The impacts and financing of large dams

Jan Willem van Gelder,
Frank van der Valk, Jan Maarten Dros, Janette Worm

A research paper prepared for WWF International - Living Waters Programme

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AIDEnvironment

Donker Curtiusstraat 7-523
1051 JL AMSTERDAM
The Netherlands
Tel.: +31 20 6868111
Fax: +31 20 6866251
Email: info@aidenvironment.org
Website: www.aidenvironment.org

Profundo
economisch onderzoek / economic research

De Bloemen 24
1902 GV CASTRICUM
The Netherlands
Tel.: +31 251 658385
Fax: +31 251 658386
Email: info@profundo.nl
Website: www.profundo.nl

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Executive Summary

Project objective

This report forms the result of the first phase of the project "Benchmarking of Policies and Practices of Banks concerning Water Sector Investments" commissioned by WWF International's Living Waters Programme. The objective of this project is to provide a sound basis for a WWF campaign to transform financial institutions' policies and practices in water sector investments to become environmentally sustainable.

This report

The report gives an overview of 26 harmful dam projects throughout the world. In particular their negative impacts on important (Global 200) ecoregions and information on financing of these dams is presented.

Out of the 26 dams, six cases, including ten dams, were selected jointly by the authors and WWF and studied in more detail:

1. Birecik Dam and Ilisu Dam, Turkey
2. Three Gorges Dam, China
3. Maheshwar Dam and Sardar Sarovar Dam, Narmada, India
4. Nam Theun-Hinboun Dam, Laos
5. Lesotho Highlands Development Project, Lesotho
6. Tucurui Hydropower Complex, Brazil

Still not sustainable

Provision of hydropower and regulation of water resources form the main goals for building large dams, which in turn is guided by the underlying motivation of economical gain and development. Large dam projects however continue to fail in delivering sustainable solutions. As was recognised by the WCD, the process of project development for large dams often shows astonishing deficiencies. Gains and positive developments are frequently exaggerated. On the other hand, severe environmental and socio-economical impacts are neglected or heavily underestimated. Such poor, biased decision making results in a multiplicity of devastating environmental impacts and associated loss of ecosystems and livelihoods, socio-economic losses and deprivation of development for the many people affected.

Changing and complex financing

In the past decades, the financing of large dams has changed considerably. Several developments play a role in this process of change, of which the on-going liberalisation of global electricity markets undoubtedly is the most important. But the

further internationalisation of commercial banking operations and the more sophisticated stage into which global capital markets have developed certainly also play a role.

This has lead to an increased amount of private financing in hydropower projects, especially on the equity side, while traditional direct financing by the host government has declined. The latter is mainly the result of privatisation of state-owned electricity companies and Independent Power Producers (IPPs). Also in the debt financing of large dams private capital plays a growing role, mainly through loans from local and foreign commercial banks, ECA.

Large dam projects are generally extremely costly, which makes the input and role of different financial institutions very important. The financial key to successfully developing a large dam project is to finance the project with funds bearing a low interest (or no interest at all) and/or a long tenure. This kind of funds is relatively scarce and/or bounded by all kind of restrictions. To cope with this dilemma, recent financing plans for hydropower plants often show a myriad of different sources and forms of financing.

Different solutions are being sought, such as:

- raising the equity component by bringing in other shareholders or using other funds;
- raising long-term debt from (multilateral) development banks and development agencies;
- using credit guarantees from ECAs and development banks to extend the tenure of loans;
- issuing domestic long-term bonds.

The financing package for each individual dam is generally provided by a combination of financial institutions belonging to several of these different categories:

1. Private financial institutions
2. Multilateral financial institutions
3. Export Credit Agencies (ECAs)

Usually a variety of financial institutions - private and public, domestic and foreign - is involved. Annex 2 presents an index of all 157 financial institutions encountered in this report. The

exact composition of each financing plan is depending on many factors - including commercial, regulatory, political and institutional factors - and generally requires lengthy negotiations. Consequently, no single financial institution or single type of financial institution can be singled out as the most important financier(s) of large hydropower projects.

Development banks

Multilateral development banks (MDBs) still play an important role in the development of large dams world-wide, but their role is decreasing in terms of their direct financial commitment. More and more they play a role in facilitating other funding, by legitimising and guaranteeing investments in a project.

With MDBs developing stricter criteria for project loans, it can be expected that more project initiators will just not apply anymore for financing by these institutions, because of the high costs and exposure associated with their involvement. Partially for the same reasons multinational development banks themselves increasingly seem to prefer financing national development banks and specialised financing agencies (which in turn finance large dams) instead of getting involved in all controversies surrounding specific dam projects. For the time being, this form of indirect financing is less controversial and less under attack of NGOs.

Commercial banks

Private commercial banks play an increasingly important role in financing large dams, but mostly in combination with guarantees from ECAs and multilateral development banks. Possibly more important than their direct financial contribution, are their skills in piecing together a variety of financial instruments into a financing plan. In almost every large dam project, a (foreign) commercial bank is assigned as financial advisor to establish and negotiate a financing plan.

ECAs

In the past few decades Export Credit Agencies (ECAs) and foreign development banks have increased their role in financing large dams world-wide, to assist supplies by equipment manufacturers.

It is possible that the prominent role played by ECAs will decrease again in the future. Many ECAs (like MDBs) are under high pressure to apply more environmental and social

criteria to their financing activities, making ECA loans a less simple and reliable funding source for project operators.

Domestic bonds

Project developers increasingly look for long-term financing on the domestic capital market. Selling long-term bonds to domestic insurance companies, pension funds, saving banks and other institutional investors, is becoming an increasingly attractive alternative for foreign financing.

Pressures !

Both multilateral development banks and ECAs are under high pressure to apply more environmental and social criteria to their financing activities. This may be countered by high political pressure from the host countries, project operators, construction companies, equipment suppliers and other financiers to keep them aboard. Dam builders face serious problems in this respect, hence the increasing advising role of commercial banks, noted above and a search for alternatives, such as raising capital within the project nation.

Responsibility

Financial institutions cannot neglect their responsibility for the consequences of projects that they finance. As this report shows, the negative impacts of large dam projects are often huge. Consequently, financial institutions need to very carefully and transparently evaluate both the decision making process and impacts before according large dam projects.

Role of NGOs

Strong and sustained pressure by NGOs is needed to hold financial institutions and project executors responsible for the extensive damage to ecosystems and livelihoods of large dam projects and force them to refrain from financing such damaging dam projects. The timely involvement of NGOs or other public pressure groups is crucial to prevent negative impacts on ecosystems and affected communities.

From an international campaigning point of view, attention could focus on the most important multilateral development banks, ECAs and international commercial banks. However in countries with large economies, attention could also focus on national development banks or financing agencies and domestic commercial banks.

For such a campaign to be effective, the varying and changing roles and forms of involvement of private and public financial

institutions, as described, need to be taken into account. This could imply different priorities in different countries.

Overall conclusions

Overall the conclusions are that the building of dams causing major environmental and social damage continues to date and that much remains to be learned and implemented of the recommendations of the World Commission on Dams (WCD). This should be a first demand to any company involved in dam building or its financing.

Strong pressure by national and international environmental organisations is crucial to force project designers and financing institutions towards sustainable solutions.

