questioned. Such successes were few in the post-Independence period. This helped to promote the excesses of a profession of engineers, bureaucrats and politicians and to besmirch such an important national achievement, by cronyism, corruption and an immense waste of money and resources. The reluctance to criticise the achievement potently lingers and hinders dealing with additional problems, created through food self-sufficiency, of distribution, storage (and wastage), and the competition between cash crops (primarily for export) and food crops.

Irrigation by means of large dams and the 'green revolution' compete as the explanations for the achievement of the holy goal of food security. Yet, as shown in the main text, large dams and large to medium irrigation projects have contributed only one tenth of the increase in food production.

5.2 That waters not used are `wasted´

The second myth is only held by the engineering profession, some in the intelligentsia and more lately by economists, but it is pernicious because it is used as a tool of persuasion to influence politicians and administrators. The myth is associated with the dominant nineteenth century idea of progress and the associated notion that nature must be subdued and controlled. The myth is that water that is not 'used' in economic endeavour is wasted.

Ajaya Dixit who argues against the myth says that historically engineering works were based on the idea of 'surplus' or 'excess'. This changed and the language of 'waste' has become dogma. He says the idea is qualitatively different from that of utilising surpluses and leads to extravagant and rather silly consequences. He says the idea became the practice of colonial science 'and its reckless pursuit of optimizing the efficiency of water use'.

In its modern guise the myth is couched in the terms of macroeconomics and argued for eloquently by organisations, such as irrigation departments in government and previously by The World Bank. The myth becomes dangerous when it fuels grandiose schemes, such as the Interlinking Rivers Project.

Dixit says: 'This notion of waste was based on the implicit assumption that when water was not earning a return, it, for all practical purposes, was flowing from a source to a sink and down the drain. In a strictly utilitarian sense this may have been a valid point of view, but from a more scientific perspective [it] amounted to hydrological imprudence, because water is indisputably part of a continuous system that circulates in its different forms on a periodic basis.'

'The Brahmananda Puran traces this cycle of water, its different manifestations like lakes, rivers, groundwater, sea, and the cyclical change in its forms from water to vapour and back to water.'

We all remember at school no matter where we grew up learning of the hydrological cycle. How water flows from rainfall into rivers and eventually reaches the sea from where it evaporates and is wafted back over land as cloud to fall again as rain. It is this whole hydrological cycle that is important and it is compromised by the 'reckless pursuit of optimizing the efficiency of water use' from one source and disregarding the whole, says Dixit.

Dixit provides examples of the inconsistencies produced by the myth of waste, such as the colonial ideology of seeing the irrigation canal as a machine that produced revenue. This glossed over the inefficiency of canals and hampers irrigation reforms to this day. Dixit says that British-built canals had an overall efficiency of 28%, that is, as much as 72% of the water fed into the system did not reach its intended destination, namely the commercially viable crop. He says: 'More than a hundred years later, and despite improvements in technology, the improvement in efficiency has been negligible. Even today, canal efficiency is just 30 per cent of its projected "command area" [in India]'. He argues that it is time that the specious claims and spurious assertions of the hydrological world are discredited in policy circles, once and for all, because they are a barrier to progress and reform.

Dixit also mentions the laughable assertion of some experts, perhaps embarrassed by such outrageous water losses that lead to waterlogging and salinisation, that seepage and other losses within the canal system is water that is recycled back into the natural system.

Partly, the controversy over large dams is fueled on one side by proponents, who are imbued with the myth and cannot see the logical inconsistencies. Those in this state will never be able to find common ground with those who oppose them. On the other side of the debate are some who are equally blinkered. It is for the rest of us to examine the complexities, using the best minds and tools available, and to try to devise optimal solutions.

6 Attempts to assess large irrigation and dam projects and make them accountable

Professor Pranab Banerji of the Indian Institute of Public Administration, New Delhi, says that at the time of Independence, a profitability criterion (of above 6%) was applied for the appraisal of irrigation projects in India. A shift from financial to quasi-economic criteria began in the early 1960s with the setting up of a Committee of Direction (the Gadgil Committee) that recommended the use of an annual benefit to annual cost ratio. A ratio of at least 1.5:1 was needed for a project to be approved. Unfortunately, as this 1.5:1 ratio became ingrained it has accidentally led to chicanery and cost overruns, as engineers massage their figures to meet the criterion.

Financial methods refer to direct accounting costs. 'Quasi-economic' is used to distinguish 'benefit-cost assessment' (a limited tool in the best of circumstances) from a full economic analysis using a range of analytical tools.

