Measuring Irrigation Subsidies in Andhra Pradesh and Southern India: An application of the GSI Method for quantifying subsidies

FEBRUARY 2011

BY:
K. Palanisami
IWMI-TATA Water Policy Research Programme
IWMI –South Asia Regional Office

Kadiri Mohan
IWMI-TATA Water Policy Research Programme
IWMI –South Asia Regional Office

Mark Giordano
International Water Management Institute
Colombo

Chris Charles
Global Subsidies Initiative (GSI)
International Institute for Sustainable Development

For the Global Subsidies Initiative (GSI) of the International Institute for Sustainable Development (IISD)
Geneva, Switzerland

GSI Global Subsidies Initiative
www.globalsubsidies.org

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Kadiri Mohan
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k.mohan@cgiar.org

Mark Giordano
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mark.giordano@cgiar.org

Chris Charles
Global Subsidies Initiative (GSI)
International Institute for Sustainable Development
ccharles@iisd.org

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International Institute for Sustainable Development

Head Office
161 Portage Avenue East, 6th Floor
Winnipeg, Manitoba
Canada R3B 0Y4
Tel: +1 (204) 958-7700
Fax: +1 (204) 958-7710
Web site: www.iisd.org

International Institute for Sustainable Development
Global Subsidies Initiative

International Environment House 2
9 chemin de Balexert
1219 Châtelaine
Geneva, Switzerland
Tel: +41 22 917-8373
Fax: +41 22 917-8054
Web site: www.globalsubsidies.org

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UNITS USED

1 MCM	=	35.3 mcft
1 TMC	=	1,000 mcft
1 gallon (UK)	=	4.5 litres
US$1	=	INR44.75 (December 2010)

LIST OF ACRONYMS

AMRP	Alimineti Madava Reddy Project
AP	Andhra Pradesh
APCBTMP	Andhra Pradesh Community-Based Tank Management Program
APSPCB	Andhra Pradesh State Pollution Control Board
BCM	Billion cubic metres
CCA	Culturable command area
CWC	Central Water Commission
DC	Distributary Committee
DES	Department of Economics and Statistics
FAO	Food and Agricultural Organization
GDP	Gross domestic product
GO	Government Order
GoAP	Government of Andhra Pradesh
GoI	Government of India
ha	Hectare
HLC	High-level canal
I&CAD	Irrigation & Command Area Development
INR	Indian Rupies
JICA	Japan International Cooperation Agency
LBC	Left-bank canal
LLC	Low-level canal
MC	Management committee
mcm	Million cubic metres
mcft	Million cubic feet
MI	Minor Irrigation
NSP	Nagarjunasagar Project
O&M	Operation and Maintenance
PC	Project Committee
PIM	Participatory Irrigation Management
RBC	Right-bank canal
RRR	Repair, renovation, restoration
SCRB	Separable Cost-Remaining Benefits
SRSP	Sriram Sagar Project
TBP	Tungabhadra Project
TC	Territorial committee
TMC	Thousand Million Cubic feet
WUA	Water User Association

GLOSSARY OF TERMS

Ayacut: An area irrigated or capable of being irrigated by gravitational flow, by lift irrigation or by any other method from any source of water. Also referred to as a "command area."

Barrage: Irrigation structures built across water streams, rivers or canals for temporarily storing or diverting water

Dugwells: Open wells used for drawing groundwater

***Gram Panchayat*:** Local government administrative institution at the community level

***Kharif*:** Cropping season from June to September

Major irrigation project: Having a command area of more than 10,000 ha

Mandal: A basic government administrative unit. A state is divided into districts; in turn, each district is divided in to mandals.

Medium irrigation project: Having a command area between 2,000 ha and 10,000 ha

Minor irrigation project: Having a command area of less than 2,000 ha

***Rabi*:** Cropping season from October to December

Tank irrigation: Tanks are traditional water harvesting and storage structures with a catchment area and a bund across the slope used to store water. Water stored and drawn from tanks is commonly referred to as tank irrigation.

***Warabandhi* system:** A system of distribution for water when it is allocated to water users sequentially, according to an approved schedule indicating the particular day, time and duration of supply

Water cess: Water cess, water charges, water rates, water tax and water prices were used frequently and interchangeably in this report. They commonly mean the fees collected from water users drawing water for a variety of purposes.

1. INTRODUCTION

1.1 EXECUTIVE SUMMARY

In India, as elsewhere, subsidies account for a significant portion of government expenditure. Government subsidies account for 14 per cent of the country's gross domestic product (GDP) (IHT, 2005); among the various subsidies, irrigation subsidies are significant. Assessing the scale of irrigation subsidies is a major challenge. A variety of different sources hold information and data; there is also a lack of clear incentives for stakeholders to gather the necessary data for accurate subsidy estimation and accounting. Data are held in a variety of formats and often for a wide variety of irrigation projects. There is also a wide range of actors present within the water supply system, which can complicate data recording and organization. The various methodologies available for subsidy estimation make it difficult to develop consistent or comparable estimates. In order to assess the scale of irrigation subsidies provided in India, a representative state— Andhra Pradesh state—was purposively selected, due to its size and irrigation development. The use of irrigation subsidies in this state was also consistent with the use of irrigation subsidies in other states in India, where agriculture is important.

Andhra Pradesh is one of the leading states in India with respect to irrigation subsidies—with significant investments in irrigation infrastructure development, the provision of free electricity for irrigation and the ongoing development of large-scale irrigation support programs. The level of irrigation subsidies in the state has increased from INR428 million (US$9.56 million) in 1980–81 to INR8,402 million (US$187.75 million) in 1999–2000 (Reddy, 2003). From 2004 onward, the Government of Andhra Pradesh (GoAP) launched the Jalayagnam Program (Water Infrastructure Development Program), prioritizing the development of irrigation infrastructure. The aim was to create a new command area of 4.45 million ha by investing INR1,662,630 million (US$37,153.74 million) by the year 2014.

The objectives of the study included: i) assessing the application of a common method for measuring irrigation subsidies in order to develop accurate, replicable and reliable subsidy estimates and ii) providing policy advice aimed at improving and standardizing the reporting of data on irrigation subsidies.

The GSI Method for quantifying subsidies—which uses the Net Cost to Supplier approach (GSI, 2009)—has been used in the study. Using the GSI Method, the cost of providing irrigation water in Andhra Pradesh was estimated using capital costs (interest and depreciation), operation and maintenance (O&M) expenses and the opportunity cost of electricity supplied to the irrigation sector. The benefits—such as the sale of irrigation water, hydropower, fishing rights and water pollution cess—were aggregated. The total aggregate subsidy was estimated by calculating the difference between the aggregate cost of irrigation water and aggregate benefits. The methodological framework used to measure a subsidy is further outlined in section 1.3.2. The definition and methodological framework quantifies subsidies by taking into account the collection inefficiencies that occur when tariffs or duties are requested from users but are not fully paid to the government.

To assess the irrigation subsidies in Andhra Pradesh state, three multipurpose water projects representing three regions of the state were selected. They were:

- The Nagarjunasagar Project (NSP) situated in the Coastal region.
- The Sriram Sagar Project (SRSP) in the Telangana region.
- The Tungabhadra Project (TBP) Low-Level Canal (LLC) in the Rayalaseema region.

Also, one incomplete project (or project nearing completion) was selected:

- The Alimineti Madhava Reddy Project (AMRP).

The AMRP was selected in order to compare the provision of subsidies between completed and unfinished projects. The study covered a four-year period from 1 April 2004 to 31 March 2008.

This report reviewed data and subsidy policies in detail for the state of Andhra Pradesh. Various irrigation support programs are detailed in the report in order to further a better understanding of the developmental policies linked to irrigation support.

With respect to aggregate cost, in the case of NSP, the cost of providing water to irrigation was INR2,291.93 million (US$51.21 million) in 2004–05, and increased to INR3,328.52 million (US$74.38 million) in 2007–08. However, in the case of SRSP, the total cost was INR5,705.58 million (US$127.5 million) in 2004–05, which subsequently increased to INR7,485.46 million (US$167.27 million) in 2007–08. The cost of providing irrigation was comparatively less in the case of the TBP, which cost INR385.87 million (US$8.62 million) in 2004–05 and INR322.07 million (US$7.19 million) in 2007–08.

Benefits (or revenue) were computed by assessing revenue received from multiple uses of water from the project, such as the sale of hydropower, sale of fishing rights and fish, and revenue collected in the form of water pollution cess.[1] The total benefits were high in the case of NSP: INR210.74 million (US$4.7 million) in 2004–05 and INR1,012.05 million (US$22.61 million) in 2007–08. In the case of SRSP, the total benefits in 2004–05 were INR74.48 million (US$1.66 million), and in 2007–08, the total benefits were INR167.28 million (US$3.74 million). The total benefits in the case of TBP were INR190.86 million (US$4.27 million) in 2004–05 and INR204.11 million (US$4.56 million) in 2007–08.

The total subsidy for each project and subsidy per ha were estimated for the three multipurpose irrigation projects in the state. In the case of NSP, the total subsidy was INR2,081.19 million (US$46.51 million) in 2004–05 and INR2,316.47 million (US$51.76 million) in 2007–08. The calculated subsidy was high for the SRSP: INR5,631.1 million (US$125.83 million) in 2004–05 and INR7,318.17 million (US$163.53 million) in 2007–08. In case of the TBP, the total subsidy was INR195.02 million (US$4.36 million) in 2004–05 and INR117.97 million (US$2.64 million) in 2007–08.

[1] Multipurpose projects serve different purposes, like flood control, groundwater recharge, water for domestic and industrial usage, recreational purposes, etc. In this study, irrigation cess, sale of hydropower, fishing rights and pollution cess were considered for computing benefits depending on the availability of and accessibility to the data sources.

In 2007–08, the per-hectare subsidy was INR2,427 (US$54), INR21,778 (US$486) and INR1,928 (US$ 43) under the NSP, SRSP and TBP projects respectively.

Based on the size of the command area irrigated by the three projects in the study, all other major completed irrigation projects in the state were grouped into three categories to better assess the extent of irrigation subsidies at the state level. The total annual subsidy for major irrigation projects in Andhra Pradesh was estimated at INR12,611.43 million (US$281.82 million) (based on an average over four years, from 2004 to 2008).

By using the subsidy figure estimated for major irrigation projects in Andhra Pradesh, an attempt was made to estimate the quantum of subsidy for all four South Indian states:

- Andhra Pradesh
- Karnataka
- Kerala
- Tamil Nadu

The total annual subsidy provided for major irrigation projects in South India was INR25,894.35 million (US$578.64 million) (based on an average over 4 years, from 2004 to 2008).

Since irrigation investment is a recurring process, cost escalation is one of the key issues facing the government due to delays in the project's completion. Cost overruns impose major financial burdens on the government and its projects. Due to the incomplete nature of several projects, and in order to account for the level of subsidy for these types of projects, one major irrigation project—the AMRP, which is nearing completion—was selected and subsidy estimates were made based upon its data.

In the case of the AMRP project, the subsidy was estimated at INR12,773.56 million (US$285.44 million) in 2004–05 and it has increased to INR30,221.88 million (US$675.35 million) in 2007–08. Per-hectare subsidies amounted to INR116,855 (US$2,611) in 2004–05, and increased steadily to INR253,698 (US$5,669) in 2005–06, INR62,639 (US$1,399) in 2006–07 and INR4,75,470 (US$10,625) in 2007–08.

It is likely that this report underestimates subsidies in the study area, as not all projects were assessed. Irrigation subsidies to smaller projects in Andhra Pradesh and the four southern states were not captured, given their significant numbers and community-level management systems, which make it difficult to estimate subsidies. Many of the sates have large numbers of small projects meaning there may have been significant subsidies not captured in this analysis. The report draws on data that include irrigation water and other water usage pricing policies, water tax collection practices and plough back (the reinvestment of water users fees into the water provisioning system) carried out by the government.

A number of challenges obtaining data for estimating certain components of what might be considered an irrigation subsidy were encountered. It is difficult to measure environmental externalities, such as damage to natural eco-systems and the loss of assets due to floods and encroachment (in the case of tank systems), as the opportunity costs of such interventions are difficult to quantify. Lost revenue on the sale of electricity to the agricultural sector for irrigation pumping can be calculated using data provided by the electricity department.

The study concluded that greater sharing of information and the adoption of agreed methodologies for storing information for calculating subsidies are warranted. Water users, government departments and related institutions are functioning independently and, as a result, there is little coordination in obtaining and storing related data. For example, the Irrigation Department is responsible for the release of water and the Revenue Department is responsible for maintaining and monitoring revenue records on the sale of water.

A number of policy suggestions are provided for government, including an overall reduction in the scale of subsidies in order to reduce consumption levels of irrigation water and use of electricity for groundwater abstraction. It also suggests that this is a way of minimizing the financial burden on the government.. This could be achieved either by increasing water charges marginally or increasing revenue generation and levels of cost recovery. Instituting management systems that involve the periodic review of subsidy policies is also important. Accordingly, changes in pricing norms can be incorporated into government policy and their effects monitored over time. The study also recommends that information on subsidies should be increasingly transparent. It is important that all sectors of society understand the level of subsidy and who benefits from it. This would help address any inequities concerning the distribution of subsides among different groups . The study finally suggests that state and national governments should aim to accurately quantify subsidies (in terms of type and quantum) so their full costs and benefits can be compared.

