India

Srisailam Left Bank Power Station Project (1)-(3)

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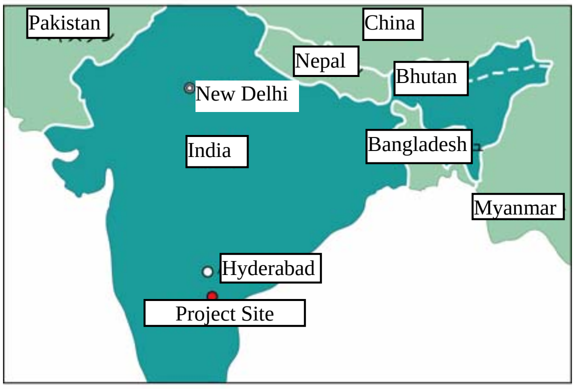
Field Survey: November 2005

1. Project Outline and Japan's ODA Loan



Map of project site

Underground Turbine Facilities

1.1 Background

With a population of about 54 million people (1981) and the fourth largest GDP of India's states (1983), Andrha Pradesh (AP) was the hub of India's southern states. Agriculture was the main industry and the state government in the past invested more than one-third of public spending in this sector. Under the state's fifth and sixth five-year plans implemented from 1980 to 1984 and 1985 to 1989 respectively, however, industrial development was earmarked as a new priority sector and the state government stepped up efforts to achieve industrialization.

Richly endowed with hydropower resources and coal deposits, AP was one of India's few states where balanced development of hydropower and thermal power was possible. However, electric power supply was unable to keep pace with demand and in 1985 the state experienced a 26% shortfall in electric power supply. Although supply and demand at peak periods was on the whole balanced, a significant power shortage was expected in the future.

Located on the Krishna River Srisailam, the project site, is the Srisailam Reservoir

[1] Ex-post evaluation of this project was conducted jointly with APGENCO. In order to strengthen the evaluation capacity of electric power sector in India, Mr. K Rmanathan and Mr. Shahid Hasan (The Energy Resource Institute) participated in as technical assistance experts.

(completed in 1984) with an effective capacity of 6.9m^3 and a 770MW hydroelectric plant (completed in 1987) which utilized this resource. However, the river flow rate was underutilized by the existing power plant and water that could have been used for power generation was discharged as discharge water. Although it was predicted that power generation by conventional mode would become difficult from 2000 onwards as the development of water resources for irrigation and other purposes continued upstream, there was a second reservoir downstream, the Nagarjugasagar Reservoir, with a capacity of 5.5 billion m^3, and pumped hydropower generation utilizing this resource as the lower reservoir was considered possible.

The objective of the project was to respond to the increasing demand for electricity in AP through efficient power generation using pumped hydropower generation. To achieve this objective, ODA loans were provided in three phases in the period from February 1988 to September 2003.

1.2 Objective

The objective of the project was to meet the increasing demand for electric power (particularly during peak hours) in AP by constructing a pumped-up power plant in AP that would utilize the Srisailam Reservoir as its upper reservoir and the Nagarjugasagar Reservoir as its lower reservoir, effectively utilizing the river flow rate, and thereby contribute to the industrial promotion and improvement of the residents' lives by electrification in AP.

1.3 Borrower/Executing Agency

The President of India/AP State Electric Power Board[2]

1.4 Outline of Loan Agreement

	Phase I
Loan Amount/ Disbursed Amount	26,101 million yen/26,089 million yen
Date of Exchange of Notes Date of Loan Agreement	September 1987 February 1988

[2] In 1999 following an organizational division of the state electricity board (unbundling), Andhra Pradesh Power Generation Corporation (APGENCO) became the executing agency.

Terms and Conditions - Interest Rate - Repayment Period (Grace Period) - Procurement	2.75%/year 30 years 10 years Partially Untied
Final Disbursement Date	January 1999
Main Contractors	Sumitomo Corporation, Patel Engineering Inc. (India). P.E.S. Engineers PVT. (India), Mitsui Co., & Ltd., Marubeni Corporation, Mitsubishi Corporation, etc.
Consulting Services	CEA (India), CWC (India), Electric Power Development Co., Ltd.
Feasibility Study (F/S) etc.	Andhra Pradesh State Electricity Board (April 1985）