The shift from financial to quasi-economic criteria was not without problems, Banerji says. The Irrigation Commission noted in 1972 that the shift 'minimises the importance of securing an adequate return from investment on irrigation projects.' Nevertheless, several years passed with ongoing recommendations for change but no action, until the Desai Committee submitted a comprehensive set of recommendations in 1983.

The Desai Committee ought to have been considered a landmark in appraisal procedures and criteria, Banerji says. It recommended the replacement of the existing quasi-economic methods with comprehensive economic appraisal techniques and the use of the economic rate of return as the appraisal criterion with a cut-off rate of 9% (7% for drought-prone areas). It also made detailed recommendations regarding the items to be included in costs and benefits and on the steps to derive economic prices for them. Detailed recommendations were made regarding the manner and the sources from which data are to be collected and on the organisational changes needed as a consequence.

Banerji says 'The Desai Committee's recommendations were perhaps too revolutionary for a conservative system. The silence with which they were met was deafening. On the other hand, there was increasing pressure on the Central Government for further relaxation in appraisal procedures …' which the government resisted '… as it faced pressures both from inside, owing to the emerging fiscal

crisis, and from outside as environmental groups and project-affected people became increasingly vociferous.'

As the fiscal crisis deepened, the number of projects fell drastically from 435 new projects started in the late 1970s (Fifth Plan and Annual Plans) to only 45 new projects started in the Seventh Plan (late 1980s). Expenditures in real terms (1980-81 prices) were, however, greater in the Seventh Plan, indicating a shift in priorities to ensure that projects under construction were completed before new ones were sanctioned.

The government also faced an increasingly articulate anti-dam lobby. It began to accept some recommendations from earlier committees and to show some sensitivity to environmentalist concerns. The net effect was a widening of the definition of project costs. By end of the 1980s and early 1990s some of the social and environmental costs began to be internalised as project costs.

Yet the essential structure of project appraisal had hardly changed since 1964. The quasi-economic criteria of annual benefits to annual costs ratio, both evaluated at market prices and comprising many rule-of-thumb items, continued even though the internal value of return is also reported and costs had a broader definition.

In 1991, following an acute balance of payments crisis, the Government of India had to apply for adjustment loans from the IMF. For the irrigation sector this required cutting of subsidies (hidden or open) and fewer resources for capital expenditure. Finance, again, became a central issue. A committee was set up that recommended the re-introduction of a minimum financial return as an essential criterion for sanctioning all investment proposals along with social benefit-cost criteria. The wheel had turned full circle back to 1964.

However, since the turn of the millennium, with rapid growth in the Indian economy, the situation has become murky. The benefit-cost ratio still seems to be the main criterion states use to justify projects and the Central Government appears to be vacillating over what to do. States may continue to develop large dams using either their own sources of revenue or external funding, bypassing the Central Government and the CWC (Central Water Commission), temporarily at least.

References and further reading

Glossary
Notes and references

Glossary

These are terms that a layman may not immediately understand that are frequently encountered in further reading (many of the definitions are from McCully 1996).

AQUIFER: geological formation of high porosity and high permeability that yields significant quantities of GROUNDWATER.

AYACUT: See COMMAND AREA.

BASIN, CATCHMENT: See WATERSHED.

COMMAND AREA – CULTIVABLE COMMAND AREA (CCA): An AYACUT is the area served by an irrigation project; the command area is the area to be irrigated by a particular canal network; and the cultivable command area (CCA) is the part of the command area that is theoretically cultivable when supplied with water. However, the actual area irrigated by the project is usually much smaller than these.

CANAL IRRIGATION: irrigation with water supplied via canal, usually having been diverted from a regulated river or reservoir.

DRIP IRRIGATION: efficient irrigation system that delivers water directly to the roots of plants, e.g. through perforated or porous pipes.

GROUNDWATER: subsurface water contained in saturated soils and rocks.

IRRIGATION EFFICIENCY: proportion of water used for crop growth relative to the total amount of water withdrawn by the irrigation system.

MICRO-IRRIGATION: (1) irrigation system using super-efficient sprinklers or DRIP IRRIGATION; (2) the use of irrigation on a small scale by gardeners growing for their own family or for local markets.

OUSTEES: people displaced by development projects. Originally used in India, the term is increasingly used by social scientists internationally (it has connotations that are pejorative and dehumanising).