1.2 PROJECT OVERVIEW

The Global Subsidies Initiative (GSI) of the International Institute for Sustainable Development (IISD) has developed a methodology for assessing irrigation subsidies, with the goal of developing internationally comparable national estimates. The methodology, *GSI's Method for Quantifying Irrigation Subsidies* (GSI, 2009), marks an initial effort designed to help develop a uniform method of subsidy analysis. It stems from several broad observations. Irrigation subsidies can distort decisions over which crops get produced, and can artificially increase the volume of output. The GSI aims to generate accurate and reliable information on the environmental and trade impacts, and perceived benefits, of irrigation subsidies. Such information can support national and multilateral policy-makers in their decisions, while increasing public awareness of this issue.

The ultimate outcome of this work is expected to be twofold: the development and strengthening of capacity to undertake analysis of support policies in a number of countries, and changes in government policies and international disciplines. The establishment of standardized and regular reporting on subsidies to irrigation could have a tremendous influence both on national policies and international subsidy disciplines. Awareness of the size, extent and effects of subsidies on irrigation—especially those encouraging the depletion of fossil aquifers—is still not adequately appreciated by policy-makers. Greater awareness of these consequences should help policy-makers avoid initiating poorly designed irrigation subsidy regimes, and place pressure on them to reform existing ones.

1.3 FRAMEWORK OF THE ANALYSIS

1.3.1 ESTIMATION OF IRRIGATION SUBSIDIES IN INDIA

The following section provides a short overview of how subsidies in India, including those to irrigation, are monitored and quantified. Two alternative approaches have been used to measure the magnitude of subsidies generally: (i) through national budgets and (ii) through national accounts. The latter estimates include explicit subsidies and certain direct payments to producers in the private or public sectors (including compensation for operating losses for public undertakings) that are treated as subsidies. This approach, however, does not encompass all of the implicit subsidies that can occur. The estimates of budgetary subsidies are computed as the amount over and above the costs for providing a service in comparison to fees or tariffs recovered from the provision of that service. The costs have been taken as the sum of revenue expenditure relating to the specific service, annual depreciation on cumulative capital expenditure for the creation of physical assets as part of the service, interest costs (computed at the average rate of interest actually paid by the public enterprises) and loans given for the service concerned, including those to the public enterprises. The costs recovered are the receipts from a service, which are usually in the form of user charges, fees, interest receipts and dividends.

Mathematically, the subsidy (S) for a service (such as the provisioning or irrigated water) is obtained through the following formula:[2]

$$S = RX + (d+i)\,K + I\,(Z + L) - (RR+I+D)$$

The subsidy equals:

- RX = revenue expenditure on the service
- L = sum of loans advanced for service at the beginning of the period
- K = sum of capital expenditure relating to the service excluding equity investment at the beginning of the period
- Z = sum of equity and loans advanced to public enterprises classified within the service category at the beginning of the period
- RR = revenue receipts from the service
- I+D = interest, dividend and other revenue receipts from public enterprises falling within the service category.
- d = depreciation rate
- i = interest rate

[2] This formula has been adapted from "Subsides in India," retrieved from: http://en.wikipedia.org/wiki/Subsidies_in_India.

Unlike subsidies to inputs such as fertilizers, subsidies for public irrigation services are not explicitly reported by the government in any public documents (Gulati & Narayanan, 2003); rather, they have to be estimated by extracting data from government data sources. The method commonly employed for calculating irrigation subsidies is based on the concept that an irrigation subsidy equals the losses that the supplying agency incurs by providing irrigation water at concessional rates. Using this method, irrigation subsidies are referred to in the National Accounts Statistics as "imputed charges on irrigation." They relate to fixed capital or the depreciation of government-owned irrigation infrastructure. According to the National Accounts Statistics, these "imputed irrigation charges" are equal to the losses incurred by the irrigation departments and are treated as a subsidy in the income and outlay accounts of India's administrative departments (see Table 1)

These estimates implicitly define an irrigation subsidy as the difference between the cost of supplying water for irrigation and the revenue received as payment from the users of the irrigation water. It is presumed that the losses incurred by the irrigation department are due to supplying water at concessional rates. However, this definition is incomplete and the estimates are inaccurate, with the chief drawback being the lack of clarity about what actually constitutes "imputed irrigation charges." Table 1 is an example of the subsidy estimate based on the National Accounts. It shows the level of aggregation is high supporting information may not be available.

TABLE 1: IRRIGATION SUBSIDY ESTIMATES BASED ON NATIONAL ACCOUNTS STATISTICS FOR MAJOR, MEDIUM AND MINOR IRRIGATION PROJECTS (MILLION INR)

Years	Imputed irrigation charges	GDP	NDP	Depreciation*	Irrigation Subsidy**
1993–94	58,720	53,960	34,730	19,230	39,490
1994–95	67,690	61,600	39,700	21,900	45,790
1995–96	78,850	73,370	48,510	24,860	53,990
1996–97	91,170	84,640	56,220	28,420	62,750
1997–98	102,840	95,390	63,490	31,900	70,940

* Depreciation = Gross Domestic Product (GDP) – National Domestic Product (NDP)
** Irrigation Subsidy = imputed irrigation charges – depreciation
Note: GDP and NDP from departmental enterprises (agriculture)
Source: Gulati and Narayanan, 2003

1.3.2 METHODOLOGY ADOPTED FOR THE STUDY

In this study, GSI's Net Cost to Supplier methodology was used to estimate the irrigation subsidies for major irrigation projects in Andhra Pradesh. An irrigation subsidy is defined as the net cost to the (government) supplier in making irrigation water available. An irrigation subsidy is conceptualized as the difference between the cost of making irrigation water available and the revenue received as payment from the beneficiaries of irrigation water.

The Net Cost to Supplier or subsidy (S) of making irrigation water available can be derived by deducting from the gross cost to the government (C), the revenue realized in the form of payments (R) received from the beneficiaries of water.

$$S = C\text{-}R$$

The Net Cost to Supplier approach for measuring irrigation subsidies depends upon the identification and measurement of three key components: cost, beneficiaries and revenues. Depending upon the perspective of the analyst, the method of measuring the three key constituents can differ. Keeping in mind the data and methodological constraints in estimating subsidies, some of the costs in making irrigation water available and the revenue from sale of this water, the annual cost of making irrigation water available has been defined as the sum of the following costs:

The total cost to government:

- Annual capital cost (interest and depreciation charges) of irrigation infrastructure.
- Operation and maintenance (O&M) costs;[3]
- Opportunity cost of electricity used for irrigation pumping; and
- Cost of environmental externalities (insofar as they can be quantified and attributed to government expenditure).

The total revenue to the government from investments made in the provisioning of irrigation water comprises:

- Revenue realized from the sale of water;
- Revenue realized from the sale of hydropower;
- Revenue realized from the sale of fishing rights;
- Revenue realized from the sale of electricity to the agricultural users;
- Revenue realized from the imposition of pollution taxes, insofar as they relate to the provision and use of irrigation water.

"Price," "fee," and "charges" are used interchangeably in this report. In all cases, we mean the amount of money asked for or given for a good or service. A price, fee or charge for water is the money asked for or given for the water itself or the service of delivering the water, or both. This is in contrast to the term "tariff," which means any list or scale of prices or charges, not the specific price or charge itself.

The focus of this study is on estimating the costs of providing public irrigation water through analyzing a selection of major irrigation schemes and the payments made by farmers who are part of the scheme.

[3] O&M cost includes: cost of staff salaries, administrative costs, repairs and replacement of damaged infrastructure and office costs.

The three major irrigation systems in Andhra Pradesh selected were:

- The Nagarjunasagar Project (NSP) situated in the Coastal region.
- The Sriram Sagar Project (SRSP) in the Telangana Region.
- The Tungabhadra Project (TBP) Low-Level Canal (LLC) in the Rayalaseema Region.

These three irrigation projects account for about 50 per cent of the total area irrigated by major irrigation projects in Andhra Pradesh. A project nearing completion was also studied to analyze the fiscal impact of increasing investment costs during the project construction period:

- The Alimineti Madhava Reddy Project (AMRP).

A full list of the data sources used when computing the components of the subsidy for the target projects can be found in Section 1.3.5.

In order to develop a more comprehensive estimate for the state of Andhra Pradesh, projects were divided into three categories:

- Category I: Major irrigation projects in Andhra Pradesh with an ayacut more or less similar in size to NSP
- Category II: Major irrigation projects in Andhra Pradesh with an ayacut more or less similar in size to SRSP
- Category III: Major irrigation projects in Andhra Pradesh with an ayacut more or less similar in size to TBP

An estimate for Andhra Pradesh was calculated. The following steps were followed in order to develop a subsidy estimate for the four South Indian states:

- Using the three categories, I, II, & III, a per-hectare subsidy rate was calculated for the different project categories for Andhra Pradesh.
- Projects in the four southern states were classified into one of the three categories.
- Based on the aggregate size of the ayacut across the categories, a subsidy estimate for major irrigation projects in South India was calculated by applying the per hectare subsidy rate to the irrigation areas in the four states.

In developing an estimate for the southern states, all major irrigation projects in the four South Indian states (Tamil Nadu, Andhra Pradesh, Karnataka and Kerala) were considered because of similar O&M costs and prevailing irrigation water tariffs. All major irrigation projects in South Indian states were categorized into three groups based on their ayacut size, corresponding to the equivalent ayacut size of the three study projects in the Andhra Pradesh.

1.3.3 STUDY AREA

The State of Andhra Pradesh has the largest irrigated area in India, and has a fast-growing irrigation sector. Andhra Pradesh is historically called the "Rice Bowl of India," as more than 77 per cent of its crops are irrigated rice. Compared to other parts of India, Andhra Pradesh is endowed with rich water resources.[4] A comparison of agricultural and irrigation statistics for India and Andhra Pradesh is presented in Table 2.

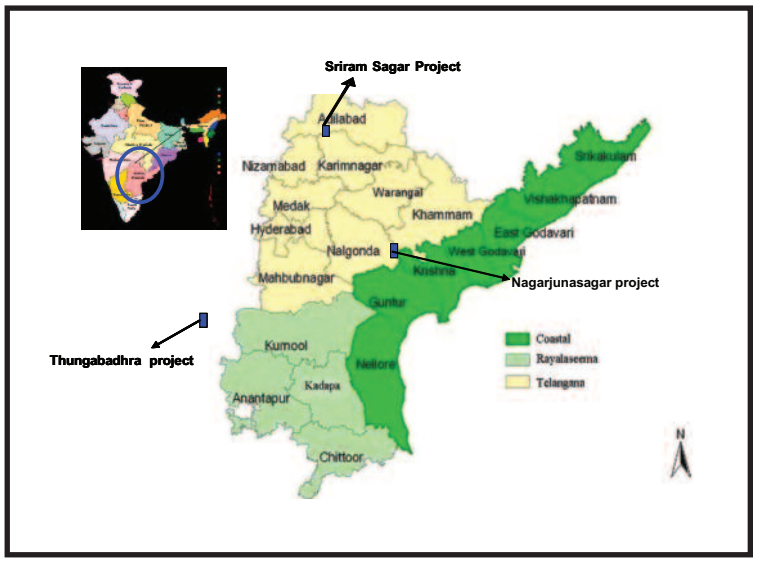
[4] June to September is the season for tropical rains, as well as southwest monsoons and northeast monsoons. October and November see low-pressure systems and tropical cyclones forming in the Bay of Bengal, which, along with the northeast monsoons, bring rains to the southern and coastal regions of the state.

TABLE 2: AN OVERVIEW OF LAND UTILIZATION AND IRRIGATION STATISTICS OF ANDHRA PRADESH AND ALL INDIA (MILLION HA)

Content	Andhra Pradesh (2008–09)	India (2001–02)
Total geographical area	27.50	328.07
Forest cover	6.210	69.1
Barren and uncultivable land	2.055	30.16
Permanent pastures and other grazing land	0.57	12.99
Land under miscellaneous tree crops, groves not included in net area sown	0.3	4.33
Land currently irrigated	2.92	31.29
Ultimate irrigation potential	6.75	98.84*

* Statistics current as of 2004–05
Source: DES, 2009; CWC, 2003; GoI, 2002 & 2005

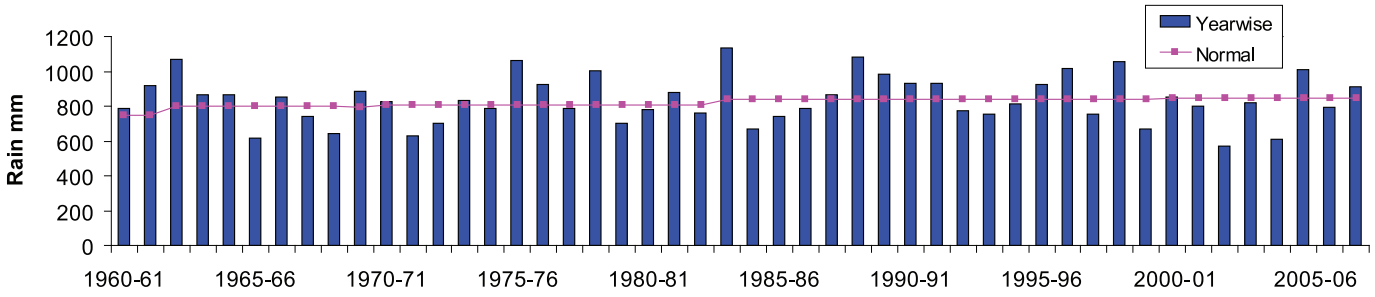
FIGURE 1: MAP OF ANDHRA PRADESH – THREE REGIONS WITH ADMINISTRATIVE DISTRICTS AND SELECTED IRRIGATION PROJECTS IN THE STUDY AREA



Rainfall

More than 75 per cent of precipitation falls during southwest monsoons (between June and September). The normal annual rainfall in the state is 928 mm. Rainfall records show drought occurs fairly recurrently in the state. An analysis of the rainfall from 1961 to 2006 indicates deficits in rainfall in all of the 18 years in one or multiple parts of the state (Figure 2).