	Phase II
Loan Amount/ Disbursed Amount	22,567 million yen/22,471 million yen
Date of Exchange of Notes Date of Loan Agreement	December 1994 February 1995
Terms and Conditions - Interest Rate - Repayment Period (Grace Period) - Procurement	2.6%/year 30 years 10 years General Untied
Final Disbursement Date	April 2001
Main Contractors	Same as for Phase I
Consulting Services	Same as for Phase I

	Phase III
Loan Amount/ Disbursed Amount	14,499 million yen/14,184 million yen
Date of Exchange of Notes Date of Loan Agreement	October 1997 December 1997

Terms and Conditions - Interest Rate - Repayment Period (Grace Period) - Procurement	 2.3%/year 30 years 10 years General Untied
Final Disbursement Date	February 2003
Main Contractors	Same as for Phase I
Consulting Services	Same as for Phase I

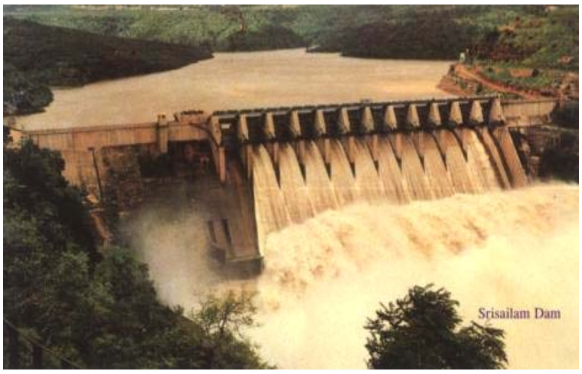
2. Evaluation Result

2.1 Relevance

2.1.1 Relevance at the time of appraisal

In India's five-year plans, the electric power sector was earmarked as one of the major steps towards achieving economic development, and its priority has remained consistently high. Because it is an extremely important sector for the sound development of the domestic economy, emphasis was placed on public investment in this sector in the Seventh Five-Year Plan (1985-1989).

In 1985, AP had an electricity shortfall of 26% and while there has been a balance between supply and demand during peak demand hours, the shortfall in supply during peak hours was expected to reach 15% in 1994. Therefore, increasing peak supply capacity became an issue of top priority. Due to these conditions, industrial development became the new priority sector in the Sixth and Seventh Five-Year Plans (1980-1985 and 1985-1989) in place of the agricultural sector, which had been emphasized until then, and the improvement of electric power services to improve the investment climate became a pressing issue.



Unused water discharged from Srisailam Reservoir

Water that could be used for power generation was being discharged unused from the Srisailam Reservoir and it was anticipated that electric power generation by conventional mode would only be possible up until 2000 because of the increasing use of water upstream due to progress in the development of irrigation. At the same time, it was believed that pumped hydropower generation utilizing the downstream Nagarjugasagar Reservoir as the lower reservoir would be possible.

In view of the above overall factors, the relevance of the project at the time of the appraisal was judged to be extremely high.

Diverging Point of Intake Tunnel

2.1.2 Relevance at the time of ex-post evaluation

Under India's 10th Five-Year Plan (2002-2007), the electric power sector remains a vital sector and has been allocated 16% of the budget. As nationwide power shortages remain unresolved, renewal and rehabilitation of existing facilities, improvement of the plant load factor (PLF) in thermal power plants, boosting power generation capacity through new construction, and structural reforms in the state electricity boards (SEBs) were cited as important issues[3].

An increase of more than 70% in electric power generation capacity and improvement in PLF in thermal power plants in AP in the past 10 years have significantly improved electricity shortages, reducing the power shortfall at peak hours from 19% in 1995 to 11% in 2003. In addition, in AP's 10th Five-Year Plan (2002-2007), industry and the service sector continue to be positioned as the driving forces of economic growth, and it aims for annual economic growth of more than 8%. Therefore, demand for electricity continues to increase and is expected to increase annually by 5.8% until 2010. Consequently, boosting the state's power generation capacity remains a pressing issue. Because usage of upstream water from the Srisailam Reservoir for irrigation and other purposes has been lower than initially expected, conventional power generation without resorting to pumped hydropower generation was still possible as of 2005.

In view of the above factors overall, it can be said that the relevance of the project remains strong at the time of evaluation.