Heavily involved

This study resulted in the following list of candidates to be addressed, because of their strong involvement in large dam projects:

National development banks

• BNDES	Brazil
• China Development Bank	China
• Power Finance Corporation	India

Multilateral development banks

- World Bank
- Asian Development Bank
- Inter-American Development Bank
- Corporación Andina de Fomento

ECAs and Foreign Development Banks

• Export Development Corporation	Canada
• Exportkreditnämnden	Sweden
• Exportrisikogarantie	Switzerland
• Hermes Kreditversicherungs	Germany
• Kreditanstalt für Wiederaufbau	Germany

Private commercial banks

• ABN AMRO Bank	Netherlands
• Allianz / Dresdner Bank	Germany
• Australia and New Zealand Banking (ANZ)	Australia
• BNP Paribas	France
• Citigroup	United States
• Crédit Agricole	France
• Crédit Suisse	Switzerland
• Deutsche Bank	Germany

• J.P. Morgan Chase & Co	United States
• Mitsubishi Tokyo Financial	Japan
• Société Générale	France
• UBS	Switzerland

Introduction

This report forms the result of the first phase of the project "Benchmarking of Policies and Practices of Banks concerning Water Sector Investments", commissioned by WWF International's Living Waters Programme. The objective of this project is to provide a sound basis for a WWF campaign to transform financial institutions' policies and practices in water sector investments to become environmentally sustainable.

In this first phase, basic information regarding typical financing (public and private) of environmentally harmful dam projects was collected, from literature, internet and databases. As a result, an overview was produced of 26 (hydropower) dams throughout the world, selected because of their negative impacts on important (Global 200) ecoregions. For each dam key figures and data are presented concerning its environmental impact and the way in which it was financed. An introduction to the basics of financing in provided in chapter 1.

From the overview, 6 cases, including 10 dams, were selected jointly by the authors and WWF. These were studied in more detail to obtain a clear picture of the impacts of and financing structure for these dams. These cases are presented in chapter 3, while the remaining dams are briefly described in chapter 2 and presented in the overview in Annex 1. The dam profiles are grouped according to geographical region (Europe, Asia, Africa and Latin America).

After the discussion in chapter 4, conclusions regarding the financing of detrimental dams are drawn in chapter 5, based upon the evidence gathered thus far. This is followed in chapter 6 by recommendations for follow-up. Annex 2 presents an index of all financial institutions encountered in this report.

The authors welcome comments, reactions or suggestions on the contents of this report.

1 An introduction into the financing of companies and projects

1.1 The basics of company financing

Each company owns a certain amount of assets, which it uses to produce and sell goods and/or services. The assets of a company consist of all material and immaterial belongings of the company, including land, building, machines, cash, investments, et cetera.
These assets are financed by the capital of the company. If the company has no capital, it can not acquire assets and cannot run its business. The providers of the capital of the company - the financial stakeholders - therefore are very important, and collectively control the company.

There are two main forms of capital: equity and debt. We will describe the differences between these two forms of capital here:

Equity

Equity is the present value of the shares bought by the shareholders. The shareholders are the co-owners of the company, and this form of capital therefore participates in all the risks that are taken by the company. A shareholder buys shares at a certain value. But if the company makes profits, the present value of the shares (the equity) increases. Consequently, if the company incurs losses the equity decreases.
Part of the increased value of the shares is paid out, in the form of dividends. But the rest is used to finance expansion. Until the shareholder sells the stock, he or she does face the risk the company goes bankrupt, in which case he or she will not get anything back for his or her investment.

Debt

Debt is the other main form of capital a company can acquire, to finance its day-to-day operations and its expansion plans. Debt (which is also called *liabilities*) is mostly provided by financial institutions, but also by trading partners and tax agencies. Different from shareholders, creditors (= the providers of debt) are not co-owners of the company. Therefore they do not participate fully in the risks the company takes. Debts are entitled to a financial reward in the form of a certain amount of interest, which the company and its creditor have laid down in the debt agreement. This amount of interest can be fixed, but can also be related to the performance of the

company. In most cases, debts also have to be paid back within a certain period of time.

When a company gets into financial difficulties, the rights of the creditors are stronger then those of the shareholders. When a company goes bankrupt, the assets of the company are in the first place used to pay off the creditors. Some of the creditors will have stronger rights, and are paid off before others. Only after all creditors have been paid off, the shareholders can claim some part of the remaining assets.

Debt can be provided by various financial stakeholders, including private persons, financial institutions, other companies and governments. The most important categories of debt-providers (or creditors) are:

- Banks
- Bondholders
- Governments (including tax agencies)
- Trade creditors

It should be noted that not all creditors do intentionally provide capital to the company. When the company waits a few weeks or months before paying its bills or its taxes, its suppliers and the tax agency during that period become its creditors unintentionally.

Apart from these two main forms of capital - equity and debt - there are some in-between categories. The most important are the so-called *minority interests*. This is the capital provided by the outside shareholders of the not-fully-owned subsidiaries of the company. Not all subsidiaries are 100% owned by the company, but if they are majority owned by the company their assets will be regarded as belonging fully to the company. In other words: in the financial accounts of a company, all assets of its majority-owned subsidiaries are treated as assets of the company itself. In reality, a part of these subsidiary-assets are being financed by the outside or minority shareholders of these subsidiaries. This implies that the outside shareholders of the company's subsidiaries indirectly finance part of the total assets of the company. In this report, the outside subsidiary shareholders therefore are treated as a separate category of financial stakeholders.

Various financial institutions can provide various forms of capital to a company, or can assist it in acquiring various forms of capital. In the next paragraphs we will first describe the various categories of financial institutions, followed by a description of the various financial services which banks and other financial institutions can offer to companies.

1.2 Private financial institutions

Private financial institutions (FIs) can be divided in two broad categories - banks and institutional investors - which each can provide different forms of financing to a company. Within each category, we can discern various sub-categories:

Banks

Commercial banks

Commercial banks use the saving money of individuals, organisations, institutions and companies to provide loans to other individuals, organisations, institutions and companies.

Investment banks

Investment banks assist companies in finding the capital they need, predominantly by issuing shares or bonds to institutional and private investors. Sometimes investment banks acquire a large shareholding in a company themselves, with the intention to take over the management of the company, restructure it, and sell the shareholding at a profit.

Trust companies

Trust companies manage the financing subsidiaries of a company in a tax haven, to reduce tax payments on international loans, transfers of dividend, et cetera.

Private banks

Private banks (or asset managers) invest funds provided to them by wealthy individuals. Different from mutual funds, private banks tune their investment strategy to the wishes of the individual client.

Large international banking groups generally undertake all these different forms of banking.

Institutional investors

Insurance companies

Insurance companies invest the premiums paid by individuals and companies, to be able to pay benefits to these individuals

and companies when they are confronted with damage or loss of income.

Pension or retirement funds
Pension or retirement funds are a specific category of insurance companies, investing premiums paid by employees to be able to pay these employees benefits after their retirement.

Mutual funds
Mutual funds invest money provided by individuals and organisations, and pay the benefits directly to these individuals and organisations. Different from insurance companies and pension funds, mutual funds don't guarantee a certain benefit.

Venture and investment funds
Venture and investment funds invest money provided by individuals and organisations in companies, like mutual funds. But unlike mutual funds, venture and investment funds generally acquire large shareholdings in (mostly unquoted) companies, with the intention to influence or even take over the management of these companies. This is very similar to what some investment banks do.

Together with private investors, these institutional investors are also referred to as *the capital market*. So, although banks of course do also provide capital to companies, banks are not seen as part of the capital market.

The distinction above is of course very schematic. Furthermore, it is increasingly getting blurred. In the past, legislation in most countries prohibited insurance companies from undertaking banking activities, and vice versa. And the restrictions applying to pension funds were even stricter in most countries.
But during the last two decades, these restrictions have been relaxed or abandoned altogether in most countries. So many large financial groups now have banking divisions as well as insurance divisions. Some pension funds are also beginning to undertake banking and/or insurance activities.
And regarding mutual funds: these can be managed by a bank, by an insurance company, as well as by a specialised fund manager.

1.3 Public financial institutions

Apart from the private financial institutions, we should also mention the public and semi-public financial institutions. Public financial institutions are generally owned by one or more states. Semi-public financial institutions are generally partly or completely privately owned, but they supply certain financial services (especially export risk guarantees) on behalf of a state. In this case, the state also bears the financial risks associated with these services.

