

## RANDENIGALA PROJECT

The Randenigala Project is the last of the Major Multipurpose Projects undertaken in the Accelerated Mahaweli Programme. It consists of two dams at Randenigala and Rantembe. Randenigala is due to provide the largest reservoir under the Mahaweli Programme, and is located 6 km (3.5 miles) upstream of Minipe anicut from where the new main Right Bank and the old left Bank canals take off for irrigation development down-stream. This project is expected to generate about 20 percent of the country's present annual electrical energy requirement and will act as the most important base reservoir for the water management of System C and B and later System A and transbasin areas.

The Project chiefly consists of the

construction of a 94 m (308 ft.) high, 458 m (1,590 ft.) rock-fill dam across Mahaweli, creating a reservoir of 860 million cu.m. (697,000 ac. ft.) By July 1985 70 metres of the dam had been completed and there was a further 24 metres to go. The power house on the Left bank immediately down stream of the dam will have an installed capacity of 126 MW. A steel lined 6.2 m (20 ft.) diameter, 270 m (886 ft.) long tunnel through the dam will convey water to the Power House to run the turbines located just below the dam. The gated chute spillway is 48 m (761 ft.) long and is capable of discharging the probable maximum flood of 8085 cumecs (285,500 cusecs).

The irrigation outlet will be through a 9.6 m (31.5 ft.) diameter 375 m (1,230 ft.) long concrete lined

tunnel, which along with another similar tunnel is presently used to divert the river during construction of the dam.

Randenigala Civil Contractors (RCC), a joint venture of the three construction firms Dycherhoff & Widermann, Bilfinger & Berger, and Alfred Kunz of the Federal Republic of Germany was awarded the Civil Works contract which is the main component of the project. The Civil Contractor mobilised at site in early September 1982. The site installation works such as access roads, temporary bridges, houses, offices, electricity and water supply were completed in 1983.

By the end of June 1984, rock and soil excavation for Diversion Outlets, Approach Channels, Intake Structures as well as the drilling of the two diversion tunnels and concrete lining of Tunnel No. 1 were completed. Excavation work for Power Intake and Waterways and the Power House and most of the First stage concreting were also done.

Construction costs continued to escalate and by 1982 the new estimate prepared was as follows:

### Costs of Headworks — Kotmale

		Estimated Contract Price June 1979	Absolute Contract Price including price variation
(Rupees Million)			
1.	Work done by government agencies (for surveys, rehabilitation, communications, establishment and consultants)	500	800
2.	Civil Works —		
	Initial Works	681	
	Underground Works	1,214	
	Reservoir	2,187	4,082
			6,122
3.	Hydraulic equipment —		
	Tunnel steel linings	46	
	Tunnel gates, etc.	56	
	Spillway gates	90	
	Bottom outlet	75	267
			438
4.	Generating Plant —		
	Power Station	292	
	Sub-station	152	444
			739
5.	Physical contingencies	321	481
	<b>TOTAL</b>	<b>5,614</b>	<b>8,580</b>

Construction work for Power Intake and Waterways, Spillway and Dam Embankment continued upto the end of 1985. All civil works are due to be completed by 1986.

The hydro-mechanical, mechanical and electrical works are being coordinated according to the progress of the civil works and commissioning of the Project is scheduled for mid 1986.

### Reservoir Impounding

Randenigala reservoir will have a surface area of 23.5 sq. km. (5,807 acres) but will inundate only 2.8 sq. km. (692 acres) of cultivated land. The population within the reservoir area is only about 2,000 and of them nearly 300 have been re-settled in System C.

## PROJECT BENEFITS

### Irrigation

The Randenigala reservoir will regulate the water release of the Victoria reservoir and will provide supplemental irrigation benefits to Systems A, B and C, with the subsequent development of new Systems in the overall Mahaweli Programme.

### Power

The Randenigala power station will generate 428 GWH of firm energy and 100 GWH of secondary energy.