RAINWATER HARVESTING: farming technique, which conserves water by collecting rainwater run off, behind earth or rock bunds or in small basins.

RIPARIAN: of, or relating to, or located on the bank of a river.

WATERSHED: a drainage area, sometimes used in its US sense of the entire area drained by a river (synonymous with catchment, catchment area, basin and drainage basin). A large watershed includes many smaller tributary watersheds. The catchment of a dam is the entire network of drainage that flows into the dam. However, BASIN is used here as the ultimate descriptor of the entire watershed of a large river system. For example GODAVARI BASIN refers to the entire series of watersheds that make up the entire drainage system of the Godavari River and all its tributaries.

Notes and references

Key reference

The authors have tried to keep the number of works cited to a minimum to provide a set of entry points for further reading. The World Commission on Dams (WCD) as well as producing a final report in 2000 commissioned and encouraged many other reports. These are kept as a knowledge base at the WCD website http://www.dams.org/. The key reference is **WCD 2000**: **Rangachari R.**, **Sengupta N.**, **Iyer R.R.**, **Banerji**, **P. and Singh**, **S.** *Large Dams: India's Experience*, a WCD country case study prepared as an input to the World Commission on Dams, Cape Town 2000. (Hereinafter referred to as **WCD 2000**.)

Part I Background

Quotation from McNeill, John *Something new under the sun: an environmental history of the twentieth century* Penguin, London 2001.

1 Introduction

Quotation from Engels, Friedrich *Condition of the working class in England: The Great Towns* Leipzig 1845, also published by Penguin (see http://www.marxists.org/archive/marx/works/1845/condition-working-class/ch04.htm).

There are endless articles in the media on India's expanding economy. See for example an excellent one page snapshot by Jeffrey Sachs entitled *India: center of an export services revolution*. Sachs, Jeffrey *The end of poverty: how can we make it happen in our lifetime* Penguin, London 2005. Also see Sachs p 244 et seq., for a simple account of macroeconomic issues related to the different types of capital including infrastructure p 244 and for differential diagnosis and capital accumulation p 251 to 257, in particular p 251-253. The key chapter in Sachs book for anyone interested in conceptual tools for aid or development work is his chapter on 'clinical economics' p 74-89.

2 Dams and diversions in history

The information closely follows McNeill 2001 p157-159 and the quotations are from McNeill.

3 Post colonial India

3.1 Overview

The introductory information is from McNeill 2001 p 161-2. The information regarding 15 per cent of planned expenditure and that of 205 major projects only 29 had been completed by 1979-80 comes from Thukral, Enakshi Ganguly ed. *Big dams, displaced people: rivers of sorrow rivers of change* Sage, New Delhi 1992, p 9 and p 174.

3.2 Period of dam builders

Table 1 is modified after R. Rangachari *An historical review* WCD 2000. (Hereinafter referred to as Rangachari WCD 2000.) R. Rangachari is from the Institute of Public Auditors of India, New Delhi.

Nirmal Sengupta *A brief review* WCD 2000 is the basis for the remainder of the information in this section and the quotations. (Hereinafter referred to as Sengupta WCD 2000.) Professor Nirmal Sengupta is from the Madras Institute of Development Studies (MIDS), Chennai.

Sengupta WCD 2000, Table 2.3 also has large dams broken down by state. The major dam building states are Maharashtra and Madhya Pradesh, followed by Gujurat, with 1 529, 1 093 and 527 dams over 10 m (completed and under construction), respectively.

3.3 Current situation

The quotations are from The World Bank draft document *India's water economy: bracing for a turbulent future* October 2005. The presentation on water was made to the Government of India in New Delhi in October 2005. A final document was produced in December 2005. Hereinafter referred to as World Bank 2005. (Available at http://www.worldbank.org/)

Part II Polavaram Dam basics

4 Andhra Pradesh (AP) water background

Quotation from McCully, Patrick *Silenced rivers: The ecology and politics of large dams* Zed Books 1996, p 180.

4.1 AP river basins

Information from two sources: (1) Shankari, Uma et al. *Let the waters flow: a backgrounder for citizens on water issues in Andhra Pradesh*, Hyderabad, 2003. (2) *Utilization of Godavari waters for sustainable development and poverty alleviation in Telangana* A presentation at a 'round table conference' by the Institution of Engineers (Hyderabad) in February 2005 to a meeting of politicians, engineers and farmers. Hereinafter referred to as: Institution of Engineers (Hyderabad) 2005.