The public and semi-public financial institutions can be divided in the following categories:

Multilateral development banks

The activities of multilateral development banks like the World Bank and the Asian Development Bank are very similar to those of private commercial and investment banks. But their activities are also politically motivated, which can make a difference in the risks and conditions they are prepared to accept and the type of (public and private) companies they are prepared to invest in.

Development and investment banks

Many states have their own development and/or investment bank, which are sometimes partly privatised. Their activities are also very similar to those of commercial and investment banks. But again their activities are also politically motivated, which can make a difference in the risks and conditions they are prepared to accept and the type of (public and private) companies they are prepared to invest in.

Export credit agencies

Export credit agencies are sometimes state-owned, but sometimes they are privately owned insurance companies supplying a financial service on behalf of the state. The principal activity of export credit agencies is guaranteeing loans extended by banks to companies in foreign countries, to stimulate exports. Some export credit agencies also undertake commercial banking activities.

1.4 Categories of financial services

The services provided by financial institutions to a company, can be divided into three categories:

- Services related to acquiring equity
- Services related to acquiring debt
- Other financial services

We will discuss these three categories of financial services in the following sub-paragraphs.

1.4.1 Services related to acquiring equity

Financial institutions can help a company with acquiring more equity in the following ways:

Direct participation

Financial institutions can, through the funds they are managing, buy shares in a certain company. This provides the company with new equity, and gives the financial institution direct influence on the company strategy. This influence of course depends on the size of the shareholding.

Helping to attract equity on the stock exchange

Going to the stock exchange gives a company the opportunity to increase its equity by attracting a large number of new, small and big, shareholders. These shareholders can be private investors as well as institutional investors.
When it's the first time a company offers its shares on the stock exchange, this is called an *Initial Public Offering (IPO)*. When a company's shares are already traded on the stock exchange, it can issue a *secondary offering* of additional shares.

To arrange an IPO or a secondary offering, a company needs the assistance of one or more investment banks, which will promote the shares and find shareholders. As an IPO attracts a lot of public attention for the company as well as for the arranging investment banks, the investment banks will closely scrutinise the strategies and policies of the company, and demand adjustments if needed. The role of investment banks in this process therefore is very important.

Finding equity outside the stock exchange

Going to the stock exchange is expensive, tied to certain restrictions, and requires much transparency of the company. So especially small, starting companies, and privately-held family enterprises, will not always be able or willing to attract capital through the stock exchange. In stead, they can look for equity in an informal way, by approaching private investors, institutional investors, or other companies (e.g. a competitor). They can also ask an investment bank to help them find suitable investors.
Many institutional investors will not be prepared to invest in companies that are not traded on any stock exchange. But some

will, and some even specialise in this way of investing (the so-called *venture funds*).

1.4.2 Services related to acquiring debt

Financial institutions can help a company with acquiring more debt in the following ways:

Extending a loan

The easiest way to obtain debt is to lend money. Money can be lent from individuals or other companies, but most often money is lent from a commercial bank. Institutional investors don't play an important role in this respect.
There are several forms of loans:

Short-term loans

Short-term loans (including trade credits, current accounts, leasing agreements, et cetera) have a currency of less than a year. They are mostly used as working capital for day-to-day operations: paying materials, machines, taxes, et cetera. Short-term debts are usually provided by a single commercial bank, which does not have to ask for substantial guarantees from the company. As the company fails to pay interest or repayment, the bank can claim part of the machinery or inventory of the company. This especially the case with leasing agreements, which are earmarked for financing certain fixed assets.
Working capital facilities don't have a fixed currency, but give the bank the same strong guarantees for repayment as other short-term debt.

Long-term loans

A long-term loan has a currency of at least one year, but generally of three to ten years. Long-term loans are in particular useful to finance expansion plans, which only bring rewards after some period of time. Often long-term loans are extended by a *loan syndicate*, which is a group of banks brought together by one or more *arranging banks*.
The loan syndicate will only undersign the loan agreement if the company can provide certain guarantees that interest and repayments on the loan will be fulfilled. This of course gives the commercial banks in the banking syndicate a considerable influence on the company's strategies and policies.

Issuing bonds

Issuing bonds is a different way of lending money. It can be best described as cutting a large loan into small pieces, and selling each piece separately. The buyer of each bond is entitled to repayment after a certain number years, and to a certain interest during each of these years. Bonds are issued on a large scale by governments (the so-called *sovereigns*), but also by corporations (the so-called *corporates*).
Bonds have some similarities with shares: both are *securities* traded on the stock exchange. But the owner of a bond is not a co-owner of the issuing company; he is creditor of the company. And bonds have, different from shares, a fixed income (the interest), and bonds will be paid back after a number of years. Bonds (and similar kind of securities like warrants and convertibles) are therefore called *fixed-income securities*.
When comparing bonds with loans, bonds have some advantages. The borrower taps another source of capital (not commercial banks, but the capital market); bonds can have a much longer currency (up to 25 years) than loans; and bonds require much less reporting to the lenders. But at the other hand: to reschedule the terms and conditions of bonds when a company is getting into trouble, is very difficult. Loans are more custom-built than bonds, and easier to adapt during the currency.
Bonds are sold on the capital market, to private investors as well as to institutional investors. Banks rarely buy any bonds. But to issue bonds, you need the assistance of one or more investment banks. This process is much alike to an IPO.

1.4.3 Other financial services

Apart form activities connected directly to acquiring capital (equity or debt), financial institutions do also provide some other services to production, trading and service companies. These are discussed below:

Fiscal planning and trust services

A financial institution can help a production company with facilities to plan its investments, loans, bonds, and other capital movements in a fiscal attractive way. A clear example of such a facility, is setting up, housing, and managing a financing company in a tax haven like the Netherlands. The Netherlands is a preferred country to set up financing companies, because of the clauses on so-called back-to-back loans which the Netherlands have concluded in their numerous tax treaties with other countries. A financing company lends a certain

amount from a bank in The Netherlands or another country, and then on lends the same amount to its parent company for a slightly higher interest. The interest-difference is taxed in the Netherlands, but the interest paid by the parent company is free of tax in its own country.

These kinds of services, often referred to as *trust banking*, are provided by specialised trust companies as well as by trust banks.

Selling of assets

Selling of assets, either physical or financial, frees capital for the company. This makes it possible to reduce its debts and strengthen its financial position, or reinvest in other business opportunities. An investment bank can use its international contacts to help a company to sell off some assets, thereby maximising the amount of capital that is freed for the company. In general, institutional investors will not be interested in buying the physical assets of a company. But they could be interested in buying certain financial assets of a company, the so-called *secondary debt market*.

Insurance facilities

Insurance companies offer various insurance facilities to companies, from damage done to their properties to the (political) risk that their customers will not be able to pay. For exporting companies, this last form of insurance can be particularly important.

Export credit guarantees

Export credit guarantees are a specific form of credit insurance, generally provided only by (semi-)public export credit agencies. The guarantee assures the bank that its loan will be repaid, also when the customer is not able to repay it. This reduces the risks involved, and makes it more attractive for banks to extend loans. In turn, this makes it possible for the bank to offer more attractive conditions for its loan.

Commodity and currency swap contracts

Commodity and currency swap contracts are financial services provided mostly by commercial banks to exporting customers. A commodity swap contract guarantees the exporter a fixed price for its commodity during a certain period, independent of market and exchange rate fluctuations. A currency swap contract just guarantees a company a fixed exchange rate for exchanging its export earnings in the local currency.

2 Inventory of dams

The first selection of dams to be investigated for this study was made, in close consultation with WWF, mainly on basis of the following arguments:

- good global coverage, in particular in developing countries;
- good coverage of Global 200 ecoregions;
- sufficiently available information;
- recent and agreed, *i.e.* decisions, including on financing have been taken.