### Employment

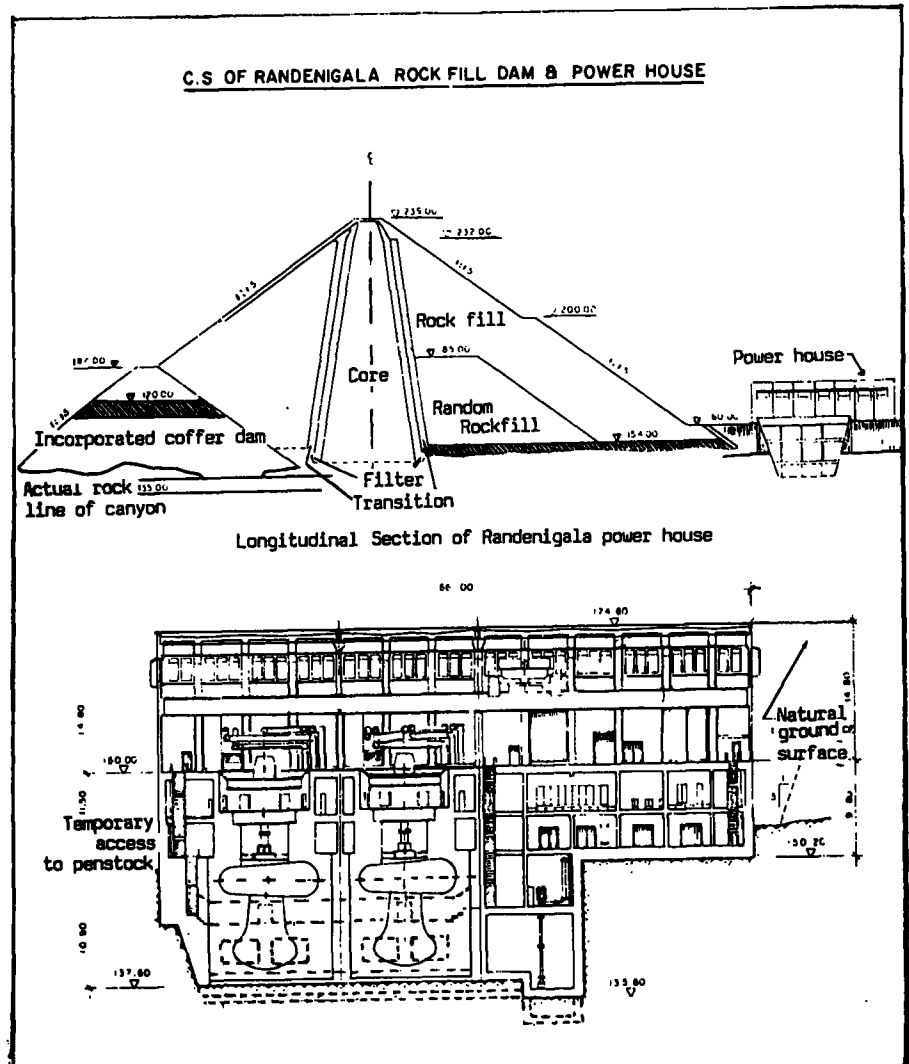
Over 2,000 Sri Lankans are being provided employment during the construction phase. The project began with 125 expatriates and the number is reported to be pruned down for replacement by local engineers.

### Cost Estimates

The originally estimated cost of the Randenigala Dam and hydro-electric unit was Rs. 700 million, including a foreign component of Rs. 350 million; the allocation for irrigation being Rs. 415 million and for power Rs. 285 million.

Feasibility studies for Randenigala and Rantembe projects were carried out by "Joint - Venture Randenigala" Consultants, comprising Messrs. Salzgitter Agrarund Electrowatt assisted by CECB, with a Technical Assistance grant of D.M. 8.5 million provided by the Federal Republic of Germany, (through Kreditanstalt fur Wiederaufbau - "KFW"). This was followed by a long term soft loan of DM 400 million from "KFW" for the construction of the Civil Engineering Components.

There are views expressed among local engineers that the nature of the contracts for the headworks generally limited opportunities for them to benefit from these schemes. As one



engineer stated: "the finest opportunity to train and develop the engineering skills were offered by the implementation of the AMP to this country, but that opportunity was missed.

Australia's Snowy Mountains Project did exactly that - they made the best use of opportunity offered. We only helped the big consultants from abroad. We could have provided 100's of engineers and other technical skills by getting closer involved in the project." For a further elaboration of this viewpoint see comments of Prof. Thurairajah on page 34.