FIGURE 2: ANNUAL RAINFALL IN ANDHRA PRADESH 1960–2006



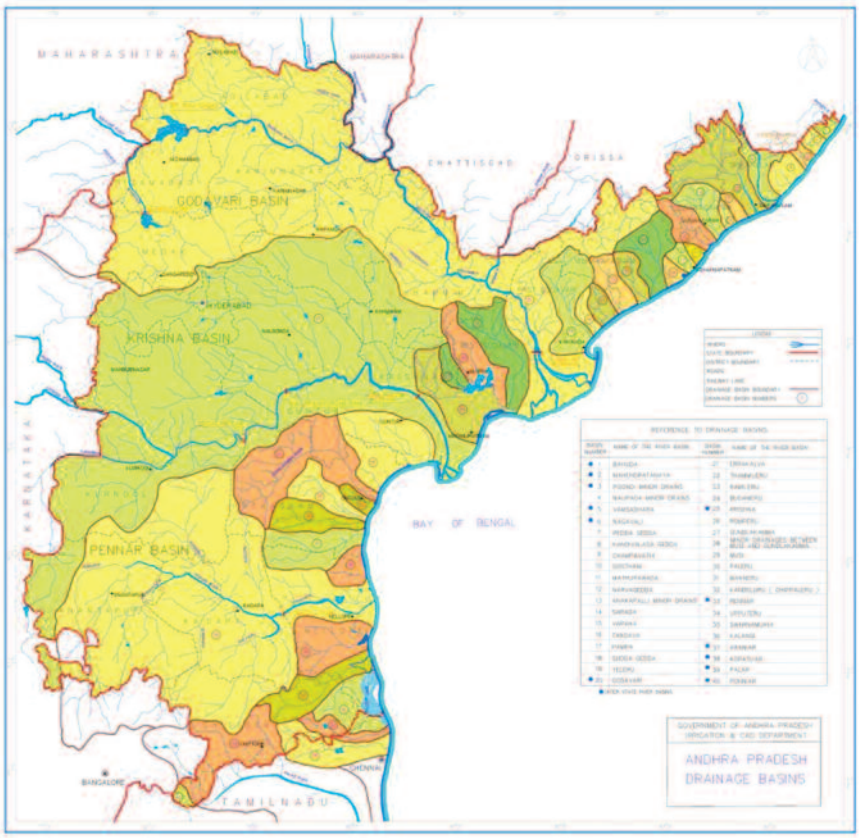
Source: DES, 2007a

Surface water resources

Andhra Pradesh is popularly known as the "river state" with 40 major rivers, as well as minor rivers, flowing through it (Figure 3). Of these, Godavari, Krishna and Pennar are considered the most important. There are also nine interstate rivers. These rivers carry 77.75 billion cubic metres (BCM) of water into the state annually, with a 75 per cent level of dependability.[5] Of the 77.75 BCM available, only 49.24 BCM is utilized, leaving a balance of 28.51 BCM remaining (Palanisami, Rahul & Kadiri, 2010). Figure 3 provides an overview of river systems in Andhra Pradesh.

[5] Dependability is defined as percentage and refers to the percentage probability of the river reaching its expected level of water flow or capacity.

FIGURE 3: RIVER BASINS IN ANDHRA PRADESH



source: I&CAD, 2010

Groundwater resources

The Central Ground Water Board estimates that Andhra Pradesh has about 32.95 BCM of replenishable groundwater reserves. Groundwater development or utilization is at around 14.88 BCM or 45 per cent of the available resources. This suggests that the usable balance is 18 BCM, about 55 per cent of the total available (CWC, 2003).

A recent estimate by Andhra Pradesh State Ground Water Department (2008) suggests that 13.2 BCM of the 18 BCM of available water is located in command areas of major irrigation projects. Another 1.3 BCM could be located in forest areas and other non-cultivable areas. This leaves approximately 3.5 BCM as the actual amount available to be developed and used by the state.

Water usage among different sectors in Andhra Pradesh

The total water resources (surface and ground water) of Andhra Pradesh are estimated to be 108,200 million cubic metres (MCM) (100 per cent) of which about 65,169 MCM (60 per cent) are currently utilized. Irrigation uses 64,252 MCM (98.66 per cent), drinking uses 601 MCM (0.9 per cent), industry uses 288 MCM (0.4 per cent) and power generation uses 28 MCM (0.04 per cent). By 2025, total water requirements for drinking water, industrial and power generation purposes is estimated to reach 3,468 MCM; 1,445 MCM; and 56

MCM, respectively, with irrigation's estimated requirement for water reaching 108,050 MCM. This would mean a total water resource requirement of 113,019 MCM, which is approximately 4,819 MCM more than presently available water resources in the state (Table 3).

Andhra Pradesh has a water availability of 1,400 m^3 per capita per annum,[6] which already puts the state into the *water-scarce* category. By 2020, with a projected increase in the population to 90 million, water availability per capita per annum will reduce to 1,150 m^3, bringing the state closer to the *severely scarce* category.[7] To sustain further economic growth and development in the state, available water resources will have to be managed and utilized more efficiently and in an equitable manner to avoid social unrest (Palanisami et al., 2010).

TABLE 3: PRESENT WATER USE AND FUTURE NEEDS IN ANDHRA PRADESH

S. No.	Water user	Present utilization (2001)		Needed by 2025		% increase
		MCM	% to total	MCM	% to total	
1	Irrigation	64,252	98.66	108,050	95.55	168
2	Drinking water	601	0.90	3,468	3.10	581
3	Industries	288	0.40	1,445	1.30	510
4	Power generation	28	0.04	56	0.05	200
5	Total	65,169		113,091		173

Source: CWC, 2005

1.3.4 IRRIGATION CONCENTRATION, CROPPING PATTERNS AND WATER UTILIZATION

The State of Andhra Pradesh comprises three regions: Coastal (9 districts), Rayalaseema (4 districts) and Telangana (10 districts) (Figure 1). There are variations among the three regions in terms of how irrigated areas are organized. Canal irrigation accounts for 75.21 per cent in the Coastal region, 8.85 per cent in the Rayalaseema region and 16.41 per cent in the Telangana region (Table 4). The reasons for this can be attributed to fewer investments, geographic and topographic factors and political interference.

TABLE 4: NET IRRIGATED AREA FROM DIFFERENT SOURCES, BY REGION (2008–09) (IN THOUSAND HA)

District	Canals		Tanks		Wells		Other sources		Total net irrigated area	
	Area	%	Area	%	Area	%	Area	%	Area	%
Coastal Region										
Total	1,256	75.21	364	56.17	578	24.88	106	58.89	2,304	47.79
Rayalaseema Region										
Total	140	8.38	45	6.94	434	18.68	14	7.78	633	13.13
Telangana Region										
Total	274	16.41	239	36.88	1,311	56.44	60	33.33	1,884	39.08
Andhra Pradesh										
Total	1,670	100.00	648	100.00	2,323	100.00	180	100.00	4,821	100.00

Source: DES, 2009a

[6] Less than 1,700 m^3 per capita per annum is categorized as water scarce.
[7] Less than 1,000 m^3 per capita per annum is categorized as severely scarce.

The cropped area in Andhra Pradesh is divided into seven agro-climatic zones based on rainfall distribution, soil topography and other characteristics. They are: Krishna Godavari zone, North Coastal zone, Southern zone, North Telengana zone, Southern Telangana zone, Scarce Rainfall zone, and High Altitude and Tribal areas.

The major crops include rice, bajra, jowar, groundnut, sunflower, sugarcane, pulses, cotton, chilis, turmeric, and horticultural crops like mango, banana and citrus. In 2008–09, rice alone was grown on 63 per cent of irrigated area; the net cropped area was 13.83 million ha and net irrigated area was 4.82 million ha. In terms of cropping intensity, it was 1.26 and irrigation intensity was 1.39 (Table 5).

TABLE 5: IRRIGATION AND CROPPING INFORMATION FOR ANDHRA PRADESH

S.No.	Content	Year 2008–09
1	Gross cropped area	13.83 million ha
3	Net irrigated area	4.82 million ha
4	Crop intensity[8]	1.26
5	Irrigation intensity	1.39
6	Irrigated area under rice	63%

Source: DES, 2009a

1.3.5 DATA SOURCES FOR ESTIMATING IRRIGATION SUBSIDIES

Data for estimating irrigation subsidies are limited and not maintained for this purpose. However, important data sources for the study include:

- Irrigation and Command Area Development (I&CAD) Department, GoAP: Information on capital investments and O&M expenditure for irrigation infrastructure, revenue from water charges and areas irrigated by different organizations in the state.
- Department of Agriculture, GoAP: Data on the extent of irrigated crops, production, productivity, etc.
- State Electricity Regulatory Commission: Data on the generation and scale of hydropower, sale of hydropower, investments in infrastructure, electricity consumed for the irrigation purposes.
- Fisheries Department: Data on inland fish production from major multipurpose irrigation projects and revenue receipts from the sale of fishing rights.
- Andhra Pradesh Pollution Control Board: Data on water usage charges for industries and other users from the major irrigation infrastructure and revenue from imposing water cess on industries.
- GoAP: Budget reports.
- Andhra Pradesh State Groundwater Board: Data on groundwater abstraction, groundwater sources and users.

[8] Crop intensity is the ratio of net area sown to the total cropped area.

2. OVERVIEW OF IRRIGATION DEVELOPMENT IN ANDHRA PRADESH

2.1 POLICY OBJECTIVES FOR SUPPORT TO THE IRRIGATION SECTOR: HISTORICAL ORIGINS

Systemic problems relating to the irrigation sector are prevalent in the State of Andhra Pradesh. The net irrigational potential created through large financial investments is underutilized. A gap of nearly 33 per cent between created and utilized irrigation potential exists. This is due to a variety of reasons, including: defective water distribution systems, the non-compliance of farmers in adopting cropping patterns for which the system was designed and the lack of operational plans. In addition to this underutilization gap, water distribution within the command areas is often neither reliable nor equitable, with large differences in water availability between the head and tail end of irrigation canals.

The Pipe Committees set up under the Irrigation and Command Area Development Act (1984) were amalgamated with the Water User Association (WUA) through consensus. Relying on the success and experience gained from such pilot projects, the government enacted the Andhra Pradesh Farmer's Management of Irrigation Systems (APFMIS) Act (1997).[9]

2.1.1 ANDHRA PRADESH STATE WATER POLICY, 2008

The Central Water Commission (CWC) recommended that all states prepare a comprehensive policy document covering efficient use of water resources and detailing the state's vision for managing water. The 2008 policy document outlined areas of concern, required approaches for tackling these concerns, proposed reform measures and identified priorities and goals for states' irrigation sectors.[10]

2.1.2 WATER SERVICES TO IRRIGATION (INSTITUTIONS FOR WATER SUPPLY)

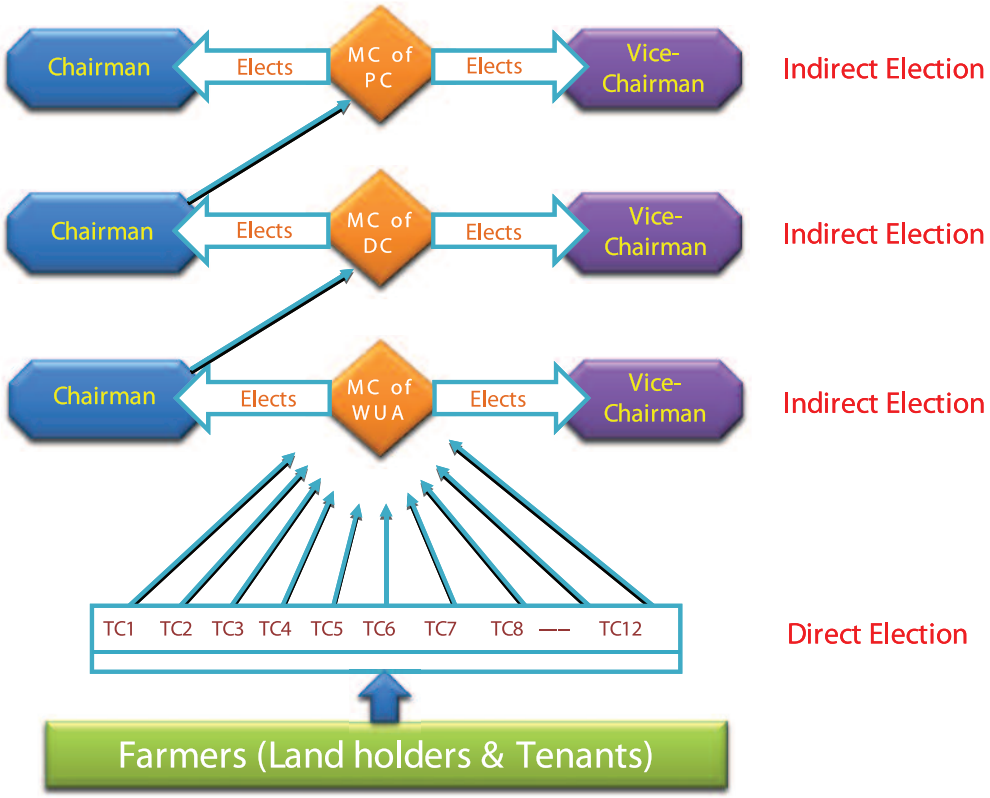
Major irrigation projects in Andhra Pradesh are being managed by the I&CAD department of the state government, including O&M of projects and their distribution systems. The WUA took responsibility for water distribution to farmers after the introduction of a Participatory Irrigation Management (PIM) approach in the state through the APFMIS Act (1997) (see Appendix 1).