4.2 Current state of water projects in AP

Comment made by Vidya Sagar Rao, retired Chief Engineer, Central Water Commission, Hyderabad, at a *Solidarity against the Polavaram Dam: Solidarity committee for Anti-Polavaram Project* meeting (supported by Medha Patkar) in Hyderabad on 4 December 2005.

Quotations in first paragraph by World Bank 2005.

Information in the remainder of this section is from the Institution of Engineers (Hyderabad) 2005, as are the quotations and footnoted information.

4.3 A short digression on sedimentation

Quotation from McCully 1996, p 110.

Table 4, from *India Together* 31 January 2006. The source of the Table was: *Eenadu* 27 June 1992 – a Telugu language Newspaper.

(http://www.indiatogether.org/environment/water/cre-water3.htm)

Also see Singh WCD 2000, p 79-80 and the Annexes to WCD 2000 for information on sedimentation.

5 Polavaram Dam

5.1 A problem with information

Another study of alternatives is Rao, T. Hanumatha *Polavaram project: the present thinking and possible alternatives, booklet* prepared by Telangana Natural Resources Management Group, Disaster Preparedness Network, Centre for World Solidarity, Revised Edition September 2005. (T. Hanumatha Rao was former engineer-in-Chief, Government of Andhra Pradesh and consultant to the United Nations.) There are also several others.

5.2 Process of project development

Comment made by Vidya Sagar Rao, retired Chief Engineer, Central Water Commission, Hyderabad, December 2005 (cited above).

5.3 Basic information

Information in 5.2 and basic information on the dam is from documents 2,3 and 5 (see Section 11.1 below)

The breakdown of capital works (in crores) is: (1) Head works 3532.91; (2) Power 1750.78; (3) Left Main Canal 1268.26; (4) Right Main Canal 1613.01; (5) Water supply canal 29.43, from document 5 (Vol. 2).

Part III Large dams discredited

6 How have large dams contributed to food security?

The first two paragraphs is from Rangachari WCD 2000, section 1.3.

With regard to irrigation potential, Himanshu Thakkar wrote a contribution to the World Commission on Dams 2000 cited below. In this paper he says: 'The persistent gap between the created potential especially under M & M [Major and Medium] projects and area reported to be actually irrigated has attracted much attention. … An analysis of eight projects in AP showed that the actual irrigated area was 11 to 70% short of potential.'

The remainder of the analysis is from Professor Sengupta WCD 2000 section 2.4. His figure of less than 10% for the contribution of large dams to the increase in food grains production is surprising, both because of the huge investment in large dams infrastructure in India since Independence and because the average person in India has somehow been led to believe that large dams have produced the increase in food security. Thakkar by a different route to Sengupta also arrived at a figure of 10% (actually also slightly less) as the contribution of large dams to increased food productivity. Thakkar, Himanshu *Assessment of Irrigation in India* contributing paper to WCD 2000, p 24 (See WCD knowledge base http://www.dams.org/). Himanshu Thakkar is from the South Asia Network on Dams, Rivers and People (SANDRP) in Delhi. Thakkar's paper is also an excellent source of information and analysis of the topic of irrigation in India in general. (For an excerpt of the larger paper specifically on large dams see http://www.sandrp.in/irrigation/lrg_dam_contri.pdf.)

7 How do large dams stand up to financial analysis?

7.1 Attempts to assess large projects and make them accountable

Banerji WCD 2000. See also Appendix, Part 6.

7.2 Costs of large dams and large-scale irrigation

Quotation from Prime Minister Jawaharlal Nehru, 1958 Annual Meeting of the Central Board of Irrigation and Power. Refers to Bhakra or Bhakra-Nangal dam.

Professor Banerji's excellent analysis continues. Table 5 and 6 are from Banerji WCD 2000, *Capital cost* p 50-52. Banerji cites B.D. Dhawan as the source for the figure of Rs 70 100 per hectare. The information on cost overruns in Table 7 is from McCully 1996, p 267.

8 Failure of planning, management and accountability

8.1 What Indian analysts say

The text is an encapsulation of what Banerji and Iyer WCD 2000 say. Iyer, Ramaswamy R. *The Framework of Laws, Policies, Institutions and Procedures* (Hereinafter referred to as Iyer WCD 2000). Ramaswamy R. Iyer is the former Secretary, Water Resources in the Government of India and is currently at The Centre for Policy Research in New Delhi.