The total cost of this complex amounts to DM 400 million (foreign) plus Rs. 822 million (local) making a total of Rs. 4,450 million. Hydro-power will be developed with an installed capacity of 122 MW to generate 525 Megawatt hours of energy (average) annually. The Main

contractors for the construction of Randenigala Headworks are the Joint Venture of Messrs. Dykerhoff Widemann, Belfinger & Berger and Alfred Kunz.

### Rantembe

Rantembe Dam will be taken up later about 3 km. downstream of Randenigala, below the confluence of the Uma Oya with the Mahaweli Ganga. It will be a concrete gravity dam 41.5 m high with a crest length of 420 m (total volume of concrete being 215,000 cubic metres).

The spillway will have 4 Taintor Gates 16.21 m x 16.0 m, with chutes 16 m. wide and 50 m. long capable of a maximum discharge of 10,235 m<sup>3</sup>/sec.

There will be 2 bottom (Irrigation) outlets provided with Taintor gates each capable of a maximum discharge of  $200 \text{ m}^3/\text{sec}$ .

Steel Penstocks of dia. 4.2 m. with a rated discharge of  $90 \text{ m}^3/\text{sec}$  lead to the power station equipped with 2 Francis Turbines with an installed capacity of 24.5 MW each working under a gross head of 33.5 m. This will produce 158 GWH of firm energy annually (average 251 GWH).

The Federal Republic of Germany has provided financial assistance for this project of DM 400 million on easy terms. This was considered enough for the Headworks of Randeinigala and Rantembe Projects, but due to price escalation this was sufficient only for Randeinigala at present costs.

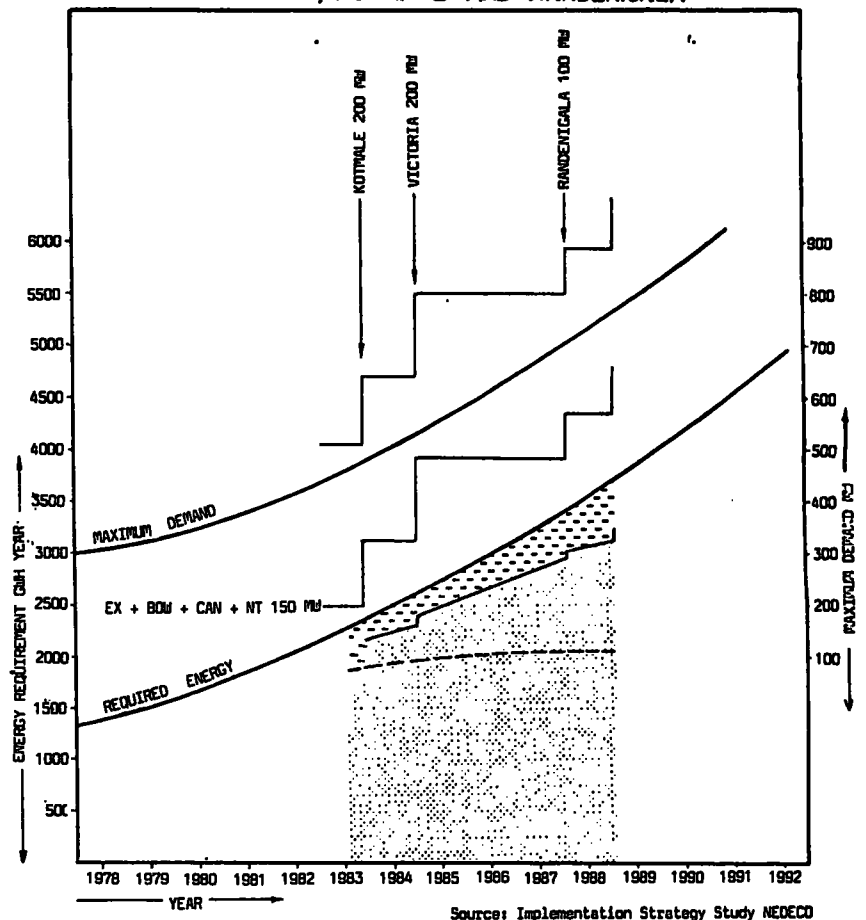
The Minister of Finance declared recently that the Federal Republic of Germany has already agreed in principle to give a concessional aid in a sum of DM 120 million for the Rantembe Project. This amounts to approximately Rupees 1050 million at  $\frac{1}{2}$  percent interest over 50 years. I am confident that the balance money also for the Rantembe Project can be obtained very soon. Rantember is a corollary to Randeinigala "I am confident that we will be able to commence this Rantembe Project this year", he said.