[9] See Appendix 1 for information on important recent water irrigation legislation in Andhra Pradesh (Andhra Pradesh Farmers Management of Irrigation Systems Act, 1997, Andhra Pradesh Water, Land and Trees Act, 2002).

[10] See Appendix 2 for details of Andhra Pradesh State Water Policy (2008).

In order to implement PIM in the state, a total of 11,317 WUAs were formed. They are responsible for planning, management of water resources (at the micro level), collecting water charges and the utilization of funds provided by the government. WUAs may cover 6 to 8 territories (command areas are divided into territories on a hydrological basis). Under the APFMIS Act (1997), there are three different levels of management for major irrigation projects: WUAs at the minor canal level, Distributary Committees (DCs) at the distributary level and Project Committees (PCs) at project level.[11] The three levels of farmers' organizations and their relationships are shown in Figure 4.

FIGURE 4: WUA'S ORGANIZATION FOR MAJOR IRRIGATION PROJECTS[12]



Source: Tucker et.al., 2010

The organizational structure of minor irrigation schemes is only one-tiered with WUAs and two-tiered for medium-sized irrigation schemes (WUA and PC).

[11] The structure of the farmers' organization and the process for its formation has changed with the amendment of the APFMIS Act in 2002. The present description pertains to the post-amendment structure and process.

[12] Direct elections means electing a Territorial Committee (TC) by direct ballot by all the members of the WUA. Indirect elections means the electing Management Committee (MC) members by the elected TC members by voting.

2.2 HISTORICAL DATA ON AGGREGATE SUBSIDY LEVELS TO THE IRRIGATION SECTOR

2.2.1 IRRIGATION SUBSIDIES IN ANDHRA PRADESH AND INDIA

The government budget for the irrigation sector in the Andhra Pradesh has increased from INR428 million (US$9.3 million) in 1980–81 to INR8,402 million (US$182.6 million) in 1999–2000 (Table 6). This is a significant increase.

TABLE 6: SUBSIDY TO MAJOR, MEDIUM AND MINOR IRRIGATION PROJECTS IN ANDHRA PRADESH VERSUS INDIA (MILLION INR)

Year	Andhra Pradesh	India	% AP to India
1980–81	428.06	4,121.17	10.39
1981–82	471.17	4,577.95	10.29
1982–83	482.25	5,424.23	8.89
1983–84	516.42	6,319.93	8.17
1984–85	814.43	7,254.57	11.23
1985–86	835.44	7,442.20	11.23
1986–87	1,074.47	10,778.77	9.97
1987–88	1,955.01	19,649.45	9.95
1988–89	5,478.14	23,544.50	23.27
1989–90	3,569.20	23,087.94	15.46
1990–91	3,943.77	25,712.93	15.34
1991–92	4,539.69	28,680.85	15.83
1992–93	4,916.70	32,876.13	14.96
1993–94	5,306.53	34,414.32	15.42
1994–95	6,028.57	39,492.72	15.27
1995–96	7,218.99	44,006.16	16.40
1996–97	7,064.21	44,394.37	15.91
1997–98	7,458.94	46,556.91	16.02
1998–99	7,930.56	49,366.82	16.06
1999–2000	8,402.18	52,176.73	16.10

Source: Raju & Gulati, 2002, as quoted in GoAP, 2003.

Since the formation of Andhra Pradesh in 1953, planned expenditure to develop major, medium and minor irrigation projects totalled INR715.3 million (US$15.98 million) up until the end of the 8th Five Year Plan of India. The outlay for the 9th Five Year Plan period (1992–1997) for irrigation schemes was INR603.03 million (US$13.47 million) (Reddy, 2003).

2.2.2 QUANTIFICATION OF SUBSIDIES IN ANDHRA PRADESH

Presently, the GoAP has no specific standard method for measuring subsidies. Capital investments were made based on public representation and demands received from various sections of society, often with regional political support.

Very few efforts have been made to quantify irrigation subsidies in Andhra Pradesh. Through case studies assessing selected irrigation projects in Andhra Pradesh, Palanisami (2003) estimated irrigation subsidies by using two methods. The first method used for estimating the level of subsidy took expenses (O&M costs) for major schemes and subtracted the gross revenue receipts received by the irrigation schemes. The second method subtracted gross receipts from 10 per cent of the annualized capital cost plus working expenses (O&M costs).[13]

2.2.3 CALCULATION OF O&M COST COMPONENTS

Easter & Liu (2005) developed two alternative cost allocation procedures in allocating project costs among selected major multipurpose water projects in Andhra Pradesh. How costs are allocated between users in a multipurpose project is a critical assumption that can increase or decrease an irrigation subsidy estimate. The first allocation method is based on the quantity of water delivery for each purpose or use. As only the consumers of water are allocated the costs, the three consumptive uses are allocated the costs, with 95 to 98 per cent allocated to irrigation (Table 7 & 8). The second approach allocates costs based on benefits generated by the project. As a result, all five major water uses are allocated a portion of the project costs, and irrigation's share drops to between 88 and 94 per cent. Thus, in multipurpose projects, irrigation is likely to be allocated a major share of the costs but, with growing domestic and industrial demand for water, irrigation's share of the cost is likely to drop significantly over time. In projects that include an important flood control component, irrigation's cost-share would drop even more.

TABLE 7: COST ALLOCATION FOR THREE CONSUMPTIVE USES BASED ON WATER DELIVERY (%)

Water projects	Domestic water supply	Industrial	Irrigation
NSP	2	0	98
SRSP	1	4	95
TBP	2	3	95

Source: Easter & Liu, 2005

[13] The following components were included by Palanisami (2003): 1. Actual irrigated area and design command area. Both areas are used in working out the subsidy. 2. Full O&M costs of the projects. 3. O&M costs for the projects adjusted to match just the irrigation component (e.g., flood control costs are not included as they are a non-irrigation component). Adjusted figures are calculated using the Adjusted Separable Cost-Remaining Benefit (SCRB) procedure (World Bank, 2003).

TABLE 8: COST ALLOCATION BASED ON BENEFITS (%)

Purpose of the project	Multipurpose Water projects		
	SRSP	NSP	TBP
Irrigation	88.1	94.3	91.3
Hydropower	3.0	4.0	4.2
Domestic	3.0	1.6	2.1
Industry	4.3	0.1	2.3
Fisheries	1.6	0.1	0.1

Source: World Bank, 2003

2.3 SUMMARY OF POLICIES, PROGRAMS AND SUPPORT FOR IRRIGATION

2.3.1 IRRIGATION DEVELOPMENT PROGRAMS

2.3.1.1 JALYAGNAM PROGRAM

Since 2004 the GoAP has initiated the implementation of the Jalyagnam Program (a water resource development program), which prioritizes the development of irrigation infrastructure, particularly in economically undeveloped and drought-prone areas. It includes the construction of reservoirs and lift irrigation systems for lifting water from major rivers, particularly the Godavari. The Jalayagnam Program constitutes a major component of the central government program of the National Irrigation Mission. The program is intended to create new command areas in the order of 4.45 million ha with an expected investment of about INR1,662,630 million (US$37,153.74 million) (see Table 9).[14]

TABLE 9: PROJECTED INVESTMENT IN IRRIGATION AND THE EXPECTED AREA IRRIGATED BY 2014 AS PART OF THE JALAYAGNAM PROGRAM

S.No.	Type of project	Expected irrigated (million ha)	Expected investment (million INR)
1	Major (>10,000 ha command area)	9.378	1,564,570
2	Medium (2,000–10,000 ha command area)	0.983	35,360
3	Minor (<2,000 ha command area)	0.627	62,700
	Total	10.986	1,662,630

Source: I&CAD, 2010

[14] The Jalayagnam Program was started in 2004 and is ongoing. Expenditure under this part of the Jalayagnam program may not necessarily be considered subsidies at present, as several projects are under construction at various stages and it is not currently possible to estimate whether the entire estimated amount will be spent or not. Since a few of the projects, like the Polavaram project, are under examination on environmental grounds, completion is uncertain. Also, if there are delays in implementation, then there will be further cost increases for those projects. Analysts should estimate the amount of funds tied up in projects that are not delivering water, as there are definite opportunity costs associated with this invested capital.

2.3.1.2 PROGRAM FOR THE MODERNIZATION OF IRRIGATION SOURCES

i. Major irrigation: With active participation of the WUAs, all existing major irrigation projects are being modernized in order to achieve the optimum utilization of water. The government has invested INR147,000 million (US$3284.91 million) in seven major projects in Andhra Pradesh covering an irrigated area of 2.04 million ha.

ii. Medium irrigation: An action plan has been developed to modernize 11 medium-sized irrigation projects in need of work, with financial support provided by the Japan International Cooperation Agency (JICA). Field-level surveys indicate that 17 more medium-sized projects require modernization, with an expected investment of about INR4,500 million (US$100.55 million). Once completed, the projects would cover an irrigated area of 0.068 million ha (see Table 10).

TABLE 10: EXPECTED AREA IRRIGATED AND PROJECTED INVESTMENT FOR THE MODERNIZATION OF MAJOR AND MEDIUM IRRIGATION PROJECTS

Project	Irrigated area (million ha)	Amount (million INR)	Expected year of completion
Godavari Delta System	4.048	34,000	2012–13
Krishna Delta System	0.526	46,000	2012–13
Pennar Delta System	0.101	9,000	2011–12
NSP	0.89	44,000	2013–14
Nizamsagar Project	0.02	5,500	2012–13
Tungabhadra Project (HLC / LLC)	0.101	8,500	2013–14
Total Major	2.044	147,000	
Total Medium	0.06	4,000	

Source: I&CAD, 2009

iii. Minor irrigation (MI): Andhra Pradesh is endowed with 79,347 minor irrigation projects with an irrigation potential of 2.25 million ha. During the period 2004–09, a total area of 0.23 million ha of new ayacut was created under MI schemes. From 2009 to 2014, investment will be INR33,000 million (US$737.43 million), which should yield 0.3 million ha of new ayacut out of a target area of 0.38 million ha. Thus, the total new irrigation potential created as part of MI from 2004 to 2014 would be 0.61 million ha and the area forming part of the stabilization and modernization schemes would be 0.99 million ha. The area cultivated under MI sources has risen from 0.51 million ha in 2004 to 1.01 million ha in 2008–09. By 2014, it could reach 1.62 million ha out of an irrigation potential of 2.63 million ha. Modernization of tank facilities and catchment area development will promote effective utilization of these irrigation systems (Andhra Pradesh Water Reforms, 2009).

iv. Rehabilitation and restoration of existing tanks:

- **State Plan Project:** Rehabilitation and restoration of 1,939 minor irrigation projects in 22 districts to facilitate water flow to tail-end villages; includes repairs to the bund, canal lining, etc. with a budget allocation of INR3,195.7 million (US$71.41 million).

- **Repair, Renovation and Restoration (RRR) Project:** For 261 minor tanks in two districts of the state, the I&CAD Department, GoAP has implemented a pilot RRR project funded by the GoI.
- **Andhra Pradesh Community-Based Tank Management Program (APCBTMP):** Three thousand MI tanks rehabilitated under the World Bank and GoI supported APCBTMP; a proposal for the restoration of another 3,000 tanks linked to agriculture is being submitted to GoI as part of the recently scaled-up RRR scheme.
- ***Indiramma Cheruvu* Program:** Rehabilitate and modernize 23,048 irrigation tanks in the state, covering an area of 0.27 million ha. Carried out in collaboration with the Rural Development Department using 18,260 million INR under Andhra Pradesh's National Rural Employment Guarantee Scheme. So far 3,737 tanks have been completed with 19,311 in various stages of implementation.

With the MI development program, the GoAP aims to provide 0.5 million ha of irrigated area with an expenditure of about INR73,700 million (US$1646.93 million).

v. Subsidy program on electricity for irrigation: Since 2004, electricity has been free for farmers in the state of Andhra Pradesh, and is supplied 7–9 hours per day during stipulated times. It is used for irrigation pumping for deep tube wells, dugout wells and other lift-irrigation purposes. The costs and benefits of this scheme are being assessed by the GoAP.[15]

vi. Andhra Pradesh Economic Restructuring Project (irrigation component): The GoAP initiated the Andhra Pradesh Economic Restructuring Project (irrigation component) with World Bank assistance, with a project cost of INR9,622.4 million (US$215.03 million). Some of the objectives of the project were to: promote the sustainability of the irrigation sector through the involvement of farmers in irrigation management, reverse the decline in irrigated area, improve the productivity of irrigated agriculture and improve the levels cost recovery for O&M activities.

2.3.2 SUPPORT TO IRRIGATION IN ANDHRA PRADESH

In recent years, irrigation accounts for a significant share of just over 10 per cent of the total government budget for Andhra Pradesh. There appears to be a change in the percentage share of irrigation investment during the last two years, potentially due to the "zero-based budget" exercise carried out during 2000 and 2001. The share of visible irrigation expenditure as part of planned expenditure is higher when compared to non-plan expenditure,[16] though it declined drastically after 1999–2000. The average share of the budget dedicated to the irrigation sector as part of planned expenditure declined from above 30 per cent prior to 1999–2000 to less than 20 per cent in later years. On the other hand, non-planned expenditure is lower: falling generally around 8 per cent—though it has been declining during the last eight years. This decline indicates that more emphasis is placed on building new projects than maintaining the old systems. Investment in the irrigation sector over the past 10 Five-Year Plan Periods is shown in Table 11.