8.2 What The World Bank says

The two major arms of The World Bank relevant to funding large projects must promote privatisation, because it is in their articles of agreement. The International Bank for Reconstruction and Development's (IBRD) second purpose formulated at Bretton Woods in 1944 is to promote private investment. (The IFC established in 1956 – International Finance Corporation – has a similar but stronger bent.) For some reason The World Bank doesn't publicise this necessity.

Following its opening statement that India faces a turbulent water future (World Bank 2005), The World Bank says: 'The problems of a developing India, however, are not limited to providing adequate quantities of water. Growing populations, cities and industries are putting great stress on the aquatic environment. Many rivers – even very large ones – have turned into fetid sewers. India's cities and industries need to use water more effectively, and there will have to be massive investments in sewers and wastewater treatment plants.'

8.2 .1 The World Bank's analysis

World Bank 2005. The emphasis on '*has fueled endemic corruption*' is ours rather than The World Bank's.

8.2 .2 How water 'users' have coped with this failure

World Bank 2005.

8.3 A digression on privatisation

Sachs 2005 (see section 1) is a good starting point for the relatively neutral macroeconomic approach. Sachs also has a track-record of advising countries and succeeding in solving difficult macroeconomic problems. If nothing else his chapter on 'Clinical economics' (p 74 *et seq*.) gives sound guidelines on how to move beyond simplistic macroeconomics to more complex and detailed analyses. However, even the best macroeconomists are suspect on the topic of privatisation.

9 The distressing story of oustees

9.1 What happens when people lose their homes and livelihood

The quotation in paragraph 3 is from Shekhar Singh et al. *Environmental and social impacts of large dams: the Indian experience (Summary Report)* WCD 2000, p 112. (Hereinafter referred to as Singh WCD 2000.)

The information in paragraphs 4 to 8 is from McCully 1996 p 66-82. The quotation in paragraph 9 is from McCully 1996 p 76.

9.2 How many people?

Roy, Arundhati *The greater common good* essay in *The cost of living* Modern Library, 1999. Quotation below this from McCully 1996 p 66.

Calculations of the numbers of displaced are always 'back of envelope' exercises as no one really knows. The authors in Singh WCD 2000 calculate the number for 213 dams to get an average submergence of 8748 hectares (ha) and an average number of people per ha of 1.51. Hence multiplying 8748x1.51x4291 (the number of large dams) one gets 57 million.

The Central Water Commission (CWC) recorded 13 000 ha average submergence in one study (11 dams) and 24 555 ha in another (54 dams). Another study of 83 dams found an area of submergence of 16 604 ha. Combining all these and averaging for all 148 dams one gets 19 237 ha. The CWC estimate of average number of people per ha was 1.1, whereas The World Bank gave a figure of 2.26. Playing with the figures but still using the 8748 ha above one gets 41 million (1.1x8748x4291); and 98 million (2.26x8748x4291), using the two averages for people per hectare. Alternatively, if one uses 19 237 ha multiplied by 1.1, 1.51 and 2.26 for 4291 dams one gets, 91 million, 125 million and 187 million, respectively. One quickly recognizes the estimates are not reliable. However, one also suspects that the previous low conservative figures of 14 million, 20 million and 33 million are also not reliable. A median conservative estimate for submergence displacees in India since Independence would be 50 million and if one includes canal, livelihood and other indirect displacees a figure of 100 million would not be too far off.

Table 5 is mainly from McCully 1996, p 84, the quotation below the table is from p 83. Nagarjunarsagar figures are from, Thukral 1992 p 54 *et seq.* (cited in 3.1 above).

Bagri, Hirakud, Nagarjunasagar, Ukai, Pong displacements are covered in Thukral 1992. Dharmadhikary, Shripad *Unravelling Bhakra : Assessing the Temple of Resurgent India* Manthan Adhyayan Kendra 2005 is a recent general study of Bhakra that covers displacement. D'souza, Dilip *The Narmada Dammed: An Inquiry into the Politics of Development* Penguin 2002 gives details on Sardar Sarovar and the Narmada. The SANDRP newsletter *Dams, rivers and people* is an excellent source of information (http://www.narmada.org/sandrp/), as is the Narmada Bachao Andolan's newsletter *Narmada Samachar* (http://www.narmada.org/samachar/). There are also many other books and displacement case studies available.

9.3 What about government compensation?

The N.V. Gadgil quotation is from McCully 1996 p 76. The Dr. K.L. Rao quotation is from Sengupta WCD 2000 p 22-23.