This resulted in a list of 26 dams, of which 3 in Europe, 10 in Asia, 5 in Africa and 8 in Latin America. Asia, as the most enthusiastically dam building continent, is well represented, as are its largest countries China (4) and India (3). Major Global 200 Freshwater Ecoregions such as the Amazon, the Mekong and the Yangtze were included.

For each of these 26 dams a profile, containing technical, involved companies, environmental and financing information was produced on basis of internet, literature and database sources.

A limited number of dams could be investigated and described more thoroughly. This selection was made, again with WWF, on basis of the collected information and the following criteria:

- the strength and relevance of the environmental case / the severity of the environmental impacts;
- the (likely) availability of financial information;
- the (likely) availability of environmental information;
- geographical coverage;
- inclusion of both (components) of very large schemes and of smaller dams.

The resulting list of candidate cases is underneath. Due to resource limitations, only those in bold were in fact taken up as cases.

- **Turkey, Birecik**
- **Turkey, Ilisu**
- **China, Three Gorges**
- China, Xiaowan
- India, Kameng

- **India, Sandar Sarovar**
- **India, Maheshwar**
- **Laos, Nam Theun Hinboun**
- Mali, Manantali
- Uganda, Bujagali
- **Lesotho, Katse, Muela and Mohale Dams (Lesotho Highlands Water Project)**
- **Brazil, Tucurui**
- Chile, Pangue
- Chile, Ralco
- Paraguay/Argentina, Yacyreta
- Venezuela, Caruachi

The (bold) cases are presented in the next chapter. Data on the other dams, in particular regarding financing, is more concisely presented in Annex 1.

3 Case studies

3.1 Turkey: Birecik dam and Ilisu dam (GAP)

3.1.1 Introduction

The Birecik and Ilisu dam are part of the south eastern Anatolia project (GAP), a massive US$32 billion public project to harness the power and potential of the upper reaches of the Tigris and Euphrates rivers and to irrigate the fertile plains that lie between them. When completed in 2010, 21 dams and 17 hydroelectric power plants will produce approximately 22% of Turkey's projected electricity requirements, equivalent to the entire national energy consumption in 1988 (see fig. 1 below).

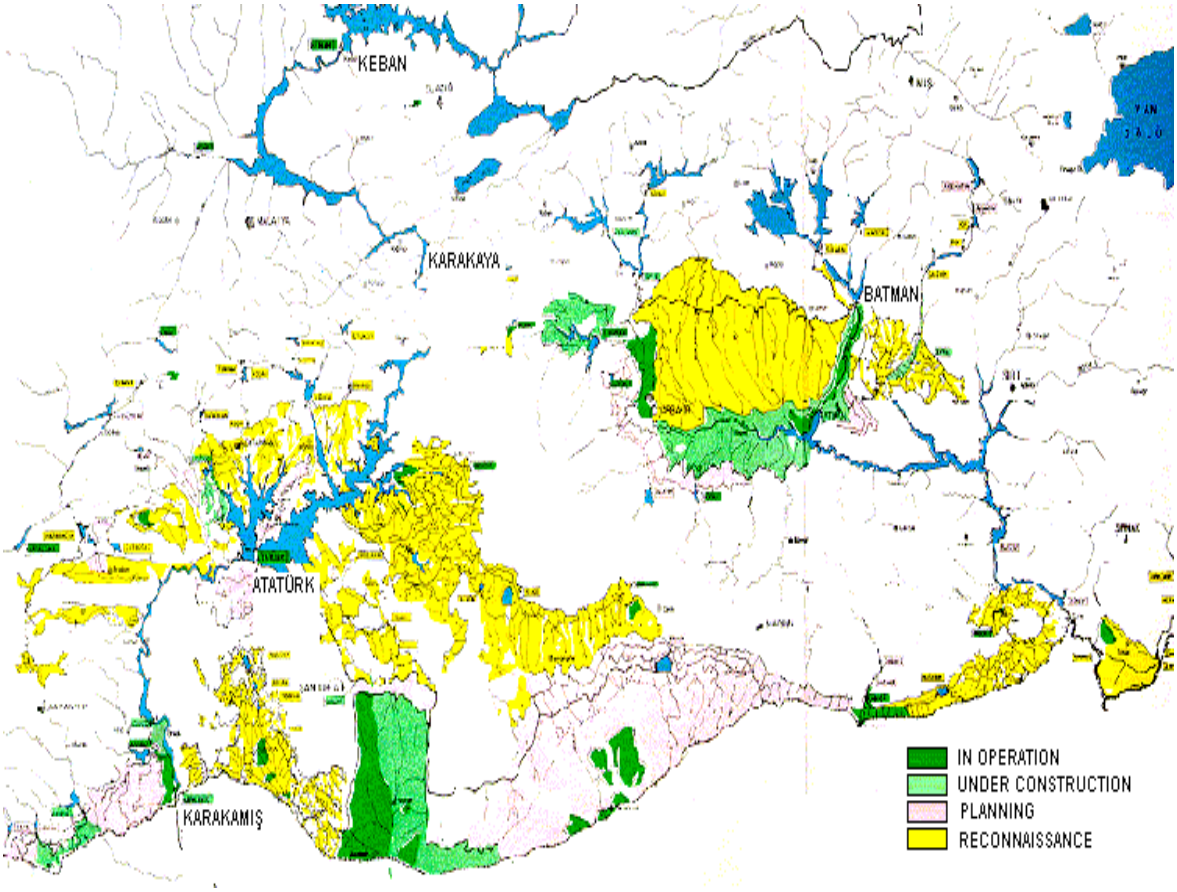

Figure 1: The Southeast Anatolia Project (GAP) development plan [1]

Background GAP

The main objectives of the scheme are thus to supply irrigation water and to provide hydropower in the arid plains via a complex system of dams, pumps and other infrastructure. By these means, the project intends to provide economical and social development in one of the least developed regions of Turkey.

Macro level planning, management, coordination, monitoring, evaluation and implementation of the project are carried out by the GAP Regional Development Administration (GAP RDA) which was established by Decree no.388 in force of law in 1989. GAP RDA has a long and systemic-integrated regional development approach. It employed young, dynamic and specific skilful personnel and provides them a creative and innovative atmosphere.

The GAP area covers 9 provinces, corresponding to approximately 10% of Turkey's total surface area as well as of total population. In terms of surface water supply, the Euphrates and Tigris Rivers represent over 28% of the surface, while the total irrigated area accounts for over 20% of the country. The affected region has rich cultural, historical and environmental assets. It also has geopolitical importance while its geographical position affects neighbouring countries (Syria and Iraq).

Despite the promising positive effects described in the first paragraph, the GAP has also resulted in the disruption of local populations and villages, disputes over water rights, pollution, threats to indigenous communities and to archaeological sites, violation of human rights, environmental refugees and war damages, declining populations of migratory birds and coastal fisheries and the severe degradation of ecosystems.

The Master Plan

The GAP Master Plan was prepared to develop the region's agricultural and economical potential. It identifies the bottlenecks for the development process, and sets development objectives, goals and strategies. Subsequently, a five-year action plan was developed which considers interactions between sectors, population projections and spatial development forecasts on the basis of numerous studies.

The Master plan as a whole is centred on sudden injections of skilful human resources developed technology, developed

transportation and education, with respect to the management of soil and water resources for irrigation, industrial and urban uses in an efficient manner. With respect to the social development the project intends to provide better social services, education and employment opportunities, to control migration and to attract qualified personnel to the area.

In March 1995, the GAP Administration and UNDP jointly organised the seminar "Sustainable Development and GAP". The seminar discussed the principles of sustainable human development in the GAP Region and eventually resulted in a joint program for "Sustainable Development in the GAP Region", which was put in implementation starting from March 1997. The program supports the implementation of 29 different projects that can be grouped under the following 5 headings.

- Promotion of social sustainability and development of social services,
- Promotion of agricultural sustainability and improvement of agricultural productivity,
- Promotion of local entrepreneurship and industrial development for economic viability,
- Promotion of sustainable human settlements, and
- Ensuring optimal and sustainable utilisation of natural resources.