#### Upper Kotmale Hydro Power

An agreement covering a feasibility study of the Upper-Kotmale hydro-power scheme was signed between the Japanese government and Sri Lanka's Power and Energy Ministry on August 10, 1985.

The proposed project includes the construction of one reservoir and two hydro-power generation stations with a total generation capacity of 230 MW. The study will take about 2 years and the final report is scheduled to be submitted to both governments in August 1987.

### SYSTEMS CAPABILITY WITH VICTORIA, KOTMALE AND RANDEINIGALA



EX = Existing system including 50 MW thermal  
 BOW = Bowaterne  
 CAN = Canyon  
 NT = New thermal  
 \* Systems capability  
 — Thermal generation  
 ■ Hydro generation  
 - - - Hydro generation without Kotmale, Victoria and Randeinigala

#### Operation and Maintenance of Headworks

The Mahaweli Authority of Sri Lanka and its project heads, the Ceylon Electricity Board, the Mahaweli Economic Agency, the Mahaweli Engineering and Construction Agency, the Irrigation Department and the Mahaweli Water Management Secretariat will all be responsible for specific functions of operation and maintenance on the reservoirs, tunnels, hydro power plants, dams, channels, drainage systems and other irrigation works and structures that have been constructed at such heavy cost. There is no doubt that great care would need to be exercised over these structures once the construction is over. Among the functions requiring emphasis are:

- \* Routine maintenance checks of embankment slopes and crests of earth embankments for evidence of the development of unfavourable conditions.
- \* Detailed inspections of concrete structures by operating personnel at yearly intervals, or more frequently. A more thorough inspection by a board of engineers for important structures.
- \* Concrete-lined canals to be dewatered periodically and inspected for cracks and ruptures.
- \* Radial gate offtakes sluices, lifting stems and gear also need constant attention and a high degree of maintenance.

## HOW LOCAL ENGINEERS COULD HAVE BENEFITED FROM MAHAWELI CONSTRUCTION

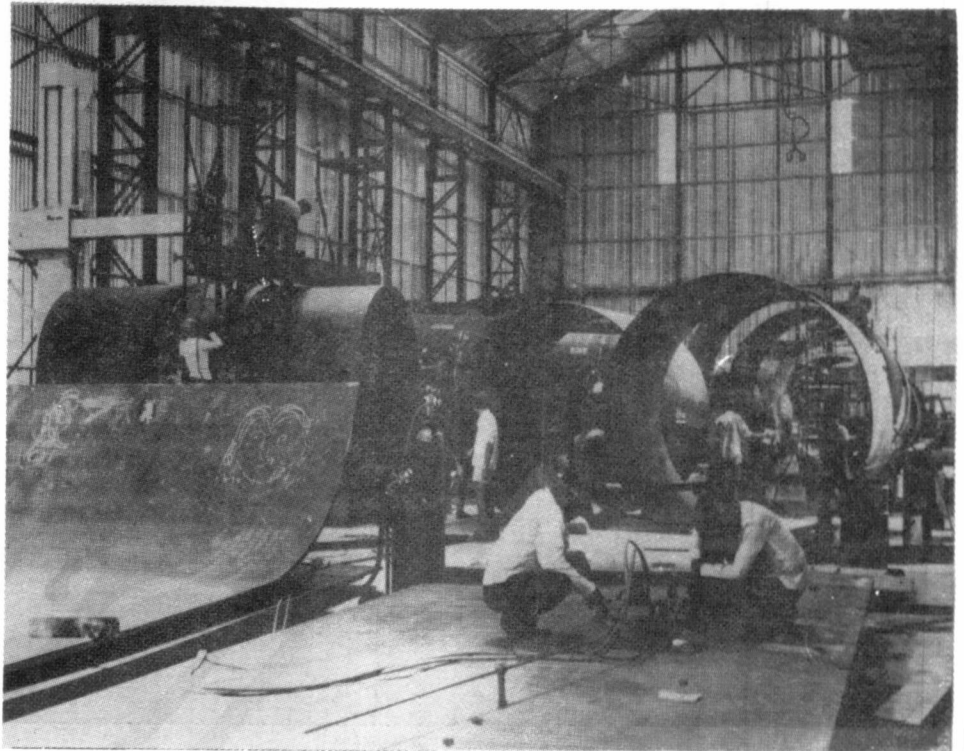
*Prof. A. Thurairajah of the Open University, Faculty of Engineering*