[15] See section 3.2.2 for further details on the size of electricity subsidies in Andhra Pradesh.

[16] Government expenditure is classified into "plan" and "non-plan" expenditure. Plan expenditure refers to the expenditure incurred by the government on programs recommended by the planning commission. Non-plan expenditure consists of expenditure that is obligatory in nature. The government has special responsibilities in meeting the current plans. The distinction between "plan expenditure" and "non-plan expenditure" is purely an administrative classification and is in no way related to economic or national accounting principles.

TABLE 11: INVESTMENT IN THE IRRIGATION SECTOR IN THE PAST 10 FIVE-YEAR PLANS IN ANDHRA PRADESH (MILLION INR, WITH CONVERSION TO $ MILLION U.S. IN PARENTHESIS)

S.No	Type/Period of Plan	Expenditure
1	1st Five-Year Plan (1951–1956)	219 (4.89)
2	2nd Five-Year Plan (1956–1961)	656 (14.65)
3	3rd Five-Year Plan (1961–1966)	1,245 (27.82)
4	Three Annual Plans (1966–1969)	796 (17.79)
5	4th Five-Year Plan (1969–1974)	1,250 (27.93)
6	5th Five-Year Plan (1974–1979)	4,562 (101.94)
7	Annual Plan (1979–1980)	1,601 (35.78)
8	6th Five-Year Plan (1980–1985)	8,674 (193.83)
9	7th Five-Year Plan (1985–1990)	14,488 (323.75)
10	Two Annual Plans (1990–1992)	7,458 (166.66)
11	8th Five-Year Plan (1992–1997)	35,053 (783.31))
12	9th Five-Year Plan (1997–2002)	53,435 (1,194.08)
13	10th Five-Year Plan (2002–2007)	224,736 (5,022.03)

Source: Finance & Planning (Planning Wing) Department, GoAP, 2009

The plan and non-plan breakdown of expenditure on major and medium irrigation projects indicates a shift in expenditure towards planned expenditure after 1998–99. In 1998–99, there was a jump in total expenditure on irrigation even when using constant prices. This upward trend has continued in later years, though expenditure dipped in the year 1 April 1999 to 31 March 2000. This indicates that more emphasis has been placed on new projects rather than maintaining the old systems (Table 12).

TABLE 12: IRRIGATION EXPENDITURE ON MAJOR AND MEDIUM PROJECTS BY PLAN AND NON-PLAN IN ANDHRA PRADESH (MILLION INR)

Year[17]	Non-plan		Plan		Overall
	Total	%	Total	%	Total
1975–76	211.267	35.29	387.435	64.71	599
1976–77	206.128	27.06	555.671	72.94	762
1977–78	341.911	32.67	704.504	67.33	1,046
1978–79	386.547	32.59	799.626	67.41	1,186
1979–80	467.421	34.36	892.898	65.64	1,360
1980–81	543.84	37.35	912.297	62.65	1,456
1981–82	661.378	40.19	984.326	59.81	1,646
1982–83	446.04	31.76	958.32	68.24	1,404
1983–84	554.578	33.82	1,085.212	66.18	1,640
1984–85	941.917	38.17	1,526.081	61.83	2,468
1985–86	1,456.256	41.55	2,048.643	58.45	3,505
1986–87	1,416.811	34.97	2,635.177	65.03	4,052
1987–88	1,347.52	34.51	2,557.322	65.49	3,905
1988–89	4,831.685	61.89	2,975.552	38.11	7,807
1989–90	3,072.087	52.18	2,815.452	47.82	5,888
1990–91	3,456.767	56.67	2,642.558	43.33	6,099
1991–92	3,821.296	56.74	2,913.185	43.26	6,734
1992–93	4,168.768	54.71	3,450.816	45.29	7,620
1993–94	4,881.329	45.92	5,748.576	54.08	10,630
1994–95	5,948.476	48.78	6,246.731	51.22	12,195
1995–96	6,932.112	55.37	5,588.524	44.63	12,521
1996–97	8,002.85	58.42	5,695.729	41.58	13,699
1997–98	9,168.317	58.38	6,536.499	41.62	15,705
1998–99	9,703.328	55.64	7,736.866	44.36	17,440
1999–2000	9,220.119	46.98	1,0404.74	53.02	19,625
2000–01	1,266.267	49.16	1,309.72	50.84	2,576

Sources: Planning Commission of India, 2003

[17] Year refers to fiscal year, which starts on 1 April and ends 31 March of the following year.

3.0 ANALYSIS OF FEES AND TARIFFS FOR IRRIGATION WATER

3.1 ESTIMATION OF WATER FEES AND TARIFFS

Water taxes are estimated by different agencies and departments and are applied to a diverse range of water users.

a. Irrigation users: Tax is levied from all land receiving water for irrigation and aquaculture purposes from any government source. The sources of irrigation are classified as:

- Category 1 – All major and medium irrigation projects
- Category 2 – All other government sources of irrigation with water supplied for a period of not less than four months in a year[18]

Land is classified as wet or dry. Land classified as irrigated wet or irrigated dry shall be regarded as dry. Culturing prawns, fish or any other aquatic life inside tanks, ponds, pens or any other enclosures using water from government sources is considered aquaculture. Ayacuts for each irrigation source (already existing or new) is publicly identified (notified) by the District Collector within the district. If the ayacut extends to more than one district, the Commissioner of Land Revenue is advised. Once the area under each project is confirmed, a list is published by the Mandal Revenue Officer containing the names of the landowners within the jurisdiction, the size of the land and the water tax payable. This enables the payees to check the accuracy of the notification and query the relevant authority if there are any discrepancies.

The Competent Authority in the Irrigation Department representing the WUAs will assess the area irrigated in relation to the crop sown and liaise with the presidents of the WUAs. Details of the assessed area will be furnished to the Mandal Revenue Officers, who in turn send a demand for tax (estimated irrigated revenue receipts). It is the responsibility of the Revenue Department to collect taxes with the assistance of the farmers' organizations responsible for activities within specified areas of operation. The tax collected is then correctly apportioned to the WUAs in allocations decided by the government.

Water charges are revised yearly by the Irrigation Department and the Revenue Department, based on the extent of irrigated area per crop—known as "Joint *Ajamahish*." Collection of water charges often falls short of the level requested, due to poor compliance by farmers despite the low charges. Various explanations, ranging from farmers having a "free ride" attitude, to lack of willingness to pay and lack of trust in the system, are often put forth to explain the low recovery rates. The recovery rates for the entire state range from 20 to 46 per cent over a period of ten years.

b. Industry: The Executive Engineer of the I&CAD Department calculates the tax based on the individual industry's demand for bulk water supply from the reservoir and credits the water tax to the government account.

c. Drinking water: Local village, *Gram Panchayat*, municipality and metropolitan administrations fix the water taxes and collect them from the individual households. The Irrigation Department is not involved.

d. Fisheries: The Fisheries Department and the Andhra Pradesh Fishery Corporation lease or auction reservoirs for one year to fisherman cooperatives and collect the lease annually.

[18] It should be noted these categories are different from the categories 1, 2 and 3 used in this study to classify irrigation projects by size.

3.2 PREVAILING WATER TARIFFS

Basic Land Revenue on all the registered dry lands in the state was waived in 1984 with the introduction of the A.P. Water Tax Act. 11 of 88. It introduced a uniform and clear system for levying water tax and was retrospectively applied to 1 July 1986. The revenue is derived only from water tax levied on farmers receiving water for irrigation purposes for a period of not less than four months in a year from any government-provided sources of irrigation. Rates for irrigation services are based on the nature of the crop and type of water source. The rates are outlined in Table 13.

TABLE 13: DETAILS OF WATER TAXES FOR IRRIGATION PURPOSES (INR/HA)

S.No.	Nature of crop	Period of water tax per hectare under A.P. Water Tax Act, 11/1988		Revised rates of water tax per hectare as per the Ordinance 01/1997	
		Category I	Category II	Category I	Category II
1	Ist or Single Crop Wet	150.00	100.00	500.00	250.00
2	2nd and 3rd Wet Crop	150.00	100.00	375.00	250.00
3	Ist Crop Irrigated Dry (I.D)	100.00	50.00	250.00	150.00
4	2nd and 3rd Crop I.D	100.00	50.00	250.00	150.00
5	Dufasal Crop in Financial year	300.00	200.00	875.00	875.00
6	Aquaculture per year	-	-	1,250.00	1,250.00

Note: Category I: all government sources categorized as major and medium projects; Category II: other than Category I with less than 5 months' supply
Source: I&CAD, 2002

For industry, the rate or fees for water delivery are assessed and collected based on the type of water source used and the number of gallons of water used. Domestic household water is charged according to the consumption of kilolitres of water per month.

3.3 COLLECTION AND UTILIZATION OF IRRIGATION WATER TAX

About 25 to 30 per cent of the water tax collected for major irrigation projects is utilized for O&M cost for the same project through a plough-back scheme (the money is given back to the WUAs managing the project and reinvested) to farmers' organizations. The remaining 5 per cent is allocated to DCs, PCs and *Gram Panchayats* associated with the irrigation project. However, for WUAs associated with minor irrigation projects, 90 per cent of the water tax is shared with WUAs and 10 per cent with *Gram Panchayats* (Tucker, et al., 2010).

To fund the activities of the WUAs, since 2001 the GoAP has set aside a percentage of the water tax collected for sharing among the relevant organizations responsible for the O&M of the irrigation projects (Table 14).

TABLE 14: PROPORTION OF WATER TAXES COLLECTED FROM WUAS REDISTRIBUTED TO MAJOR, MEDIUM AND MINOR IRRIGATION PROJECTS

	Major Irrigation Projects (%)	Medium Irrigation Projects (%)	Minor Irrigation Projects (%)
Government	50	50	-
Water User Association (WUA)	25	30	90
Distributary Committee (DC)	10		-
Project Committee (PC)	10	15	-
Gram Panchayat (GP)	5	5	10

Source: I&CAD, 2009

In the 2005–06 fiscal year, the total water tax collected from irrigation was INR5,600 million (US$125.13 million). Since 2008–09, there has been a marked improvement in the status of water tax collection and government plough back of funds for O&M activities (Table 15).

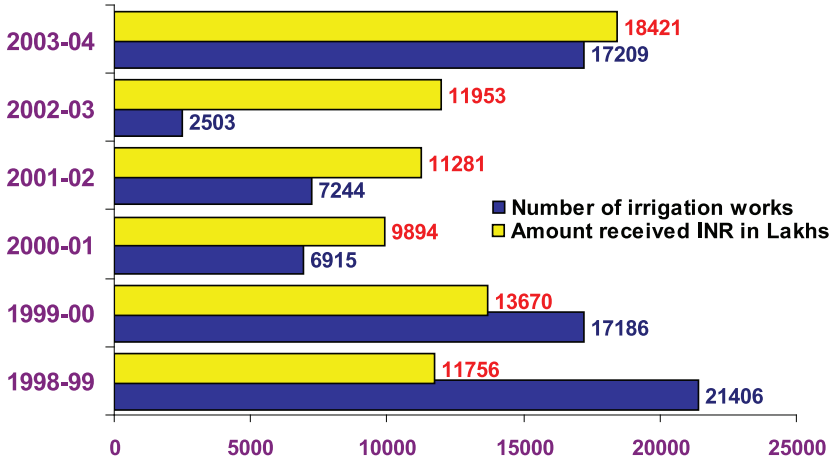
TABLE 15: WATER TAX COLLECTION AND PLOUGH BACK FOR O&M ACTIVITIES (MILLION INR)

S.No.	Collection	Allocation for O&M	Plough back	Budgetary support
2005–06	5,600	-	-	-
2006–07	6,700	-	3,000	-
2007–08	7,500	-	3,000	-
2008–09	11,500	20,000	6,000	14,000
2009–10	1,320 (projected)	16,000	10,000	6,000

Source: I&CAD, 2009

In the future, the WUA's role in the O&M of irrigation systems will depend on its ability to generate resources. In the APFMIS Act, there are provisions for generating revenue for WUAs to self-manage and projects achieving financial independence. A closer look at the revenue flows to WUAs indicates that the major source of revenue is plough back from the water tax (Figure 5).

FIGURE 5: O&M ACTIVITIES AND FUNDS RECEIVED BY WUAS AT THE STATE LEVEL (1998–2004) (LAKH INR)



Source: I&CAD, 2009

3.4 WATER TAX DEMAND AND COLLECTION RATES

Table 16 shows that since the inception of PIM in 1997, the level of water tax collection has been too low for effective resourcing by WUAs for O&M activities. This is further complicated by the Revenue Department taking a long time to plough back (transfer) the water tax collected to WUAs. Consequently, between 2004 and 2006, there were no "plough backs" to the WUAs and no O&M activities undertaken by them as a consequence.