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[3] Structural reforms in many of India's SEBs began in the 1990s with initiatives to address issues such as distortions in the pricing system, significant power losses, and a low collection rate of electricity charges, and efforts were made to promote private sector entry into the electric power generation and distribution sectors. This was done by unbundling power generation, transmission and supply into separate divisions and by phasing in the privatization of power supply.

2.2 Efficiency

2.2.1 Outputs

During the project, an underground pumped hydropower generation plant with an output capacity of 990MW was constructed more or less according to plan. At the time of the appraisal, it was assumed that the composition of the generating units would consist of either 110MW x 9 units or 165MW x 6 units. After taking into consideration results of the consultants' studies, AGPENCO finally decided to use 165MW x 6 units which would reduce costs and construction time. Consulting services increased accordingly with the extension of the construction period.

Facility Configuration of Srisailam Left Bank Pumped Hydropower Station

For the lower reservoir for pumped hydropower generation, it was initially envisaged that the Nagarjugasagar Reservoir would be used in its original form. Partial riverbed improvements were accordingly planned for the area downstream of the Srisailam Reservoir to ensure that a stable supply of pumped water would be possible even when the water level of the reservoir was low. Plans were for AGPENCO to undertake the riverbed improvements using its own funds. However, after results of detailed studies revealed that extensive construction requiring an enormous amount of funds would be necessary, a decision was made to construct a weir instead of constructing riverbed improvements and create a new lower reservoir which would provide eight hours of pumped water per day. This weir, self-funded by APGENCO, is currently under construction and is expected to be completed at the end of 2006 if construction is not interrupted by a rise in the water level of the Nagarjugasagar Reservoir.

2.2.2 Project Period

This project was India's largest underground power generation plant and the construction was extremely difficult. At the time of the appraisal for Phase I, it was anticipated that the project would extend over a period of 87 months from January 1987 to March 1994. However, the actual project period went from February 1988 to September 2003 for a period of 212 months, finishing nine and a half years later than the initial schedule at the time of the first appraisal.

Among the main causes of the delay were additional underground engineering works due to heavy seepage and a soft ground that had not been initially anticipated, a delay in payments to contractors, and a delay in the payment of customs taxes by the executing agency due to its financial limitations.

By the time of the third appraisal in 1997, a delay of more than seven years had already occurred. Following this, however, a number of measures were devised to improve and promote the efficiency of the project execution including the introduction of a 24-hour-a-day system for civil engineering works, the introduction of additional heavy construction equipment and conveyor belts, penalty contracts with contractors stipulating the payment of penalties for delays, tighter management of operations by the executing agency (improvement in coordination through regular meetings, etc.), and a switch in the method of disbursement to transfer procedure.

Table 1. Project Period and Project Costs: Projections and Actual Performance

	Project Period	Total Project Cost
Plan at the time of the Appraisal for Phase I (1987)	January 1987-March 1994 (87 months)	60,044 million yen
Plan at the time of the Appraisal for Phase III (1997)	February 1988-January 2002 (168 months)	79,153 million yen
Actual	February 1988-September 2003 (212 months)	78,093 million yen

2.2.3 Project Cost

The total cost of the project reached 78,093 million yen, exceeding the 60,044 million yen estimated at the time of the appraisal for Phase I by approximately 30%. The main causes of the increases in costs were: (1) increases in the cost of electric power generating equipment, (2) the adoption of the latest technologies for the transmission and transformer equipment as well as an increase in the amount of equipment, based on detailed studies by the consultants, and (3) an increase in the amount of civil engineering works required due to seepage and soft ground as well as cost increases in civil engineering works due to inflation. The increase in the cost of civil works increased further with delays in construction. Project costs totaled 41% above initial plans and over 80% of these cost increases were related to electric and mechanical works noted in (1) and (2) above. Increases in costs for civil works (nearly all in local currency) were offset by depreciation of the local currency and therefore were maintained at a level of 12% increase in yen terms.

2.2.4 Evaluation Summary of Efficiency

Output of the project was almost as planned. However, because of the significant delay in the implementation period and the significant increase in project costs over planned levels, it can be said that the level of overall efficiency in terms of the overall execution of the project was low.

2.3 Effectiveness

2.3.1 Operation and Output of the project

According to the initial plan, the project was scheduled for completion in 1994 and it was anticipated that by around 2000, when use of water upstream for irrigation purposes was expected to increase, electricity would be generated by both reservoir type power plant and pumping methods and would gradually shift exclusively to pumped hydropower generation. However, the six turbines for pumped hydroelectricity only began actual operation gradually from 2001. With the final unit completed in September 2003, a facility capacity of 990MW began operation. A maximum output of 967MW was recorded in FY2004.