Agricultural activities are dominant within the economic and social structure of the GAP. It involves 67% of economically active population, whereas only 6% is involved in the manufacturing industry. Main industries are textile, metal products, food beverage, wood products and chemicals. Microelectronics industries began to develop recently.

The GAP region experiences a rapid urbanisation process with an urban population of 64% while rural population total 36%. The rate of population growth is 2.4% annually, a point higher than the national average. The reason of this fact is a high birth rate and rural-urban migration towards other cities within the GAP region, in search of better living standards, services and job opportunities.

As mentioned before, the GAP involves several dams in the Euphrates (Firat) and Tigris (Dicle) river. The following sections will focus on the Birecik and the Ilisu dams and their extensive associated water irrigation infrastructure.

3.1.2 Key project data Birecik Dam

The Birecik Dam and Hydraulic Power Plant (HPP) is the first large-scale facility in Turkey materialised on Build-Operate-Transfer (BOT) model. The dam and HPP will be transferred to the Ministry of Energy and Natural resources after being operated by the company for 15 years. A consortium composed of Turkish and foreign firms constructed this dam on the lower Euphrates basin. It is the fourth dam on the Euphrates after Keban, Karakaya and Atatürk Dams. The construction of the Birecik dam began in 1996 and was finished earlier than planned. The impoundment started in November 1999. The dam has an installed capacity of 672 MW and it will generate 2.5 billion kWh energy a year. The total cost for construction was 2.3 billion DM (1.2 billion US$).

Location: Euphrates River, South Eastern Anatolia, Turkey
Global 200 Ecoregion: (158 - Mesopotamian Delta and Marshes, 195 Anatolian - Freshwater)
Issue(s): 6,500 people displaced, impacts on downstream rivers and wetlands
Construction period: 1996-2000
Height: 63 meters
Production capacity: 672 MW
Project operator: *Birecik Baraj Ve Hidroelektrik Santrali Tesis Ve Isletme* or Birecik Company (Turkey).[2] This is a joint-venture between:[3]

TEAS	Turkey	30.0%
Gama	Turkey	18.0%
Philipp Holzmann	Germany	16.9%
GEC Alsthom	France[4]	10.5%
Strabag Österreich	Austria	8.4%
Cegelec	Belgium/France	6.2%
Verbundplan	Austria	4.3%
Sulzer Hydro	Germany	3.7%
TGT (joint-venture Gama & TEAS)	Turkey	2.0%

TEAS is the Turkish state-owned electricity company. The other partners are construction companies and equipment suppliers.
Building consortium: Philipp Holzmann (Germany), Strabag (Austria), Sulzer Hydro (Switzerland) and Gama Endustri (Turkey).[5]
Power generation equipment suppliers: Cegelec (France), GEC Alsthom (United Kingdom) and ACEC Energy (United Kingdom).[6]
Other companies involved Coyne et Bellier (France) and Lahmeyer (Germany). [7]
Remarks: The Birecik Dam is part of the South-Eastern Anatolia Project (GAP), a US$ 32 billion infrastructure development programme that envisages the construction of 22 dams and 19 power plants on the Tigris and Euphrates rivers and their tributaries. It is planned that at full development over 1.7 million hectares of land will be irrigated and 27 billion kWh of electricity will be generated annually with an installed capacity over 7,500 MW. [8]

3.1.3 Key project data Ilisu Dam

The Ilisu Dam is situated in the Tigris riverbasin and is part of the larger GAP scheme. The dam will force up to 80,000 mostly Kurdish people from their homes, up to 15,000 more will lose their farmlands and livelihoods. Additionally, it will flood the medieval town of Hasankeyf, a protected archaeological and cultural site. Since Syria and Iraq also depend on the water from the Tigris, the Ilisu Dam threatens these downstream nations as well (see figure 2 below).

Figure 2: Location of Ilisu Dam[9].

Location: Tigris River, South-eastern Anatolia, Turkey
Global 200 Ecoregion: (158 - Mesopotamian Delta and Marshes, 195 - Anatolian Freshwater)
Issue(s): Siltation, water quality, health risks, no public EIA. 25,000 people displaced.[10]
Construction period: 2000-2008
Height: 135 meters
Production capacity: 1,200 MW
Reservoir area / volume: 31,300 hectares
Project operator: State Hydraulic Works (Turkey).
Building consortium: Originally: Balfour Beatty (United Kingdom), Impregilo (Italy), Skanska (Sweden), Nurol (Turkey), Kiska (Turkey), and Tekfen (Turkey). But Balfour Beatty, Impregilo and Skanska later resigned from the project. [11]
Power generation equipment suppliers: Alstom (United Kingdom) and Voest-Alpine Technologie (Austria). [12]
Other companies involved: ERM (United Kingdom) and Binnie, Black and Veatch (United Kingdom). [13]
Remarks: The Ilisu Dam is part of the Southeastern Anatolia Project (GAP), a US$ 32 billion infrastructure development programme that envisages the Construction of 22 dams and 19 power plants on the Tigris and Euphrates rivers and their tributaries. It is planned that at full development over 1.7 million hectares of land will be irrigated and 27 billion kWh of electricity will be generated annually with an installed capacity over 7,500 MW. [14]

3.1.4 Environmental issues and impacts

This section discusses overall impacts of the GAP project on natural resources. As stated in a UNEP report[15], "There is no

doubt that the disappearance of the Mesopotamian marshlands represents a major environmental catastrophe that will be remembered as one of humanity's worst engineered disasters".

Upstream effects

Loss of agricultural lands

The GAP will cause flooding of large amounts of grazing and arable land and affect directly or indirectly 70,000 livelihoods.[16] This flooding will result in riverbank erosion, deforestation, and the loss of numerous plant and animal species.

Increased erosion

Deforestation and erosion will increase due to intensive agriculture, cattle ranching and fuelwood collection relating to the high population pressure and in the resettlement areas next to the GAP sites. Additionally, construction of the huge irrigation schemes (reservoirs, canals and pipes) will induce accelerated erosion and salinisation of soils.

Eutrophication

Studies have predicted dense algal growths throughout the system, which can be fatal to fish populations.

Downstream effects

Streamflow

The downstream effects of the GAP project on communities and ecosystems are tremendous due to the limited, till almost extinct flow regimes behind the dams. The Mesopotamian Marshlands report states "one major impact of such massive water storage capacity is that it has considerably reduced water supply and eliminated the floodwaters which nourished wetland ecosystems in the lower basin. The cumulative impact of the dams therefore played an important role in reducing the marshlands' spatial extent". Saline return waters from recently commissioned irrigation schemes, and sediment and nutrient retention have also negatively affected wetland fertility and ecosystem processes.

Biodiversity loss

Consequently, a direct result of the GAP is the loss of biodiversity in the unique marshland ecosystems in Euphrates and Tigris delta. These ecosystems and the specific plant and animal species have a unique global significance. Due to extreme reductions in flow regimes behind the dams, water quality reduction and human activities (including the irrigation schemes), several endangered plant and animal species in the Euphrates and Tigris river basins will be placed under severe strain and may entirely disappear.

3.1.5 Other issues and impacts

In a press release Mark Muller, Chairman of Kurdish Human Rights Project (KHRP) said[17], "The reports acknowledged the utter lack of consultation of the local Kurdish people, and raise serious concerns about the likelihood of an effective resettlement plan, and add weight to the increasingly alarming possibilities of water wars in the Middle East".