TABLE 16: WATER TAX DEMAND AND COLLECTION (1997–2006)

Year	Demand (million INR) Total	Collection (million INR) Total	% of collection Total
1997–98	2,912.4	700.7	24.06
1998–99	3,370.7	931.7	27.64
1999–00	3,607.0	1,057.3	29.31
2000–01	2,994.6	1,157.3	38.65
2001–02	2,924.2	586.7	20.06
2002–03	3,357.9	949.7	28.28
2003–04	3,310.4	345.7	10.44
2004–05	3,263.7	567.7	17.39
2005–06	3,521.0	834.0	23.69

Source: Adapted from I&CAD, 2007

4. IRRIGATION INFORMATION AND DATA

4.1 COST OF WATER PROVISIONING

4.1.1 VALUATION OF CAPITAL EXPENDITURE ON IRRIGATION PROJECTS

The cost of the irrigation infrastructure is initially approved by the planning commission and subsequently revised based on the time taken to complete the project and its state at the time of project completion. Further, the projected cost of the project, reassessed to the present value, will be estimated by the Government of Andhra Pradesh periodically. The annualized present cost of capital expenditure was considered for subsidy estimation in this study.

4.1.2 COST OF PROVIDING IRRIGATION WATER

The cost of providing irrigation water includes annualized capital and O&M expenditure. These costs are incurred by the irrigation project for water storage, distribution and abstraction. The opportunity cost for electricity was estimated by considering the cost of electricity when it is being sold to farmers versus supplying it free of cost.

TABLE 17: COST OF PROVIDING IRRIGATION WATER UNDER THE SELECTED IRRIGATION PROJECTS (MILLION INR)

Project	Cost component	2004–05	2005–06	2006–07	2007–08
NSP					
	Annualized capital cost*	1,573.11	1,730.42	1,903.43	2,093.75
	O&M expenditure	444.57	435.88	475.99	919.90
	Opportunity cost of electricity	274.25	287.97	301.17	314.87
	Total	2,291.93	2,454.27	2,679.59	3,328.52
SRSP					
	Annualized capital cost	5,244.00	5,769.00	6,346.00	6,980.90
	O&M expenditure	69.58	69.36	75.24	53.76
	Opportunity cost of electricity	392.00	411.60	431.20	450.80
	Total	5,705.58	6,249.96	6,852.44	7,485.46
TBP					
	Annualized capital cost	308.10	280.10	254.61	231.51
	O&M expenditure	0.18	0.30	0.31	0.33
	Opportunity cost of electricity	77.60	81.48	85.36	90.24
	Total	385.88	361.88	340.28	322.08
	US$	8,623,017	8,086,704	7,604,022	7,197,318

* Annualized capital cost was calculated using a 10 per cent interest rate and a life span of 100 years for infrastructure.

In the case of the NSP, the cost of providing water to irrigation was INR2,291.93 million (US$ 51.22 million) in 2004–05, and increased to INR3,328.52 million (US$74.38 million) in 2007–08. In the case of SRSP, however, the total cost was INR5,705.58 million (US$127.5 million) in 2004–05, and subsequently increased to INR7,485.46 million (US$167.27 million). The cost of providing irrigation was comparatively less in the case of TBP: INR385.88 million (US$8.62 million) in 2004–05 and INR322.08 million (US$7.2 million) in 2007–08, due to less capital cost (Table 17).

4.2 GOVERNMENT OR WATER SUPPLIER REVENUE COMPONENT

4.2.1 REVENUE REALIZED FROM THE SALE OF WATER

Among the major users of water, revenue received from irrigation accounts for the maximum share. The total revenue received through the sale of irrigation water from the four major irrigation projects in Andhra Pradesh has ranged from INR121.78 million (US$2.72 million) in 2004–05 to INR490.02 million (US$10.95 million) (Table 18).

TABLE 18: IRRIGATION WATER CHARGES COLLECTED FOR THE FOUR MAJOR IRRIGATION PROJECTS UNDER STUDY (MILLION INR)

S.No.	Year	NSP	SRSP	TBP	AMRP	Total
1	2004–05	109.44	27.51	7.14	30.74	121.78
2	2005–06	410.93	589.97	20.84	31.81	218.56
3	2006–07	230.63	47.0	29.42	29.47	188.49
4	2007–08	672.8	32.34	13.67	31.97	490.02
	Total	1,423.8	106.85	71.07	123.99	**1,018.86**
	US$	31,816,760	2,387,709	1,588,156	2,770,726	**22,767,821**

Source: I&CAD, 2010

4.2.2 REVENUE REALIZED FROM THE SALE OF ELECTRICITY FOR IRRIGATION PUMPING

The agricultural sector is one of the major consumers of electricity in the state, yet it accounted for only 25.9 per cent of sales in 2004–05. Due to high electricity charges, farmers were unable to pay. Since 1 April 2004, Government of Andhra Pradesh has been providing free electricity for agricultural purposes. As a result, in 2008–09 the total amount spent on supplying free electricity for agricultural purposes was INR8,519.02 million (US$190.37 million) (Table 19). The opportunity cost of electricity consumed for irrigation purposes in the target projects was estimated in this study as part of the cost of providing irrigation water.

TABLE 19: AGRICULTURAL POWER CONSUMPTION AND ESTIMATED SUBSIDY IN ANDHRA PRADESH BY DISTRICT (2008–09)

S.No	District	Agricultural power consumption (million units)			Subsidy (million INR)*
		Low tension (LT)	High tension (HT)	Total	
1	Adilabad	408.83	3.47	412.3	206.15
2	Nizamabad	1,210.19	66.21	1,276.4	638.2
3	Karimnagar	875.05	3.85	878.9	439.45
4	Medak	1,317.33	3.11	1,320.44	660.22
5	Mahaboobnagar	1,606.33	6.58	1,612.91	806.455
6	Nalgonda	1,651.01	272.22	1,930.23	965.115
7	Warangal	1,135.16	35.06	1,170.22	585.11
8	Khammam	313.75	3.74	317.49	158.745
9	Srikakulam	61.9	1.26	63.16	31.58
10	Vizianagaram	75.6	0.02	75.62	37.81
11	Visakhapatnam	91.17	0.11	91.28	45.64
12	East Godavari	363.92	25.62	389.95	194.975
13	West Godavari	915.83	13.47	929.3	464.65
14	Krishna	252.2	39.75	291.95	145.975
15	Guntur	267.19	147.32	414.51	207.255
16	Prakasam	576.56	62.13	638.69	319.345
17	SPS Nellore	449.59	192.95	642.54	321.27
18	Kadapa	989.51	12.39	1,001.9	500.95
19	Kurnool	383.06	5.54	388.6	194.3
20	Anantapur	1,257.34	10.88	1,268.22	634.11
21	Chittoor	1,096.62	71.24	1,167.86	583.93
22	Ranga Reddy	755.88	0.11	755.99	377.995
	Total	**16,054.02**	**984.03**	**17,038.05**	**8,519.025**
					US$190,369,274

*Cost of electricity is estimated at INR0.5 per unit, the earlier price of electricity when sold to farmers prior to being provided for free.

Note: Low-tension electricity is single-phase electricity supplied via 11, 33 or 66 KV transmission; high-tension electricity is three-phase electricity supplied via 132, 220 or 400 KV transmission.

Source: DES, 2009a

4.2.3 REVENUE FROM THE IMPOSITION OF POLLUTION TAXES

Andhra Pradesh State Pollution Control Board (APSPCB) is the state-level authority with the task of imposing and collecting water cess. Its water cess collection mechanism is a simple one, in which the state head office estimates the tax and collects the water cess from all industry located in the state.

TABLE 20: TOTAL WATER POLLUTION CESS COLLECTED IN ANDHRA PRADESH

S.No.	Year	Amount collected (million INR)	$U.S.
1	2005–06	242.45	5,407,821
2	2006–07	231.32	5,162,011
3	2007–08	271.85	6,055,866
4	2008–09	317.32	7,083,799
5	2009–10	293.31	6,547,486

Source: APSPBC, 2010

In 2009–10, the revenue received was INR293.31 million (US$6.55 million) by imposing water pollution taxes (Table 20). The APPCB remits all of the collected revenue to the Government of India. A water cess is imposed on industries irrespective of whether they use water directly from major irrigation projects. It was not possible to differentiate water cess linked to industry using irrigated water. For this reason, data relating to industry was not used in the estimate of aggregate support to irrigation, while water cess from farmers was.

4.2.4 TOTAL BENEFITS FROM THE SELECTED IRRIGATION PROJECTS

Table 21 illustrates revenue and cost recovery that is undertaken for selected irrigation projects. Benefits were computed by assessing revenue received from multiple uses of water from the project, for example, water cess from farmers, sale of hydropower, sale of fishing rights and fish, and revenue collected in the form of water pollution cess.[19]

Data in Table 21 reveal that total benefits were high in the NSP: INR210.74 million (US$4.71 million) in 2004–05 and INR1,012.05 million (US$22.62 million) in 2007–08. In the case of the SRSP, the total benefits in 2004–05 amounted to INR74.48 million (US$1.66 million), while in 2007–08 they totalled INR167.29 million (US$3.74 million). In 2004–05, total benefits of TP amounted to INR190.86 million (US$4.27 million), and INR204.11 million (US$4.56 million) in 2007–08.

[19] The project serves multiple purposes, such as flood control, groundwater recharge, bringing additional area under irrigation, water for domestic usage and industrial usage, recreational purposes, etc. In this study, irrigation cess, sale of hydropower, fishing rights and pollution cess were considered for computing benefits due to availability of and accessibility to the data sources.

TABLE 21: AGGREGATE BENEFITS FROM SELECTED IRRIGATION PROJECTS (MILLION INR)

Project	Benefit or revenue component	2004–05	2005–06	2006–07	2007–08
NSP					
	Sale of irrigation water	109.44	410.93	230.63	672.8
	Sale of hydropower	72	164	206	319
	Sale of fishing rights	11.82	11.82	2.41	2.41
	Revenue from water pollution cess	17.48	18.8	18.19	17.84
	Total	210.74	605.55	457.23	1,012.05
SRSP					
	Sale of irrigation water	27.51	59.0	47	32.34
	Sale of hydropower	3	134	124	90
	Sale of fishing rights	9.67	10.15	10.15	10.65
	Revenue from water pollution cess	34.3	32.8	34.1	34.3
	Total	74.48	235.95	215.25	167.29
TBP					
	Sale of irrigation water	7.14	20.84	29.43	13.67
	Sale of hydropower	177.6	153.6	152.8	184
	Sale of fishing rights	4.2	4.2	4.41	4.41
	Revenue from water pollution cess	1.92	1.96	1.99	2.03
	Total	190.86	180.60	188.63	204.11
	US$	4,265,028	4,035,754	4,215,196	4,561,117

Source: Project Records of NSP, SRSP and TBP, I&CAD Department, Government of Andhra Pradesh, 2004–2009

5.0 AGGREGATE SUPPORT FOR IRRIGATION

5.1 TOTAL SUBSIDY ESTIMATION

Subsidies were calculated for four fiscal years beginning in the 2004–05 fiscal year and ending in the 2007–08 fiscal year using the difference between the cost of providing irrigation water and total benefits (revenue received) from the irrigation project.

Table 22 illustrates the total subsidy under each project. In case of the NSP, the total subsidy was INR2,081.93 million (US$46.52 million) in 2004–05 and INR2,316.47 million (US$51.76 million) in 2007–08. In comparison, the calculated subsidy was high in the SRSP: INR5,631.1 million (US$125.83 million) in 2004–05 and INR7,318.17 million (US$163.53 million) in 2007–08. The total subsidy for the TBP was INR195.02 million (US$4.36 million) in 2004–05 and INR117.97 million (US$2.64 million) in 2007–08.

TABLE 22: AGGREGATE SUPPORT TO IRRIGATION SERVICES FOR SELECTED IRRIGATION PROJECTS (CURRENCY IN MILLION INR, EXCEPT WHERE OTHERWISE INDICATED)

Project	Support component	2004–05	2005–06	2006–07	2007–08
NSP					
	Total cost of providing water	2,291.93	2,454.27	2,679.59	3,328.52
	Total benefits for the project	210.74	605.55	457.23	1,012.05
	Aggregate support (subsidy)	2,081.19	1,848.72	2,222.36	2,316.47
	Ayacut area (ha)	801,619	989,069	941,700	954,251
	Subsidy in INR/ha	**2,596**	**1,869**	**2,359**	**2,427**
SRSP					
	Total cost of providing water	5,705.58	6,249.96	6,852.44	7,485.46
	Total benefits for the project	74.48	235.95	215.25	167.29
	Aggregate support (Subsidy)	5,631.10	6,014.01	6,637.19	7,318.17
	Ayacut area (ha)	295,547	591,093	587,045	336,032
	Subsidy in INR/ha	**190,53**	**10,174**	**11,306**	**21,778**
TBP					
	Total cost of providing water	385.88	361.88	340.28	322.08
	Total benefits for the project	190.86	180.60	188.63	204.11
	Aggregate support (Subsidy)	195.02	181.28	151.65	117.97
	Ayacut area (ha)	61,163	61,163	61,163	61,163
	Subsidy in INR/ha	**3,188**	**2,963**	**2,479**	**1,928**

In 2007–08 the subsidy per hectare for each respective project was: INR2,427 (US$54.23) (NSP), INR21,778 (US$486.66) (SRSP) and INR1,928 (US$43.08) (TBP) (Table 22). Furthermore, the per-hectare subsidy was high in the SRSP due to relatively high capital investment.

5.2 IRRIGATION SUBSIDY FOR MAJOR PROJECTS IN ANDHRA PRADESH[20]

Based on the extent of command area irrigated by the three projects examined for the study, the remaining major completed irrigation projects in the state have been grouped in to three categories to assess the irrigation subsidies at the state level (Table 23). The three categories of major irrigation projects for Andhra Pradesh were grouped together according to similar ayacut areas.