Table 2. Operation and Output of Srisailam Left Bank Power Station
(conventional catchment power generation)

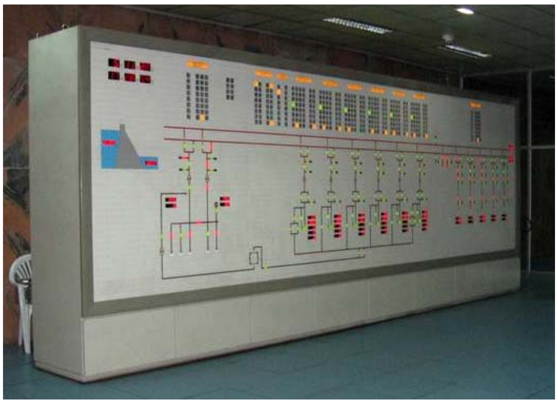
FY	Maximum Output	No. of Annual Operating	Annual Electric Power	Ratio of APGENCO’s Total

		Hours	Output	Output
2001	307MW	2,092	382GWh	1.2%
2002	476MW	2,304	558GWh	1.9%
2003	721MW	1,516	328GWh	1.2%
2004	967MW	3,154	1,412GWh	5.5%
2005 (First Half)	941MW	2,372	1,465GWh	-

Upstream water usage did not increase as expected and at present reservoir type power plant electric power generation is still in progress. Since not all of the generating units were completed in FY2001 and FY2002, output was low due to a drought in 2003. However, from FY2004 onwards, target goals for both operating hours and electric power output were adequately reached and, showing a steady increase, output for FY2004 rose to 5.5% of APGENCO's total electric power output[4]. Furthermore, close to 40% of the power generated in FY2004 and the first half of FY2005 was during peak hours (5 am to 8 am and 6 pm to 9 pm). Although the downstream weir for pumped hydropower generation has not been completed, the high water level of the Nagarjugasagar Reservoir made it possible to commence pumped hydropower generation in December 2005.

2.3.2 Contribution to AP's power supply and demand

The shortfall in power supply in AP became serious, with supply falling short of demand by 13-15% from 1995 to 1999. In FY2003, however, demand was 48,161GWh and supply was 47,441GWh, lowering the shortfall to 1.5%. In FY2004, power output due to the project was 1,412GWh, equivalent to about 3% of AP's electric power supply for that fiscal year.


Display Panel of Generator Control Room

AP's power shortage during peak hours since FY2000 has been running at about 10-11%, which has improved in comparison with the 19% shortage around 1995. AP's maximum supply during peak hours was 6,615MW in FY2003 and the maximum output of the project in 2003 was 721MW, which was equivalent to 11% of the state's total output. Therefore,

[4] According to the plan at the time of the appraisal, annual operating hours were estimated at approximately 2,500 (average value over a 15-year period following commencement of operation) with 751GWh output for conventional generation and 788GWh output for pumped generation. Furthermore, the target assigned to each power plant by APGENCO was 1,420GWh for FY2004 and 1,155

the project has been making a significant contribution to ameliorating power shortages during peak hours. The power plant is located close to the heart of AP's power demand and is not only capable of providing direct transmission to the capital Hyderabad but can also generate power flexibly as the need arises to accommodate frequent fluctuations in power demand[5]. Furthermore, it has the capacity to play an even greater role to achieve the stable supply of electric power. During periods when conventional power generation is difficult due to drought or other factors, if pumped hydropower generation is used, a total of 1,760MW can be generated from both banks, making it possible to provide a stable power supply during peak hours[6]. In addition, a reserve supply capacity was made possible through the project. This has made the gradual overhaul of AP's thermal power plants possible. The project has thus also been contributing indirectly to raising the operating ratio of the state's thermal power plants[7]. Furthermore, the power plant is contributing to the effective utilization of resources by using unutilized water resources of the Srisailam Reservoir and by using excess electric power of thermal power plants during the night[8].

