ADAM'S TEARS TURNED TO ELECTRICITY

Fabian Acker (Editor, International Water Power and Dam Construction)

When Adam was expelled from Eden, he went to Sri Lanka (so the story goes) and, sitting on a mountain now called Adam's peak, he cried bitter tears which were so large they became the island's rivers. Today some of those tears are backing up behind the Victoria dam, which started filling in April last year. It is part of one of the most ambitious water developments in Asia, the Accelerated Mahaweli Development Programme. The Programme is now on schedule, and will be completed within the seven years planned for it. But it has gone ahead against the advice of the United Nation Development Programme and the Food and Agriculture Organisation both of which recommended 30 years, and in the face of bitter objections from the opposition of the Sri Lanka Freedom Party. The project has become a political as well as an engineering challenge and the government's stand under the leadership of President Junius Jayewardene, will soon be tested.

The programme's first turbine will start turning in July, and virgin or underwatered lands are already being farmed. So far, the benefits cannot yet match costs. When the scheme was started in 1970, the government obtained foreign aid of about $ 400 million, with the US, Sweden, Canada, West Germany, Saudi Arabia and Britain among others providing loans or grants. In 1977 Jayewardene's government, formed by the Conservative United National Party, was elected. It put forward plans for greatly accelerating the scheme with only moderate training. But while inflation brought up the costs from an estimated $ 700 million in 1977 to $ 2000 million in 1983, foreign grants stayed more or less at the same level. The cost to Sri Lanka, therefore, has increased from an earlier estimate of $300 million to $ 1600 million today.

With a considerable amount of foreign expertise, Sri Lanka began to exploit the potential of the Mahaweli River at an increasing rate. The complex of dams, hydropower stations and irrigation networks now being built should nearly double the country's installed capacity from 562 megawatts to 1070 megawatts. The river rises in the hills in the centre of Sri Lanka and discharges after a run of 330 kilometres near the port of Trincomalee; its major tributary, the Kotmale Oya, is also part of the development. New irrigation canals will bring 127,000 hectares of virgin land under cultivation.

Three countries, Britain, Sweden and West Germany, are the most substantial foreign investors. The British have just finished construction of the 128-metre high Victoria dam, and in July will install the first of three 70 megawatt turbines. Swedish contractors are working on the Kotmale dam (87 metres high) and the Germans are building the 91 metre Randenigala dam. The financial help provided by these countries will eventually return through payments to contractors and consultants. Britain, for example, has given $ 160 million in aid, and British companies have signed contracts to the value of $ 250 million.

The development of the river and its tributaries is based on an elaborate system of channels, holding reservoirs, dams and hydropower stations. Nevertheless, a part from the electrical component and the large areas involved, it is probably no more complex than systems constructed during the third century AD and continuously refined over many centuries. In one case, after engineers had chosen the best site for a dam with the benefit of reliable instruments and extensive rainfall data, it was found on investigation that one was built there 1500 years ago. It had gradually fallen into disuse and been forgotten.

The intention is to use the drop or head of the Mahaweli to generate hydroelectric power at a number of sites along its length. With its main tributary, the Kotmale Oya, there is a head of 2130 metres, which can be exploited before it reaches the sea. As water is released through the turbines or spillways of one dam, it is directed to the reservoir of another one further downstream, and so on, so that the river's water may pass through six or seven reservoirs before reaching the sea.

In some cases the water is intended only for irrigation, in others, for both irrigation and power. Having one system for both needs is cheaper than building one system for each. But it can lead to problems in a developing country such as Sri Lanka where industrial needs for energy may conflict with agricultural requirements for irrigation water. The first big dam on the river (that is, the one furtherest from the sea) is the 87 metre-high Kotmale, which is being funded in part by the Swedish International Development Agency. It is being built of rock and stone quarried locally, and, at the end of 1984, material was being placed at the rate of 100,000 cubic metres a week, which is equivalent to 1500 lorry loads every day. This rate of working, which is unusually intense, is necessary to meet the revised deadlines of the Accelerated Programme. In the original plan, the dam would have been 25 metres higher, thus increasing the reservoir's capacity by 150 percent; however, the extra height can be added at a later date if necessary.

The reservoir will help to smooth fluctuations between dry and wet seasons the water will flow to a powerhouse along a tunnel seven kilometres long, and from there into an existing reservoir, the Polgolla on the Mahaweli. This arrangement illustrates the complex balance between power and irrigation. The Polgolla feeds two other power stations one which shares an irrigation reservoir. This means that the rate at which energy is generate at the first power station, Kotmale, will affect the flow of irrigation water into another reservoir downstream. When irrigation needs are high, water will have to be released from the main reservoir, even electricity is not required. Then, when electricity is needed and the year is dry, there may not be enough water in the main reservoir to generate it.

Geology, as usual, has also provided its crop of problems. No exploratory tests can give complete assusrance of the rock's quality where tunnels have to be built, or where the dam's foundations should go. The true nature of the rock may not be discovered until well after construction has started. For example, the 7-kilometre tunnel from the Victoria dam, which will carry water to its power station, has to bend three times to keep within good rock. During constuction a fall of weak rock set the programme back by many months which was only made up by round-the-clock working. The position of the Kotmale dam had to be moved by about 200 metres after potential faults were discovered at the planned site.

With the commisioning of the first turbine at Victoria, the British have at least put most of their problems behind them. But Sri Lanka itself still has many to resolve. There is the question of finance and how seriously the economy may be skewed to pay for the project. There is the question of ecology, which even the best-engineered schemes must affect. There is the question of the thousands of families who must be resettled and brought back into productive life.

All of these questions must be answered satisfactorily if Sri Lanka is to reap the benefits of the Mahaweli programme. The biggest question, is, can the country (still under tension from the Tamil problem) sustain itself through the austerities of today in the hope of better times tomorrow?

Source: New Scientist 14 Feb. 1985