The protests regarding Hirakud in 1946, Pong 1970, Chandil 1978, Icha 1982 and Sardar

Sarovar are mentioned in McCully 1996, p 299 et seq.

Parsai, Gargai *"We have made a difference"* Interview with Medha Patkar *The Hindu*, 15 December 2005 p 13.

An example of an apparently good package on paper (discussed further below) is National Thermal Power Corporation's *Policy on resettlement and rehabilitation*, June 2005 (See http://www.ntpc.co.in/infocus/socialcomm.shtml).

In all areas of Andhra Pradesh government policy but specifically in the backward areas of water engineering and agriculture there is going to have to be a painful learning process on how to implement client or customer-based policy from the bottom-up. Without this none of the necessary reforms will ever work or be implemented properly. Peter Mollinga et al. call the top-down approach 'policy as prescription' and what is needed is the bottom-up approach 'policy as process'. They give guidance on the distinction in the context of what 'ought to be' and 'what is' with reference to 'participatory irrigation management' (PIM) in Andhra Pradesh, p 242. In some of the NGO movement and some development aid work the concept of 'grass roots' participative planning and implementation is well understood.

Mollinga, Peter P. et al. *Capture and transformation: participatory irrigation management in Andhra Pradesh*. In Mollinga, Peter P. and Bolding, Alex Eds. *The politics of irrigation reform: contested policy formulation and implementation in Asia, Africa and Latin America* Ashgate, Aldershot UK 2004.

Iyer WCD 2000 covers briefly the constitutional protections and legislative framework in India for scheduled tribes and scheduled castes.

10 Interlinking rivers

See Appendix Part 4 (below).

Part IV Polavaram Dam analysis

11 Documents and projections

Quotation from McCully 1996, p 167.

11.1 Available documents

The documents

(1) Government of Andhra Pradesh, *Project Report of Polavaram major irrigation project* Hyderabad 1981-82; (2) Reddy, N. Subba, *Polavaram Project: Report on resettlement and rehabilitation of the displaced Centre* for Economic and Social Studies, Hyderabad 1996; (3) Government of India, National Water Development Agency (NWDA) *Feasibility Report of Govdavari (Polavaram) – Krishna (Vijayawada) Link Project* c. 1995 circulated in 1999 (http://nwda.gov.in/index2.asp?sublinkid=62&langid=1); (4) Government of Andhra Pradesh *Policy on resettlement and rehabilitation for project affected families* G.O. No. 68, Hyderabad 2005; (5) Government of Andhra Pradesh *Indirasagar (Polavaram): A multipurpose major irrigation project* Volume I: Irrigation and CAD Department, Government of Andhra Pradesh *Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP)*; Volume II: Agricultural Finance Corporation *Resettlement and rehabilitation project affected persons economic rehabilitation plan (PAPERP)* September 2005.

Further comments on documents

Veracity

We all have the tendency to use research as a drunkard uses a lamppost – for support, not for illumination. David Ogilvie

The comment about for 'support' rather than for 'illumination' certainly applies to parts of The World Bank study *India's water economy: bracing for a turbulent future* 2005, where The World Bank tries to show the positive impacts of its project funding. At least genuine research is involved. In AP government documents and statements, at best many of the 'facts' are an attempt at denial and at worst they are fabrications or distortions.

Document 2: Reddy's research

The only one of the five documents with strong integrity, despite being a government commissioned study, is the survey on displacement by N. Subba Reddy from the Centre for Economic and Social Studies, 1996 (called Reddy 1996 hereafter).

Reddy 1996 is to be admired for attempting to do an honest job and put forward some unpalatable truths. However, one criticism is that he never mentions that his estimate of 'oustees' is based on the government definition of 'project affected' and does not reflect the total population of the villages surveyed. Reddy's work is also flawed because the scope was defined by the AP Government (despite the best efforts of the author) and the figures are now out-of-date.

However, Reddy and fortunately the 2001 Census of India were useful to check the veracity of the figures in Document 5: Vol. 2, from the two-volume environmental impact study (Volume II: Agricultural Finance Corporation *Resettlement and rehabilitation project affected persons economic rehabilitation plan (PAPERP))* September, 2005. Vol. 2 is a scrappy, apparently hurried compilation that initially doesn't fill one with confidence. Therefore, the ability to check the figures and make inferences by reference to two other independent studies was crucial.