2.3.3 Recalculation of the internal rate of return

When the Financial Internal Rate of Return (FIRR) was calculated at the time of the appraisal, it was based on a project life of 30 years, sales from power generated under the project was considered as benefit, and expenses included construction costs, operation and maintenance costs, fuel costs for pumped water sources (electric power) and resulted in an FIRR of 10%. When the FIRR was recalculated based on the same conditions for the ex-post evaluation, the result was -4.2%. The reason for the considerably lower result in comparison with the value at the time of the appraisal can be attributed to the increase in construction costs, delays in the project completion, and the low sales price of electric power.

Although an Economic Internal Rate of Return (EIRR) was not calculated at the time of the appraisal, when a further calculation was undertaken to include the benefits of the consumption of generated electric power resulting from the project, with project life of

[5] Going from a completely idle state, the generation units of this power plant can commence generating electricity in only 15 minutes.

[6] On the right bank of the Srisailam Reservoir is a semi-underground hydroelectric power plant with a generation capacity of 770 MW. The project made it possible to generate power using pumped water. The combined power generation capacity of the left and right hydroelectric power plants accounts for 27% of APGENCO's total capacity.

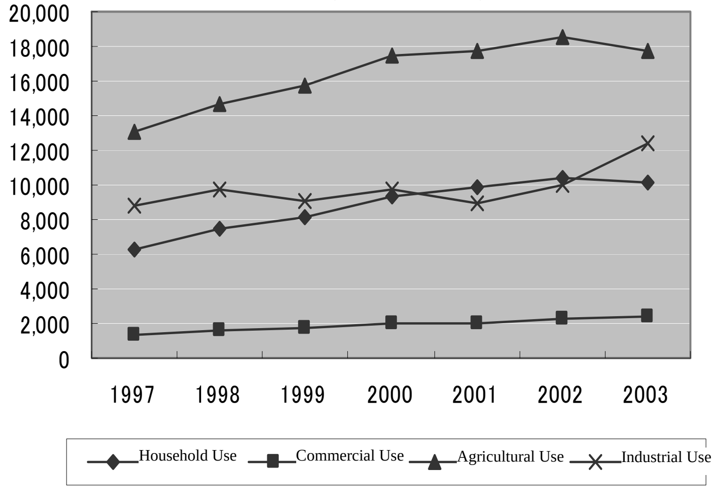
[7] The plant load factor (PLF) of APGENCO's thermal power plants has improved considerably, going from around 78% in 1995-1996 to around 89% at the time of ex-post evaluation. In addition, once full-scale pumped hydropower generation begins, it will enable the efficient use of night-time surplus electricity and the operating rate can be expected to improve further.

[8] Until completion of the project, unused river water that the Srisailam Right Bank Power Station could not utilize was discharged. Although it varied depending on the inflow into the reservoir, from FY1995 to 2000, there was an annual discharged of about 62 to 1, 371 trillion cubic feet. Following completion of the project, the inflow was low due to a drought but the amount of unused discharge was 19 to 135 trillion cubic feet. This power plant provided for generation capacity to minimize unused, discharged water if there was a demand for electricity.

30 years, and expenses including construction costs, maintenance and management costs, and fuel costs for pumped water sources (electric power), the EIRR was 2.8%[9].

Fig. 2 Electric Power Consumption in AP by Sector

(Unit: GWh)



2.3.4 Summary

Although it had been scheduled to start up in FY2000, pumped hydropower generation actually began operation in December 2005. However, since commencement of the project operations in 2001, management of the project using conventional power generation has proceeded smoothly. Even in FY2004 when total rainfall was lower than average, output significantly exceeded initial plan. At the maximum output, the project provided in excess of 10% of AP's power supply during peak hours and even though the schedule for the commencement of operations fell behind initial plans, the project goals on the whole were realized[10]. If the water level of the lower reservoir does not rise, the weir under construction at present is expected to be completed in the summer of 2006. After that, it is expected that a stable supply of pumped hydropower will be possible and that the project objectives will be sufficiently achieved.

2.4 Impact

[9] The current price level, when price fluctuations are taken into account, is about half the level of electric power prices estimated at the time of the appraisal. The sale prices (FY2005) of the Srisailam Left Bank Hydropower Company set by the AP Electric Power Regulatory Committee are 0.86 rupees/kWh for peak hours and 1.41 rupees/kWh for non-peak hours. However, these prices are equivalent to previous variable costs (such as fuel costs, and excluding depreciation) of thermal power plants and are disadvantageous to the power company. The current prices were adopted in re-calculations and APGENCO plans to make an appeal to the regulatory committee to request that it set more advantageous prices.