Resettlement

The construction of the Ilisu Dam will affect some 36,000 people due to the flooding of 68 villages. Whereas, the area that will be affected by the Birecik dam covers a total 44 villages in Halfeti, Birecik and Bozova Districts in Sanliurfa Province, Araban, Nizip and Yavuzeli Districts in Gaziantep Province and the Central and Besni Districts in Adiyaman Province. Nine villages will be completely flooded and three will be partially flooded. More people will have to move to Antep because their land, the only source of livelihood, will be buried under water even though their homes are intact[18]. Approximately 6,500 people will be re-settled. As a result, research suggests that standards of living for the majority of project-affected people will decline and not all affected people will be properly compensated or relocated to re-establish livelihoods. The budget for compensation packages is largely undervalued compared to the number of affected people. As stated in the Kurdish Observer, "The construction of new houses has stopped because they have not received their expropriation money and they asked the Government to keep their promises"[19].

Loss of archaeological sites

Also many places of cultural-historical significance will be flooded or destroyed due to the implementation of the GAP project. Particularly, the destruction of the 10,000-year-old city of Hasankeyf is dramatic cultural loss. As well as the submerging of portions of the ancient Roman city of Zeugma, a cultural meeting point of East and West that supported the only bridge across the Euphrates in Antiquity. The Birecik dam is located just 500 meters downstream of the archaeological site of Zeugma.[20]

Social impacts

The huge influx of outsiders applying for construction jobs disrupted the local communities by undermining traditional governance systems, increased prices and standards of living.

3.1.6 Project financing Birecik Dam

Project value: US$ 1,566 million [21]

Financing overview: The Birecik dam is the first power plant in Turkey built on a *build-operate-transfer (BOT)* basis. This means that the Birecik Company (NTPC) will build the dam and will operate it during a concession period of 15 years (from 2001 to 2016). After this period, the dam will be transferred at no cost to the government of Turkey. The advantage of this structure for the government of Turkey is that it will not be exposed to financial risks such as construction cost overruns.[22]

After years of discussion, the financing agreements were signed in November 1995. The financing structure was as follows: [23]

Equity:			
	Shareholders Birecik Company	US$ 226.7 mn	14.5%
	Start-up revenues	US$ 56.8 mn	3.6%
Debt:			
	Commercial bank loans guaranteed by ECAs	US$ 956.7 mn	61.1%
	Not guaranteed commercial bank loans	US$ 325.8 mn	20.8%
Total:		US$ 1,566.0 mn	

What is remarkable in this financing structure is the large role played by commercial banks, which have provided 82% of total financing. But it should be noted that 75% of their loans are guaranteed by foreign ECA's, which therefore also play a prominent role. Multilateral and bilateral development banks and agencies are totally absent, however, making this a rather unique case.

Equity financing plays a smaller role than usual (18%). Also remarkable is the large percentage of the equity supplied by construction companies and equipment suppliers. The electricity off-taker, TEAS, is the largest shareholder, but only holds 30%.

Equity financing:

Around 18% of the total project costs (US$ 283.5 million) is financed by equity. The shareholders of the Birecik Company contribute US$ 226.7 million. These shareholders are: [24]

• TEAS	Turkey	30.0%
• Gama	Turkey	18.0%
• Philipp Holzmann	Germany	16.9%
• GEC Alsthom	France	10.5%
• Strabag Österreich	Austria	8.4%
• Cegelec	Belgium/France	6.2%
• Verbundplan	Austria	4.3%
• Sulzer Hydro	Germany	3.7%
• TGT (joint-venture Gama & TEAS)	Turkey	2.0%

Debt financing:

Around 82% of the project (US$ 1,282.5 million) is financed by two international bank loans extended in November 1995. The first loan (US$ 956.7 million) is guaranteed by ECAs and has a tenure of 15.5 years. The second loan (US$ 325.8 million) is not guaranteed and has a 8-year tenure. [25]

Both loans are extended by the same banking syndicate. The arranging banks were: [26]

- **Bayerische Landesbank** - Germany
- Chase Manhattan (now part of **J.P. Morgan Chase & Co.**) - United States
- Generale Bank (now part of **Fortis Bank**) - The Netherlands/Belgium
- GiroCredit Bank (now part of **Erste Bank**) - Austria
- **Kreditanstalt für Wiederaufbau** - Germany
- **Société Générale** - France

Other banks participating in the loan syndicate were: [27]

- **ABN AMRO Bank** - The Netherlands
- Bank Austria (now part of **HypoVereinsbank**) - Germany
- **Bank für Arbeit und Wirtschaft** - Austria
- Bank für Oberösterreich und Salzburg (now: **Oberbank**) - Austria
- **Bankhaus Carl Spängler & Co.** - Austria
- Banque Bruxelles Lambert (now part of **ING Bank**) - The Netherlands

- Banque Française du Commerce Extérieur (now part of **Natexis Banques Populaires**) France
- Banque Indosuez (now part of **Crédit Agricole**) France
- Banque Nationale de Paris (now part of **BNP Paribas**) - France
- Banque Paribas (now part of **BNP Paribas**) - France
- Banque Worms (now part of **Deutsche Bank**) - Germany
- **Barclays Bank** - United Kingdom
- Bayerische Hypotheken und Wechsel Bank (now part of **HypoVereinsbank**) - Germany
- Berliner Bank (now part of **Bankgesellschaft Berlin**) - Germany
- Berliner Handels und Frankfurter Bank (now part of **ING Bank**) - The Netherlands
- **Commerzbank** - Germany
- Crédit Commercial de France (now part of **HSBC Bank**) - United Kingdom
- Crédit Local de France (now part of **Dexia**) - Belgium/France
- Creditanstalt-Bankverein (now part of **HypoVereinsbank**) - Germany
- Deutsche Girozentrale-Deutsche Kommunalbank (now part of **DekaBank**) - Germany
- DG Bank (now part of **DZ Bank**) - Germany
- Erste Bank der Österreichischen Sparkassen (now: **Erste Bank**) - Austria
- Dresdner Bank (now part of **Allianz**) - Germany
- **Gulf International Bank** - Bahrain
- **Kärntner Sparkasse** - Austria
- Korea First Bank (now part of **Newbridge Capital**) - United States
- Krediet aan de Nijverheid (now part of **Fortis Bank**) - The Netherlands/Belgium
- Landesbank Berlin (now part of **Bankgesellschaft Berlin**) - Germany
- Landesbank Hessen-Thüringen Girozentrale (now: **Helaba**) - Germany
- **Landesbank Rheinland-Pfalz** - Germany
- Mitsubishi Trust & Banking (now part of **Mitsubishi Tokyo Financial**) - Japan
- **Norddeutsche Landesbank** - Germany
- **Rabobank** - The Netherlands
- **Raiffeisen Zentralbank Österreich** - Austria
- **Royal Bank of Scotland** - United Kingdom

- SaarLandesbank (now part of **Bayerische Landesbank**) - Germany
- Salzburger Landes-Hypothekenbank (now: **Hypobank Salzburg**) - Austria
- **Salzburger Sparkasse Bank** - Austria
- Sanwa Bank (now part of **UFJ Bank**) - Japan
- Türkiye Vakiflar Bankasi (now: **VakifBank**) - Turkey
- **Westdeutsche Landesbank (WestLb)** - Germany

Credit guarantees: The following ECAs in November 1995 guaranteed an international syndicated bank loan of US$ 956.7 million, equivalent to 61.1% of total project costs: [28]

- **Ducroire-Delcredere** - Belgium US$ 206.1 million
- **Coface** - France US$ 167.5 million
- **Hermes Kreditversicherungs** - Germany US$ 403.2 million
- **Österreichische Kontrollbank** - Austria US$ 179.9 million

3.1.7 Project financing Ilisu Dam

Project value: US$ 1.52 billion. [29]

Financing overview: If and how a financing package for the Ilisu dam will be organized, is highly uncertain since most of the important players in the project have dropped. After the construction companies Balfour Beatty (United Kingdom), Impregilo (Italy), and Skanska (Sweden), in February 2002 financial advisor UBS also dropped out.

Equity financing: Unclear.