Reddy 1996 had problems with the lack of availability of information, of documents and in doing the research, despite conducting the study under the auspices of the AP Government. Even support from the top is sometimes not enough. For example, Reddy tried to get information on 'vacant lands' in the submergence districts as potential areas for R&R. He sought, through the three relevant Collectors, information from the 'MROs' (Mandal Revenue Officers) concerned, about the possibility of land-for-land resettlement (even supplying details on vacant land to the Collectors of East and West Godavari), but after three years had received no information. This was despite numerous requests and even the Principal Secretary having written on two occasions to Collectors to try to elicit the information.

He wrote to the Chief Engineer (Investigations) twice to clarify whether resettlement and rehabilitation (R&R) applied only to tribal people. The Chief Engineer replied twice in May and June 1993 to reiterate that the R&R proposal was only required for 'tribal oustees'. Reddy rather courageously decided that these views were 'not in consonance with contemporary thinking at national and international levels and went over the head of the Chief Engineer to the Principal Secretary, Irrigation Department who 'took a well-considered decision in August 1994 to include non-tribal oustees also in the R&R plan.'

The AP Government's revisionism

The government is consistently providing different figures in the press and indeed stating things in the media that can't possibly be true. In a report in the Deccan Chronicle in late December 2005 and in the Telugu papers, the AP Government tried to reduce the number of villages being submerged from 276 (as enumerated by Reddy) down to 157 based on new surveys. (Note the figure 157 may possibly come from using the 2001 Census of India 'revenue villages', numbering 156, inappropriately and out of context. See 12 below.) These efforts backfired for two reasons.

First, the Irrigation Minister of AP made a strategic mistake in releasing Document 5: the two-volume environmental impact study to a delegation supported by Medha Patka in early December 2005. Vol. 2 for all its faults, provides up-to-date information on the government's own figures for resettlement and rehabilitation (R&R). The numbers of displacees have increased since Reddy 1996.

Second, as more than three quarters of villagers in the submergence area are justifiably angry at the prospect of forced displacement and government people are no longer welcome in villages; it is highly unlikely that any hurried additional surveys are either comprehensive or accurate. One example, of many acts of civil protest, is that the tribal villagers in one village in VR Puram Mandal threatened the government survey people with bows and arrows and locked them up for twenty-four hours.

11.3 Project and irrigation cost

11.3.2 Cost of creating irrigation

The average of Rs 497 per hectare comes from: Peter, J. Raymond *IMT case study: Irrigation reforms in Andhra Pradesh* International conference on irrigation management transfer, June-October 2001, p 19. (At the time of writing, J. Raymond Peter was Executive director of the international network on participatory irrigation management (INPIM). He was formerly the Secretary of Irrigation, in the Government of Andhra Pradesh and was instrumental in designing the reform process in the water sector.)

12 Facts on displacement

Quotation from McCully 1996 p 78.

The three data sets, Reddy 1996, the Indian Census data of 2001 (provided in Vol. 2) and Vol. 2 2005, use the same villages, allowing comparisons to be made. (Note: the Census 2001 data uses revenue villages only, so that the number of villages (156) is less. The population of the non-revenue hamlets involved is amalgamated within that of the revenue villages – see below.) An analysis of the proportions of the population from each district yielded some anomalies, which warrant detailed investigation beyond the scope of this booklet. Nevertheless, the comparisons made were sufficient to establish some confidence in the information contained in Vol. 2.

12.1 Statistical information

According to Reddy's 1996 research, 276 hamlets would be affected by the project involving 27 798 households, a total population of 117 034 and an average family size of 4.2.

Reddy's enumerated figures for the same villages were 48.2% scheduled tribes and 15.27% scheduled castes and though the figures are older than in Vol. 2 they may be more reliable.

Reddy 1996 says: about 75 000 acres (30 364 ha) of cultivated land, 20 000 acres (8097 ha) of fallow land and some thousands of acres of forest land will be submerged in AP.

The definitions used in Vol. 2 are in summary: a 'PAF' (project affected family) loses house, land or more than 50% of land and meets other requirements related to minimal economic holdings or falling below the poverty line. 'OAF' (other affected family) refers to those who lose less than 50% of their land and do not qualify as a 'PAF'. (The definitions in G.O. No. 68 2005 are slightly different and, an 'OAF' is called a 'Project Displaced Family'). Reddy 1996 does not explain that his numbers do not reflect the entire population of the concerned hamlets either. Refer to the original documents for precise details.