[10] In FY2003, at peak hours the project provided a maximum power supply of 721MW, which was equal to 11% of AP's power supply output during peak demand hours. Therefore, the number of beneficiaries of the project during that year can be said to be equivalent to 10% of the population which is equivalent to 8 million people (equal to about the population of Kanagawa Prefecture).

2.4.1 Impact on industrial development

During the 1990s, agriculture (irrigation pumps) accounted for 40% of AP's electric power consumption but since 2002 power consumption for agricultural purposes has been on the decline. On the other hand, household power consumption and power consumption by the service sector showed significant increases in the period from 1997 to 2003, rising at an annual rate of 8% and 11% respectively. Electricity consumption by industry since 2001 in particular has risen at a dramatic rate, increasing 38% over a two-year period.

In terms of GRDP share in 2003 by sector, primary industries accounted for 28%, secondary industries 23%, and tertiary industries 49%. While primary industries fell steadily by about 20 points in the past 10 years, secondary and tertiary industries have risen dramatically since 2000. In contrast to primary industries which until 2004 showed growth of only 1.5%, the secondary and tertiary sectors have shown high growth at 23.2% and 13.8% respectively.

According to the AP Chamber of Commerce, investments have increased and the manufacturing and service industries have become the driving forces of the economy, as a result of ongoing policies to promote industry and to establish a favorable investment environment in terms of infrastructure and regulatory system. Improvements in electricity services can be seen as contributing to this environment. For example, until about 10 years ago, voltage fluctuation was a serious problem; however, as a result of an increase in power generation capacity and giving industry priority in the supply of electricity, significant improvements have been achieved in the past three to four years. In addition, because of the considerable decrease in scheduled power outages, industries no longer have to rely so much on in-house power generation. In contrast to 35% of industrial production relying on in-house power generation in the past, the present ratio has dropped to less than 5%. The framework of electricity charges, which previously provided excessive subsidies for electricity for agricultural purposes, has been revamped to a more equitable system; as a result, electricity charges for the manufacturing sector have fallen consecutively for the past three years and this has resulted in reduced manufacturing costs.

In short, the manufacturing and service sectors have demonstrated high growth since 2000 and have been the driving forces of the economy in AP. Improvement in electricity services including reductions in voltage fluctuations and in scheduled outages was a vital condition for enhancing the investment environment and manufacturing and business efficiency in the state. Therefore, the project can be seen as contributing to the development of the state's industry by increasing the electricity supply capacity during peak hours.

2.4.2 Impact on the improvement of living standards as a result of electrification

In 1988, only 32% of villages in AP were electrified. At the time of ex-post evaluation, almost all villages with the exception of some tribal villages are electrified[11]. In 2003 per capita electricity consumption in AP exceeded the national average by 20% and the ratio of electrified households at 62.3% exceeded by far the national average of 43.5%. By stabilizing the electric power supply, the project has contributed indirectly to the benefits of electrification enjoyed by the people of AP.

2.4.3 Impact on the vicinity of the power plant

The implementation of the project resulted in the short-term employment of about 4,000 people who were for the most part local residents. After completion of the project approximately 200 persons were hired at the power plants and half of them are local residents.

As part of the project, a residential area (colony) for 200 households was constructed on the north side of the Srisailam Reservoir as a community where the power plant employees could live. This community has facilities such as a medical clinic and a school which provide services also to the local community free of charge. Half of the beneficiaries of the clinic and school are local community. In addition, after completion of the project, a new settlement with a population of about 1,000 people was formulated in the vicinity of the power plant.

The project was for an underground power plant which utilized existing dam reservoirs and therefore had little impact on the surrounding environment. Almost no new land was acquired for the project and there was no residents resettlement accompanying the implementation of the project.

2.5 Sustainability

2.5.1 Sustainability of the project operated by APGENCO

2.5.1.1 Technical capacity

AGPENCO is the third largest power generation company in India and has the largest hydroelectric power generation capacity in India. Its operating ratio for thermal power plants is the highest in India and some of its existing hydroelectric plants have been in

[11] When at least 10% of the households of a village are electrified, the village is deemed to be electrified. Therefore, it cannot be said that all households are in fact electrified.

operation for over 30 years. No particular problems in the area of technical capacity are evident.