Debt financing: The Union Bank of Switzerland, which is now **UBS** (Switzerland), tried to arrange a syndicated loan since 1998. But in February 2002, the bank pulled out of its mandate because of fears about Ilisu Dam's social and environmental impact. [30]

Credit guarantees: The following ECAs provisionally agreed to provide export credit guarantees for the Ilisu Dam:

- **Exportrisikogarantie** - Switzerland - US$ 335 million
- **Export Credits Guarantee Department** - United Kingdom - US$ 200 million

- **SACE** - Italy - US$ 152 million
- **US Export-Import Bank** - United States - US$ 20 million

These export credit guarantees have not been formally committed however, as they were tied to deliveries by contractors which have since pulled out of the project. [31]

3.2 China: Three Gorges Dam

3.2.1 Introduction

The Three Gorges Dam in the Chinese Yangtze (or Yangzi) constitutes the currently largest hydroelectric project in the world.[32, 33, 35] The Chinese Premier Li Peng claimed in 1997 that the Three Gorges Dam would "demonstrate to the world that the Chinese people have the ability to build the biggest and most beneficial irrigation and hydro-electric project in the world".[34]

The Three Gorges, composed of the Qutang (or Chu-tang), Wuxia (Wu Gorge), and Xiling (or Hsiling) gorges, lie adjacent to each other in an east to west direction. The Three Gorges area begins at Baidicheng in Fengjie County, Sichuan Province, and ends at Nanjinguan in Yichang County, Hubei province, a distance of 193 kilometres. The actual site of the dam is forty kilometers upstream of another dam, the Gezhouba Dam, near the city of Sandouping (**Figure 3** and **Figure 4**).[37, 39]

The target of the Three Gorges Dam, the Yangtze River, is the third largest river in the world after the Nile and the Amazon in length and after the Amazon and Congo in terms of annual discharge. In Chinese it is also known as Chang Jiang or Long River. It stretches 6,300 km and has more than 700 tributaries. The Yangtze is a Global 200 Freshwater Ecoregion. The Yangtze has a watershed of about 1.8 million km^2, which is equal to 20% of China's total landmass and contains 25% of its entire cropland. About 33% of China's total population, 350 million people, live within the watershed area. This area also accounts for roughly 40% of the nation's total agricultural and industrial output.[35, 36, 39]

The site of the Three Gorges Project (TGP) is in the middle reaches of the main stems of the river in Hubei province. The Three Gorges Dam is a concrete gravity dam founded on granite. The primary functions of the Three Gorges dam are flood control in the middle and lower reaches of the Yangtze and the enormous hydroelectric powerstation with 18,200 MW of installed capacity.[39]

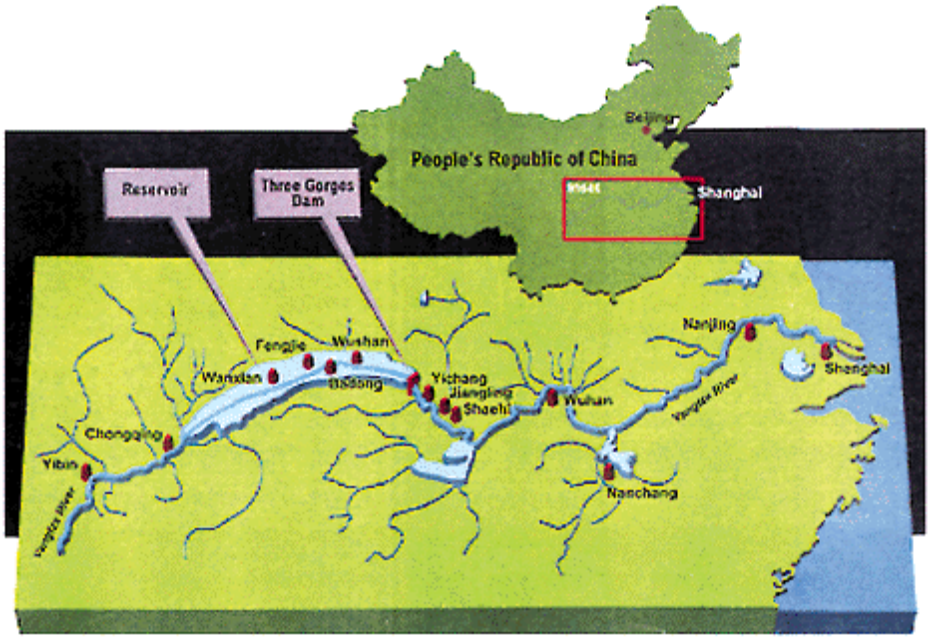

Figure 3: Map of the Yangtze[37]

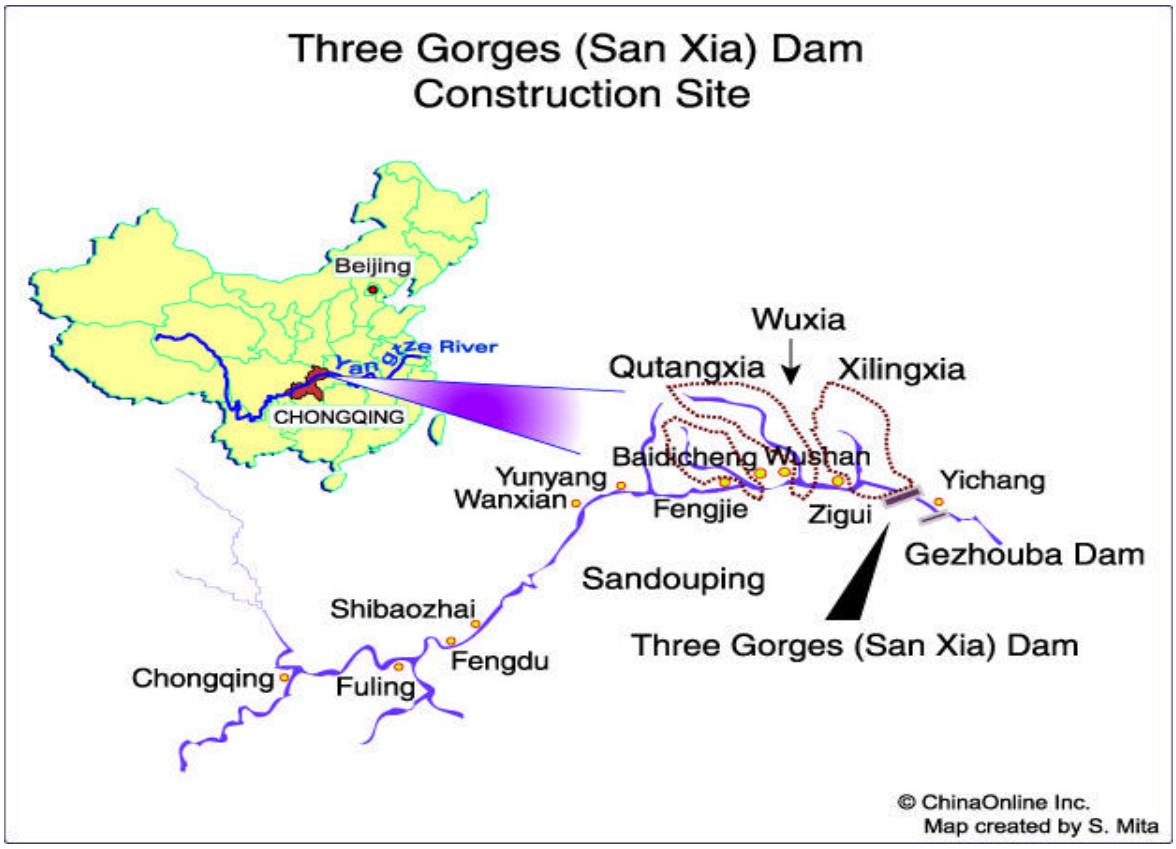

Figure 4: Map Three Gorges Dam

3.2.2 Key project data

Construction period: 1994-2009
Height: 185 meters (width: 2 km)
Production capacity: 18,200 MW
Reservoir area / volume: 632 km^2 [38] / 39,300 Mm^3 [39, 40, 41] 28,000 Mm^3 [33], over 600 km long [33, 35, 39, 42]
Project operator: China Yangtze Three Gorges Project Development Corporation
Building consortium: Power generation equipment suppliers: ABB (incorporating Alstom)43 , Knight Piesold and Partners, Siemens (incorporating Voith Siemens Hydro), VA Tech (incorporating Sulzer Hydro).[43]