It becomes slightly messy here, because the 2001 Census of India defines 'revenue villages' as the smallest unit and ignores hamlets (the census data has 156 units, not 276). However, if one understands population sampling, it is easy to imagine a distribution of 'revenue villages' surrounded by smaller close by hamlets. The few hamlets that are outside the submergence zone for submerged revenue villages should be matched by hamlets within the submergence zone that belong to revenue villages outside the submergence zone. Chance will make a slight bias in one direction or the other, but the important point is that the bias will be random. Hence (unlike the government's use of figures) the estimate is equally likely to be smaller as it is to be larger and the numbers are unlikely to be high. The only way to prove this is to make a detailed study of the village-by-village census data and to conduct field samples in the villages, which is beyond the scope of the present study.

Similarly, because Andhra Pradesh is going through what is called a 'demographic transition' extrapolating population growth for the villages concerned is complex and requires detailed analysis of the census data at village level and population growth estimation that is also beyond the scope of the present study.

12.3 Extra problems – backwaters, wave heights and periodic flooding

Reddy 1996, p 23-25.

12.4 AP Government R&R package

Quotation from Peter P. Mollinga et al. 2004, p 242 (cited in 9.3 above).

Appendix

1 Case studies around the world

These case studies are cited in McNeill, de Villiers and the World Commission on Dams knowledge base.

1.1 Egypt, the Aswan High Dam and the Nile

Much of this information comes from McNeill 2001 (See Part I Background above).

1.2 Ecological consequences

Much of this information comes from de Villiers, Marq *Water wars: is the world's water running out?* Phoenix Press, London 2001.

With reference to malnutrition, McCully 1996 also provides well-researched details of this from around the world, p 65 et seq.

2 Colonial India – the Punjab

Much of this information comes from McNeill 2001.

3 Disputes with neighbouring countries and between states

See de Villiers 2001 for more detail on these international disputes and also on the internal disputes mentioned.

4 Interlinking rivers

Quotation from Gargai Parsai's Interview with Medha Patkar (cited in 9.3 above). Bhakra-Nangal is a huge dam on the Sutlej River in northern India completed in 1963, also associated with projects on the Beas River.

For an excellent introduction to the issues see the pamphlet by Vissa, Kirankumar *Why this sudden interest in riverlinking* 2004 from the Rivers for Life organisation (Available from info@riversforlife.net. See also http://www.riversforlife.net/site/about.htm).

One articulate proponent for the scheme is B.G. Verghese a journalist and writer who has written good things in the past about water issues, but who on being appointed to the Taskforce on Interlinking Rivers (ILR) seems to have been overtaken by the hubris. See Verghese, B.G. *Exaggerated Fears on "Linking Rivers"* Himal South Asian, September, 2003, with responding comments by Ramaswamy R Iyer, Himanshu Thakkar and Sudhirendar Sharma (See http://www.himalmag.com/2003/september/response.htm). The other articulate proponent of the ILR project is Suresh Prabhu the chairperson of the Central Government's Task Force on Interlinking Rivers that wound up in 2004. Prabhu's and Verghese's proselytising for ILR stirred up a debate in Himal South Asian magazine in 2003. Articles worth consulting on the opponents' side are Ajaya Dixit see Appendix 5 below. Iyer, Ramaswamy R *Essay: making of a sub-continental fiasco* Himal South Asian, August, 2003; Sharma, Sudhirendar *Perspective: Suresh Prabhu & the art of selling delusions* Himal South Asian, August, 2003; Thakkar, Himanshu *Perspective: Flood of nonsense - how to manufacture consensus for river-linking* Himal South Asian, August, 2003 (http://www.himalmag.com/archive/).

5 Debunking Myths

5.1 That food security, dams and irrigation are the same thing

The information is based exclusively on that of Dixit, Ajaya *Rivers of collective belonging*, Himal South Asian, October, 2003 (http://www.himalmag.com/archive/). Ajaya Dixit is a hydraulics engineer. He has worked extensively as a consultant on water resources in Nepal, is founder of Nepal Water Conservation Foundation and editor of Water Nepal.

5.2 That waters not used are 'wasted'

Dixit also argues cogently against this myth in the same article.

6 Attempts to assess large irrigation and dam projects and make them accountable

The whole of this topic owes its information to an excellent and clear discussion of a complex subject by Banerji. Pranab Banerji wrote *Financial, Economic and Distributional Analysis of Dams in India* in WCD 2000. Professor Banerji is from the Indian Institute of Public Administration, New Delhi.

ISBN 81-903992-0-9