[20] This study analyzed irrigation subsidies for the three major multipurpose irrigation projects. There were problems with the availability of data on project benefits (such as pollution control, sale of fishing rights and environmental externalities). Consequently it was difficult to estimate the overall benefits generated by the project and quantify the irrigation subsidies. This was a particular problem for minor projects and groundwater sectors, due to the amount of private investments and related benefits or revenue generated by irrigation projects.

TABLE 23: CATEGORIES FOR ESTIMATING SUBSIDIES FOR MAJOR IRRIGATION PROJECTS IN ANDHRA PRADESH

Category[21]	Name of the project	Ayacut (ha)*
I		
	Nagarjunasagar Project	728,744
	Srisailam Project	410,121
	Prakasam Barrage	298,380
	Sub-total	**1,437,245**
II		
	Sriram Sagar Project	257,823
	Nijam Sagar Project	93,522
	Kurnool Cuddapah Canal	107,541
	Pennar Delta System	100,000
	Sub-total	**558,886**
III		
	TBP LLC	67,000
	TBP HLC stage I	29,251
	Rajolibanda Diversion Scheme	14,221
	Kaddam Project	27,963
	Vamsadhara Project, State I	59,919
	Yeleru Reservoir Project	27,374
	Sub-total	**225,728**
	Total ayacut	**2,221,859**

* Ayacut area here refers to the registered ayacut as part of the project.
Source: I&CAD, 2009

Total irrigation subsidies for the state as a whole was estimated using a per-hectare subsidy averaged over four study fiscal years for the three major projects considered in this study. Table 24 illustrates that the total subsidy for major irrigation projects in Andhra Pradesh was around INR12,626.92 million (US$282.16 million).

TABLE 24: ESTIMATE OF SUBSIDIES FOR MAJOR IRRIGATION PROJECTS IN ANDHRA PRADESH

Category	Ayacut (ha)	Average subsidy INR per ha	Total subsidy (million INR)
I	1,437,245	2,313	3,324.65
II	558,886	15,577	8,706.31
III	225,728	2,640	595.96
Total	2,221,859		12,626.92

[21] Categories were made in order to group the other major irrigation projects of more or less similar ayacut with that of the three projects studied.

5.3 ESTIMATING IRRIGATION SUBSIDES FOR MAJOR IRRIGATION PROJECTS IN SOUTH INDIA

There are huge variations in water allocation patterns, crop patterns, water charges, collection procedures and methods among the various states within India. This makes it impossible to use the subsidy estimated for major irrigation projects in Andhra Pradesh to estimate irrigation subsidies nationally. Conversely, there are many similarities in the South Indian states in terms of their crop patterns, estimated water charges, O&M expenses and revenue collection methods. Hence, the results from Andhra Pradesh were extrapolated to all four South Indian states: Andhra Pradesh, Tamil Nadu, Karnataka and Kerala. These four states account for about 20.8 per cent of the total irrigated canal area in the country. Their water allocation system is based on localization or duty rates, which contrasts with the culturable command area (CCA) method adopted in Northern states. In order to calculate the subsidy at a macro level for the South Indian states, all completed major irrigation projects have been grouped into the three categories indicated in Table 23. Major projects in all South India states are grouped accordingly in Table 25.

TABLE 25: CATEGORIES OF MAJOR IRRIGATION PROJECTS FOR ESTIMATING SUBSIDIES IN THE FOUR SOUTH INDIAN STATES

Name of the project	State	Ayacut (ha)*
Category I		
Nagarjunasagar Project	Andhra Pradesh	728,744
Srisailam Project	Andhra Pradesh	410,121
Prakasam Barrage	Andhra Pradesh	298,380
Total		**1,437,245**
Category II		
Sriramsagar Project	Andhra Pradesh	257,823
Nijam Sagar Project	Andhra Pradesh	93,522
Kurnool Cuddapah Canal	Andhra Pradesh	107,541
Pennar Delta System	Andhra Pradesh	100,000
Lower Bhavani Reservoir	Tamil Nadu	83,772
Thirumurthi Reservoir	Tamil Nadu	80,826
Chittar Reservoir-1	Tamil Nadu	121,949
Mettur Reservoir	Tamil Nadu	121,810
Krishnaraja Sagar	Karnataka	79,312
Anicut Channels	Karnataka	77,172
Ghataprabha I & II	Karnataka	139,383
Periyar Valley Project	Kerala	78,325
Total		**1,341,435**

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TABLE 25: CATEGORIES OF MAJOR IRRIGATION PROJECTS FOR ESTIMATING SUBSIDIES IN THE FOUR SOUTH INDIAN STATES (CONTINUED)

Name of the project	State	Ayacut (ha)*
Category III		
TBP LLC	Andhra Pradesh	61,133
TBP HLC Stage-I	Andhra Pradesh	29,251
Rajolibanda Diversion Scheme	Andhra Pradesh	14,221
Kaddam Project	Andhra Pradesh	27,963
Vamsadhara Project Stage-I	Andhra Pradesh	59,919
Yeleru Reservoir Project	Andhra Pradesh	27,374
Periyar Reservoir	Tamil Nadu	57,871
Pechiparai Reservoir	Tamil Nadu	25,900
Kariakoil Reservoir	Tamil Nadu	11,457
Willingdon Reservoir	Tamil Nadu	11,197
Nugu Project	Karnataka	10,526
Vijayanagar Channels-I	Karnataka	12,210
Tungabadra Right Bank LLC	Karnataka	37,504
Nayyar Project	Kerala	23,470
Pampa Project	Kerala	48,480
Chalakkudy Project	Kerala	27,258
Malampuzha Project	Kerala	40,208
Peechi Project	Kerala	23,718
Gayathri Project	Kerala	10,114
Pothundy Project	Kerala	10,046
Chitturpuzha Project	Kerala	29,950
Kuttiady Project	Kerala	34,710
Total		**634,380**

* Ayacut area refers to the proposed ayacut under the project

Source: I&CAD Department, Andhra Pradesh, Hyderabad (www.irrigation.gov.in); Karnataka Water Resource Department, Bangalore (www.waterresources.kar.nic.in); Water Resources Organisation, Public works Department, Government of Tamil Nadu, Chennai (http://www.wrd.tn.gov.in/PWD-150Years.htm.); and Department of Water Resources, Government of Kerala, Thiruvanathapuram (http://www.kerala.gov.in/dept_irrigation/index.htm)

The aggregate irrigation subsidy for the four South Indian states is estimated at INR25,894.35 million (US$578.64 million) (Table 26). This estimate excludes the subsidies provided to medium and minor irrigation projects and ground water abstraction, as these tanks are mostly under community or private ownership. Consequently there is little data available for them, making it difficult to estimate O & M costs and revenue. In other countries, fees for groundwater extraction can be charged, but in India they are not.

TABLE 26: ESTIMATE OF SUBSIDIES FOR MAJOR IRRIGATION PROJECTS IN FOUR SOUTH INDIAN STATES

Category	Ayacut (ha)	Average subsidy INR/ha	Total subsidy (million INR)	Total subsidy ($ million U.S.)
I	1,437,245	2,313	3,324.65	74.29
II	1,341,435	15,577	20,896.83	466.96
III	634,380	2,640	1,674.07	37.41
Total	**3,413,060**		**25,894.35**	**578.66**

5.4 ASSESSMENT OF SUBSIDIES FOR INCOMPLETE IRRIGATION PROJECTS

Since irrigation investment is a recurring process, cost increases due to delays in the project completion is one of the key issues facing the government. Cost overruns (those costs over and above the anticipated cost of the project when originally financed) impose major financial burdens on the government and the projects. In order to estimate the level of subsidy on incomplete projects, one major irrigation project nearing completion, the AMR project, was selected and subsidy estimated.

5.4.1 ABOUT THE AMR PROJECT

The AMR Project is under construction across the Akkampally stream, which is a tributary to the Krishna River. The project utilizes 849.6 MCM of the available water and the reservoir storage capacity is 42.48 MCM (gross) and 42.45 MCM (net) at + 245.00 M F.R.L.

The project is located near the Village of Akkampally, P.A. Pally Mandal, Nalgonda District and irrigates/stabilizes a total ayacut of 1,09,311 ha. The estimated cost at the beginning of the project was *INR126 million (US$2.77 million)*. Since the project's inception in year 1983, a total amount of INR23,759.28 million (US$530.93 million) has been spent and an irrigation potential of 63,562 ha has been created in the Nalgonda District (Table 27). The total land to be acquired for construction of this project was 226.46 ha. Due to a delay in the project construction, the total cost has risen to INR179,652.7 million (US$4014.59 million). This amount is more than the total included in Table 27 as it includes interest on the capital invested.

TABLE 27: BUDGET ALLOCATION AND TOTAL EXPENDITURE FOR THE CONSTRUCTION OF THE AMR PROJECT (MILLION INR)

S.No	Year of the construction period	Budget allocated	Capital expenditure			Total expenditure
			Establishment	Land acquisition	Works	
1	1983–84	3	1.513	1.173	0.004	2.682
2	1984–85	35	3.595	2.755	18.221	24.571
3	1985–86	55	12.498	4.067	37.61	54.175
4	1986–87	150	17.647	5.421	48.626	71.694
5	1987–88	1,000	19.422	4.978	64.141	88.541
6	1988–89	200	30.654	10.04	64.204	104.898
7	1989–90	200	32.229	2.978	43.855	79.062
8	1990–91	100	32.792	0.561	39.64	72.993
9	1991–92	50	22.583	0.426	15.991	39
10	1992–93	40	27.291	2.072	9.794	39.157
11	1993–94	60	28.155	0.477	8.284	36.916
12	1994–95	180	30.23	0.622	15.549	46.401
13	1995–96	1,000	36.833	34.334	29.009	100.176
14	1996–97	500	47.498	12.609	426.488	486.595
15	1997–98	500	60.94	35.837	198.673	295.45
16	1998–99	700	75.85	63.986	638.364	778.2
17	1999–2000	800	80.302	27.393	544.562	652.257
18	2000–01	800	86.517	6.98	885.766	979.263
19	2001–02	900	85.891	26.592	778.91	891.393
20	2002–03	920	91.283	22.867	691.766	805.916
21	2003–04	800	94.861	38.98	469.444	603.285
22	2004–05	1,548.1	106.677	98.583	826.662	1,031.922
23	2005–06	1,451.8	100.756	174.528	1874.63	2,149.916
24	2006–07	3,144.5	115.5	1,263.5	2,540.7	3,919.7
25	2007–08	4,000	152.588	202.369	3,261.34	3,616.298
26	2008–09	4,400	196.7	158.6	2,313.2	2,668.5
27	2009–10	4,943.1	198.185	324.245	3,597.89	4,120.326
	Total	**28,480.5**	**1,788.99**	**2,526,973**	**19,443.3**	**23,759.28**
	US$	**636,424,581**	**39,955,307**	**56,446,927**	**434,480,447**	**530,927,374**

Source: I&CAD, GoAP, 2010

In the case of AMRP, the present value of the project was estimated and data on the O&M expenditure collected for the study period (2004–08). The calculated subsidy is INR12,773.56 million (US$285.44 million) for 2004–05 and INR30,221.88 million (US$675.35 million) for 2007–08. Broken down per fiscal year, it works out to INR116,855 (US$2,611) per ha for 2004–05; INR253,698 (US$5,669) per ha for 2005–06; INR362,639 (US$8,103) per ha for 2006–07; and INR475,470 (US$10,625) per ha for 2007–08 (Table 28). Due to a delay in the project construction (it started in 1983 and is still under construction), the cost of the project has increased exponentially from its original budget INR126 million (US$ 2.77 million).

TABLE 28: COST, REVENUE AND ESTIMATED SUBSIDY FOR THE AMR PROJECT

Year	Annualized capital expenses* (million INR)	O&M expenditures (million INR)	Total cost (million INR)	Revenue collected (million INR)	Subsidy (million INR)	Ayacut (ha)	Subsidy (INR/ha)
2004–05	11,672	1,121.1	12,698	19.54	12,773.56 US$285,442,682	109,311	116,855 US$2,611.28
2005–06	13,984	2,161.8	16,041	20.22	16,125.58 US$360,348,156	63,562	253,698 US$5,669.23
2006–07	17,767	5,301.8	22,954	18.73	23,050.07 US$515,085,363	63,562	362,639 US$8,103.66
2007–08	23,893	6,349.2	30,115	20.32	30,221.88 US$675,349,274	63,562	475,470 US$10,625.03

*10 per cent interest for a period of 40 years.

The AMR Project is a lift irrigation scheme, and the cost of energy to lift water from the river to the reservoir is included in the O&M calculation. The present problem is that the project authorities are lifting almost the full allocation of water for the project to the reservoir, though only about one-third of the ayacut is being irrigated. Once the full proposed ayacut is included as part of irrigation subsidy calculation, the per-ha O&M cost will be lower, but it will still remain significantly higher than completed irrigation projects in the state.

CONCLUSIONS

It is recommended that necessary steps are taken to estimate the cost of supplying irrigation water from dual or multipurpose water sources in order to fairly allocate costs to those users, rather than other irrigation water users. In the case of the incomplete project studied, the level of subsidy was higher due to cost overruns and fewer realized benefits or revenue. At the project level, the following are suggestions to improve subsidy policy, record keeping and subsidy estimation:

- O&M activities must be efficient and properly implemented.
- Changes in pricing norms can mean improved cost-recovery levels.
- Benefit enhancement from multiple uses should be pursued by irrigators.
- Maintenance of project records, and recording the details of costs and benefits should be promoted.