2.5.1.2 Structure

In 1999 the Electric Power Board of AP (APSEB) underwent structural reforms and AGPENCO was established as an electric power generation company. The company employs about 10,000 staff. In view of its track record in power generation and financial performance, the efficiency of its organizational management can be considered sufficiently high.

2.5.1.3 Financial Status

Reforms in the electric power sector which began in 1999 has been successful and AGPENCO's operating revenue and expenditure have improved considerably[12]. Sales have also steadily increased and the business has been achieving surplus since 2002. Therefore, it can be considered to have high financial sustainability.

APGENCO's Financial Status

(Unit: 100 million rupees)

Fiscal Year	Sales	Net Profit/Loss
1999	363.7	-20.4
2000	383.5	-10.5
2001	402.8	-9.6
2002	418.4	5.6
2003	420.9	1.0
2004	429.3	5.2

2.5.2 Operation and Maintenance

During the first fiscal year of operation, there were long unplanned outages for adjustments to power generation equipment. However, following this operations have proceeded without problems and since 2003 there have been no unscheduled outages. AGPENCO is currently undertaking an overhaul of the power generation equipment at

[12] During AP's electric power sector reforms, the APSEB underwent structural reforms in FY1999 and a new AP Electric Power Regulatory Council was established. As a result of measures introduced to counter power theft, power transmission and delivery loss went from 37% in 1999 to 26% in 2002. The collection rate for electricity charges also improved, rising to 98%. The streamlining of electricity charges also resulted in the reduction of excessive subsidies for electricity for agricultural purposes and electricity charges for industrial and commercial purposes fell to an appropriate level. During this period, power generation capacity was supplemented by 3,000MW from 1999 onwards and the electricity situation in AP improved considerably.

its own initiative which attests to its sufficiently sound capability in managing and maintaining the facility. It also maintains stock of major spare parts. Therefore, the maintenance and management of the project can be judged as favorable and free of any particular problems.

3. Feedback

3.1 Lessons Learned

At the planning stage of the project, it is important not to overlook risk factors that may have a considerable impact on its implementation and achievement of the project objectives. Giving careful consideration to the extent of various risks, their potential impact, and to establish appropriate countermeasure are vital. The following two points in particular should be given careful consideration in hydroelectric and pumped hydroelectric projects:

- When a downstream reservoir is to be used as the lower reservoir, as was the initial plan of this project, it is necessary to analyze the effect the water level has on construction costs for riverbed improvement and the stable operation of pumped storage. If necessary, construction of a weir and another lower reservoir should also be considered as an alternative plan.
- For projects involving large-scale underground civil works, the geological conditions are important factor that affects cost, the project period, and the project scope. The executing agency should conduct a detailed geological survey at the earliest possible stage, such as drawing the preliminary design of a project.

3.2 Recommendations for APGENCO

The weir under construction should be completed as soon as possible to enable stable pumped hydroelectric power generation.

Comparison of Original and Actual Scope

Item	Plan	Performance
(1) Outputs	(1) Underground pumped hydropower plant: 1) Turbines: 110MW x 9 units = 990MW or 165MW x 6 units: 990MW 2) Transmission/transformer facilities Main transformer, switching station 3) Civil engineering works: Head race tunnel Surge tank Pressure shaft Penstock tunnel Powerhouse cavern Transformer cavern Surge pool Tail race tunnel (2) Consultant service: 102M/M	(1) Underground pumped hydropower plant: 1) Turbines: 990MW 165MW x 6 units 2) Transmission/transformer facilities: nearly as planned 3) Civil engineering works: nearly as planned (2) Consultant service: 102M/M
(2) Project Period		
Main generating machinery and turbines	May 1991-January 2002	May 1993-September 2003
Electric and mechanical works	July 1994-April 1999	July 1994-September 2003
Civil engineering works	June 1990-April 1999	June 1990-August 2003
(3) Project Cost		
Foreign currency	39,187 million yen	39,120 million yen
Local currency	39,966 million yen (11,696 million rupees)	38,973 million yen (12,643 million rupees）
Total	79,153 million yen	78,093 million yen
ODA Loan Portion	63,167 million yen	62,750 million yen
Exchange rate	1 rupee = 3.41yen	1 rupee = 3.085 yen