In the Accelerated Mahaweli Project, a number of large and complicated engineering structures such as reservoirs, double curvature concrete dams, rockfill dams, tunnels, underground power houses etc. have been constructed. The consultants and contractors involved in these projects are foreign companies from the aid giving countries. The design and construction of these structures would have increased and developed the technical capabilities of the personnel associated with these projects. One subject of interest to Sri Lanka and its engineering profession is how much of this advanced technology really got transferred to the Sri Lankans. Will our engineers be able to design and construct such structures in the future?

In meetings of engineers, it has often been mentioned about the famous Snowy Mountain Project in Australia which gave an excellent opportunity to the Australian personnel to obtain valuable experience in such works. With the training they obtained in those works, the Australians were able to handle similar future projects without the help of foreign technologists. The question now is whether this has happened in Sri Lanka; or would we need foreign consultants and contractors if we have to undertake similar jobs in the future?

Technical capabilities of our personnel will develop if we undertake jobs of this nature by ourselves wherever possible and bring foreign consultants to advise us in fields where we are not competent. This is how even foreign companies operate. For example, the contractor for the double curvature concrete arch dam at Victoria, Balfour Beatty Nuttal, had not constructed such a dam before. However, they hired a Swiss company to advise them on this project. Now they can quote the Victoria experience to get jobs of this nature.

It is a fact that aid giving countries are anxious to give the consultancy and contract work to companies associated with their country. Therefore, even in cases where we have the technical capability, they tell us that they cannot entrust the work to a Sri Lankan agency since it has not done such work earlier. Often this is true. But if we allow this, when are we going to be able to tell the aid-giving country that we have done similar jobs earlier and are therefore



*Installation of equipment by Local Engineers at Victoria Power House*

competent? Hence, in an agreement with these aid giving countries, we must ensure that the Sri Lankans participate to the maximum possible, thus increasing the technical capability of our personnel.

An earlier case comes to my mind in this connection. For the construction of a large factory, it was proposed to the aid-giving agency by Sri Lanka that all site investigation works and recommendation of suitable foundations will be undertaken by a group consisting of the State Departments and University. But the aid-giving agency visited our organisations and finally said that they could not accept this group doing the work since they had not done similar work for another large factory before. After much negotiations, the aid-giving agency finally agreed to a compromise solution where the investigation, testing and preparation of the report was carried out jointly in Sri Lanka by the group and a foreign firm. This arrangement increased the experience of the Sri Lanka personnel, so that at least for any further job of this nature, they will be able to satisfy the aid-giving agency about their experience. In fact, when further work had to be carried out at the site, where the site had to be pre-loaded and settlements monitored, the entire work was handed to Sri Lankan personnel.

In the case of the Accelerated Mahaweli Scheme, we do not believe that a transfer of technology took place which increased the technological capabilities of our personnel. We doubt whether our technical people gained the valuable experience from these projects so that they could now undertake similar projects locally or in other countries. One feels that what took place was the transfer of engineering structures rather than the transfer of technology. It is a pity that Sri Lankan technical personnel have missed this unique opportunity of gaining such valuable experience. On the other hand had we obtained experience in all these works, we would now be able to form a consortium and bid for civil engineering works of this nature in other Third World countries with success. It is also sad to note that the Faculties of Engineering had not been associated with these great engineering works. The staff of the Engineering Faculties would have gained very valuable experience had they been involved in these projects and this experience would have been very useful in the training of future engineers. At least in the future we must provide the means by which the teachers of engineering can be associated with important projects of this nature.