6. OBSTACLES FACING SUBSIDY ESTIMATION IN THE CONTEXT OF THE GSI METHODOLOGY

6.1 OBSTACLES TO MEASURING SUBSIDIES

The study identified challenges to obtaining data for estimating subsidies. They include:

- Lack of data estimating the cost of environmental externalities such as damage to natural ecosystems due to floods, pollution and encroachment.
- The pollution-related data for canals, tanks and groundwater irrigation sources could not be collected. Pollution is observed in isolated pockets where industries are concentrated and pollution from the farming sector is not monitored. Segregating the impacts of the pollutants for either would be difficult.
- The benefits of groundwater recharge provided by surface-level projects were outside the scope of the methodology, but would have provided some benefit to the irrigation sector. Measuring the recharge value would be challenging due to a number of factors, including taking into account the location of wells in relation to canal sources and their zone of influence, rainfall patterns, etc.
- Various government departments and institutions function independently and it is a difficult to coordinate records of related data from all departments. For example, the Irrigation Department is responsible for the release of water and the Revenue Department is responsible for the maintenance of revenue accounts. These two departments need to be coordinated for keeping common records.

6.2 POLICY RECOMMENDATIONS

Some of the key suggestions from the study include:

- The study recommended that state government(s) should estimate the exact level of subsidies provided to the irrigation sector in order to move towards an overall reduction in the scale of subsidies for different projects (major, medium, minor and groundwater projects). Improving the cost recovery and performance of irrigation systems will help to reduce the fiscal burden of subsidies.
- Reducing the overall scale of subsidies. This could be done either by marginally increasing water charges or increasing revenue generation from multiple uses of the water. Improving cost-recovery rates for projects would be beneficial in terms of achieving some level of self-financing.
- Making subsidies as transparent as possible. Society should be aware of the level of subsidies being provided to specific groups. This would help reduce any equity issues relating to the distribution of subsidies among different parts of Indian society.
- Instituting systems to periodically review subsides. It is important to review and analyze the effectiveness, costs and benefits of subsidy policies in the context of projects with multiple water uses. This will allow for the improvement of pricing norms.
- State governments should try to accurately measure the benefits of irrigation subsidies for different sectors using water infrastructure to ensure project costs can be accurately compared to benefits derived from the subsidy.

- The net supplier methodology may need to consider aspects of the Separable Cost-Remaining Benefits (SCRB) methodology for the effective allocation of capital investment and O&M costs among the primary water users for a project. However, the first step for governments is to effectively measure the on-budget financial costs associated with irrigation infrastructure and water provision.
- Methods for estimating subsidies will need solid data sets in order to carry out subsidy calculations[22] and are regularly collected by the relevant Irrigation or Revenue Department and can be updated and published periodically.
- Irrigation subsidies generally support major, medium, minor and groundwater irrigation projects but the level of subsidy varies by the type of project. As this study only examined a selection of projects, further studies should be undertaken in order to drive an overall irrigation subsidy estimate at the state and national levels.

AN AGENDA TO HELP REFORM THE IRRIGATION SECTOR

- The results of the subsidy analysis should assist the development of appropriate government policies that recognize the productivity of water and the costs and benefits of its different uses.
- Analyzing subsidies and planning how to distribute project costs will help identify places where enhancing productivity or benefits is comparatively low. In the case of groundwater recharge, for example, it is important to confirm that recharge benefits have increased compared to if no investment in new water infrastructure went ahead. While the GSI Methodology does not recognize positive externalities, such as some economic benefits, in some instances the government should seek to measure them. For example, the opportunity cost of providing domestic water supplies may be higher than agriculture, but is not measured by the government or the GSI Methodology. But, by maximizing the benefits for certain activities in multiple-use scenarios, it is possible to improve supplies to the target population without much investment. The valuation of the benefits due to these services could be reviewed using the opportunity-cost or willingness-to-pay methods.
- This study did not place a per-unit price on the extraction of ground water. The provision of free water can constitute a subsidy, as water is not a renewable resource and, globally, many areas are suffering water shortages.

[22] This also relates to whether the government wishes to assess and measure potential benefits from multiple uses of water infrastructure and the value of those benefits. Negative externalities also need to be accounted for in order to promote sustainable policies.

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APPENDIX 1: MAJOR IRRIGATION LEGISLATION FOR ANDHRA PRADESH

1. APFMIS ACT, 1997

Several studies were carried out to assess the implementation of this Act. Subsequent Acts included the Andhra Pradesh Water Resources Development Corporation Act, 1997 and the Andhra Pradesh Water, Land and Trees Act, 2002. The new legal framework established water users associations (WUAs) as the apex body for dealing with water resource development, regulating the use of groundwater and promoting sustainable policies. The APFMIS Act, 1997, enacted the following measures:

- clear water rights to the farmers' organizations
- efficient, reliable and equitable distribution of available water through participatory irrigation management
- empowerment of farmers and a sense of ownership of the irrigation system
- assured water delivery to water users
- access to information on the availability of water and time of release
- improved decision-making based on local knowledge
- greater participation in decisions on the operation and maintenance of the main system
- rehabilitation of the irrigation system with funds provided as a percentage of the water rates collected
- better quality infrastructure and maintenance at lower rates
- elimination of contractors for smaller jobs, with farmers doing repairs and maintenance on conditions, as decided by the associations
- flexibility of cropping pattern used within the limits of water allocates
- resolution of conflicts by the farmers' organizations themselves
- irrigation staff to be made accountable to the farmers' organizations and to implement decisions taken by farmers' organizations
- help Department of Irrigation in concentrating on better maintenance of the system as well as completing unfinished projects and bringing new areas under irrigation.

2. ANDHRA PRADESH WATER, LAND AND TREES ACT, 2002

This Act was implemented in 2002 to promote water conservation and tree cover, and to regulate the exploitation and use of ground and surface water. The aim was the protection and conservation of water sources, land and environment for the entire state. A number of fees are levied under the Act:

- registering a bore well for 2 years: INR1,000
- granting permission for digging a new open well: INR100
- felling a tree in urban residential and industrial areas: INR50
- felling a tree in urban commercial areas: INR100

APPENDIX 2: ANDHRA PRADESH STATE WATER POLICY, 2008

The State Water Policy, 2008, focuses on key areas of water management, including: building an enabling environment; implementing a range of institutional tools, including capacity-building activities and participatory approaches; and integrating new management tools and systems.

The policy addresses the multisectoral demand, utilization and governance of water at various levels. It reduces the vulnerability of drought-prone areas in the state, safeguarding them against drought-related problems, the financial sustainability of the water sector, effective use of modern technology and reducing the risk of climate change impacts. The main objectives of the State Water Policy can be summarized as:

- Ensuring the provision of adequate, clean and affordable drinking water, through appropriate institutional and legal frameworks.
- Improving water management and efficiency through: encouraging participation and involvement of users; progressive re-engineering and reorientation of institutions, practices and processes; institutionalizing service charges for water; improving infrastructure, services and utilization efficiency for holistic and optimal development, management and operation of infrastructure.
- Improving the availability, efficiency and productivity of irrigation through outcome-orientated institutional and investment activities.

While the policy embraces a number of progressive and actionable items to achieve better management of water resources for the state, it is silent on aspects such as the impact of climate change, water entitlements for various users and the rationalization of prices, which are expected to become critical in the near future.

The Government of Andhra Pradesh has established a Water Management Committee for the State (GoAP, 2008). This committee is the apex body at the state level, making decisions on policy, reforms and regulation. The functions of the Water Management Committee are:

1. Policy Reforms

- Reviewing implementation of the State Water Policy
- Setting guidelines for reviewing institutional reforms for efficient water resource management for the various water user departments
- Setting guidelines for research and analysis in water resource management for future policy formulations and reforms

2. Regulation and Performance

- Fixing rates for various water uses
- Setting guidelines for the development of water management plans for the various water user departments
- Fixing norms for water quality-related infrastructure and services, water quality and water pollution, especially as related to industrial waste water
- Fixing norms and procedures for operation and maintenance of water resource infrastructure, both by departments and user organizations, and apportioning water taxes and royalties collected by the Department of Irrigation to various agencies for O&M of irrigation systems
- Setting guidelines for the conjunctive use of ground water and surface water in command areas, and managing water logging or salinity problems including salinity ingression
- Fixing norms for and reviewing performance of the Technical Group

3. Convergence

- Setting guidelines for harmonizing existing policies, executive orders and rules related to water resource management issued by different departments, and harmonizing water management plans for the various water user departments

ABOUT THE AUTHORS

Dr. K. Palanisami is Director, IWMI-TATA Water Policy Research Program. He was the visiting Professor at the University of Minnesota from 1982–84 and again in 1990. Dr Palanisami was a Visiting Fellow at Khon Kaen University, Thailand (1984–85) and also worked at IRRI, Philippines from 1986 to 1988. He was Visiting Researcher at Wasesa University, Japan, in 2000 and RIHN, Kyoto, in 2004. Dr Palanisami worked as consultant for the UN/FAO for East African Countries in 1997. He was Director of the Water Technology Centre from 2000 to 2006. He is the Chairman of the Project Implementation Team of More Crop and Income per Drop Programme, 2007, for the Ministry of Water Resources, Govt. of India.

Dr. Kadiri Mohan is Special Project Scientist at the IWMI-TATA Water Policy Research Program, South Asia Regional Office, International Water Management Institute, Hyderabad (India). His research focuses on irrigation management and water policy. He has experience in socioeconomic operational research and capacity building in the area of water management. During his Doctoral program, he worked on participatory irrigation management.

Dr. Mark Giordano is Theme Leader—Water and Society, International Water Management Institute, Colombo, Sri Lanka. He is a geographer and economist with wide experience in economic development, water management and transboundary resources. Mark has conducted research on transboundary resource issues and lectured on world geography, natural resources and development at Oregon State University. He served for nearly 10 years as an agricultural trade economist with the U.S. Department of Agricultures Economic Research Service. Results from his work have appeared in major geography, environmental law, political science and water science journals.

Chris Charles is project manager for the Global Subsidies Initiative (GSI) and IISD's Trade and Climate Change program. He leads GSI's research on irrigation subsidies, and is a Prince2 qualified project manager, with responsibilities that include planning and reporting, financial management and proposal development. He has worked as a project developer for a Geneva-based environmental finance company in the field of the Clean Development Mechanism, and has administrative experience with a range of NGOs.

The **International Water Management Institute** (IWMI) is a non-profit, scientific organization engaged in research and capacity-building activities for developing countries. Our mission is to overcome poverty through the better management of land and water resources. Working with diverse partners and supported by the Consultative Group on International Agricultural Research (CGIAR), IWMI seeks to translate its research findings into actionable recommendations for policy-makers, resource managers and poor rural communities. IWMI is based in Colombo, Sri Lanka and has regional offices located in 12 countries in Asia and Sub-Saharan Africa.

THE GLOBAL SUBSIDIES INITIATIVE (GSI) OF THE INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT (IISD)

The International Institute for Sustainable Development (IISD) launched the Global Subsidies Initiative (GSI) in December 2005 to put a spotlight on subsidies – transfers of public money to private interests – and how they undermine efforts to put the world economy on a path toward sustainable development.

Subsidies are powerful instruments. They can play a legitimate role in securing public goods that would otherwise remain beyond reach. But they can also be easily subverted. The interests of lobbyists and the electoral ambitions of officeholders can hijack public policy. Therefore, the GSI starts from the premise that full transparency and public accountability for the stated aims of public expenditure must be the cornerstones of any subsidy program.

But the case for scrutiny goes further. Even when subsidies are legitimate instruments of public policy, their efficacy – their fitness for purpose – must still be demonstrated. All too often, the unintended and unforeseen consequences of poorly designed subsidies overwhelm the benefits claimed for these programs. Meanwhile, the citizens who foot the bills remain in the dark.

When subsidies are the principal cause of the perpetuation of a fundamentally unfair trading system, and lie at the root of serious environmental degradation, the questions have to be asked: Is this how taxpayers want their money spent? And should they, through their taxes, support such counterproductive outcomes?

Eliminating harmful subsidies would free up scarce funds to support more worthy causes. The GSI's challenge to those who advocate creating or maintaining particular subsidies is that they should be able to demonstrate that the subsidies are environmentally, socially and economically sustainable – and that they do not undermine the development chances of some of the poorest producers in the world.

To encourage this, the GSI, in cooperation with a growing international network of research and media partners, seeks to lay bare just what good or harm public subsidies are doing; to encourage public debate and awareness of the options that are available; and to help provide policy-makers with the tools they need to secure sustainable outcomes for our societies and our planet.

www.globalsubsidies.org

The GSI is an initiative of the International Institute for Sustainable Development (IISD). Established in 1990, the IISD is a Canadian-based not-for-profit organization with a diverse team of more than 150 people located in more than 30 countries. The GSI is headquartered in Geneva, Switzerland and works with partners located around the world. Its principal funders have included the governments of Denmark, the Netherlands, New Zealand, Norway, Sweden and the United Kingdom. The William and Flora Hewlett Foundation have also contributed to funding GSI research and communications activities.

FURTHER DETAILS AND CONTACT INFORMATION

For further information contact Ms. Kerryn Lang at: klang@iisd.org or info@globalsubsidies.org or +41.22.917.8920.

GSI Programme
International Institute for Sustainable Development
9 chemin de Balexert, 1219, Geneva, Switzerland
Phone: +41.22.917.8785
Fax: +41.22.917.8054