A consortium of Siemens, Voith and GE subsidiaries won a US$320 million contract to supply six generators for the Three Gorges dam.45 In September 1997, a consortium of German banks, including Kreditanstalt fur Wideraufbau (KfW), Dresdner Bank and Commerzbank, signed a US$271 million loan package with China's State Development Bank to buy turbines and generators for the dam.46 In November 1999, official approval was given for an export guarantee of 97 million DM to Siemens for the supply of 15 transformers. Sulzer Escher-Wyss is, together with ABB, recipient of a 211 million Swiss franc guarantee by the Swiss government for equipment each company will supply to the Three Gorges dam in China. [43]

ABB has won two major contracts to supply equipment for the Three Gorges Dam and its ancillary infrastructure. In August 1997, the company won an order of US$250 million to supply eight generators for the dam. More recently, in April 1999, a second contract (worth US$340 million) was awarded to supply two converter stations for a 3,000 MW high-voltage direct current power link to transmit electricity from Three Gorges to the Shanghai area.47 ABB's bid for the Three Gorges contract was made without any consultation with the company's panel of environmental advisors, which it supposedly consults on projects with possible environmental impacts.[43]
A consortium of Siemens, Voith and General Electric subsidiaries are supplying six generators in a contract worth US$320 million to Three Gorges. ABB has won orders to supply eight generators, worth US$250 million, in addition to a US$340 contract to supply two converter stations for a 3,000 MW high-voltage link to transmit electricity from the Three Gorges site to the Shanghai area. Knight Piesold is designing the "high capacity conveyor-based concrete system".

A Canadian consortium including Hydro Quebec International, BC Hydro International, Acres International, Lavalin and SNC carried out studies for the dam, funded through a US$14 million grant from the Canadian International Development Agency. The World Bank supervised the studies. Strong opposition from NGOs around the world eventually led to the Canadian government declaring in 1992 that "we should not provide this project with any of our country's limited development assistance funds". In spite of this, Canada's Export Development Corporation (EDC) went on to approve US$12.5 million in export credit guarantees for a computer system to be used in resettlement planning. Subsequently, the US ExIm Bank announced in May 1996 that it would not give export credits to support bids from three US companies — Voith Hydro, Caterpillar Inc. and Rotec — because of a lack of information on the mitigation of environmental and social impacts. Despite the decision, the UK Export Credits Guarantees Department and the German, Swiss, French, Canadian, Norwegian and Swedish export credit agencies (ECAs) all made it clear that they would support applications from bidding companies. Canada's EDC was the first to approve financing for the project, its favourable decision being made prior to the US ExIm's refusal.

After its failure to secure public financial support in the US, Voith turned to its "parent country", Germany, creating an alliance with Siemens and requesting export financing from Germany's ECA, Hermes. Despite widespread public opposition, an export credit of 71.41 million Deutschemarks (DM) was provisionally approved 'in principle', along with 485 million DM in provisional guarantees from Kreditanstalt fur Wiederaufbau (KfW), Dresdner Bank, Deutsche Bank and DG-Bank.[43]

GE Canada, a Mississauga-based subsidiary of the U.S.-based General Electric, is a member of a consortium – including Siemens and Voith of Germany and Sade Vigesa of Brazil – supplying six turbine-generator units to the Three Gorges project. GE Canada's hydro division, GE Hydro, is building three units at its plant in Lachine, Quebec. The contract, valued at US$320 million, was awarded in August 1997. Canada's Export Development Corporation (EDC) is providing a US$153 million loan to finance it.[44]

Hydro-Québec International is a wholly owned subsidiary of Hydro-Québec (Canada), one of the largest electric utilities in North America. Hydro-Québec International signed a US$2.85-

million (US$1.9 million) contract in June 1999 with China Power Grid Development Company to supervise installation of a 900-kilometre transmission line from the Three Gorges dam to Changzhou. Hydro-Québec International is also a member of the CYJV consortium that conducted the now discredited Canadian feasibility study for the dam.[44]

GEC-Alsthom, an Anglo-French electrical equipment and engineering company (also known as Alstom), is a member of a consortium, including ABB of Switzerland and Kvaerner of Norway, contracted in August 1997 to supply eight turbine-generator units to the Three Gorges project. GEC-Alsthom's component is worth US$212 million. Other GEC-Alsthom units involved are GEC-Alsthom Mecanica Pesada in Brazil and Tianjin GEC-Alsthom Hydro in China. The Paris-based Alstom and ABB of Switzerland merged their power generation divisions in 1999, in a joint venture known as ABB Alstom Power. [44] Alstom Power signed a US$12.76-million contract on May 24, 2000 to supply electrical system equipment to the left bank power station of the Three Gorges project. Voith Siemens Hydro Power Generation of Germany signed a contract on the same day. The Chinese subcontractors are Harbin Electric Machine Company from Heilongjiang province and Dongfang Electric Machine Company from Sichuan province.[44]

Siemens, a Munich-based electrical equipment and engineering company, is a member of an international consortium, including GE Canada and Voith Hydro, that won a US$320-million contract to supply six turbine-generator units to the Three Gorges project. Siemens and Voith Hydro are producing some of the equipment in partnership with Sade Vigesa of Brazil. Germany's export credit agency, KfW (Kreditanstalt für Wiederaufbau), and three commercial banks, DG (Deutsche Genossenschaftsbank) Bank, Dresdner Bank, and Commerzbank, provided a US$271-million loan for the purchase of German turbine-generator units. German export credit agency, Hermes Kreditversicherungs AG, provided an export credit guarantee to Siemens and Voith. In April 1999 Siemens won a second Three Gorges contract to provide high voltage transmission equipment for delivering power from the Three Gorges dam to the coastal region. For US$80 million, Siemens will provide 15 transformers for a power converter station in Changzhou, 80 kilometres northwest of Shanghai. German export credit agency, KfW, will provide the bulk of the funding, with the remainder coming from other German banks: DG (Deutsche Genossenschaftsbank) Bank, Dresdner

Bank, and Commerzbank. German export credit agency, Hermes Kreditversicherungs AG, also provided an export credit guarantee of US$52.9 million to cover financial risks. Siemens and Voith Hydro merged their hydropower divisions in 1999. Voith Siemens Hydro Power Generation signed a US$12.79-million contract on May 24, 2000 to supply electrical system equipment to the left bank power station of the Three Gorges dam. Alstom Power of France was awarded a related contract on the same day.[44]

ABB (Asea Brown Boveri), a Swiss-based electrical equipment and engineering company, has won three contracts to supply equipment to the Three Gorges project as follows:

August 1997 – US$400 million contract to supply eight 710 MW turbine-generator units to the project, together with Alstom and Kvaerner. The Swiss export credit agency, Bundesrat Exportrisikogarantie, provided a US$143.1 million loan export credit guarantee in 1997 to finance the purchase of ABB equipment.

April 1999 – US$340 million contract to supply two converter stations at each end of an 850-kilometre transmission line linking the Three Gorges dam with Shanghai and surrounding areas. ABB arranged financing with the Swedish export credit agency, Svensk Exportkredit, Société Générale of France, Australia-New Zealand Banking Group, and Credit Agricole Indosuez.

September 1999 – US$112 million contract to deliver high voltage switchgear equipment to an electrical substation at the Three Gorges dam site. About 25 percent of the equipment will be produced in China in cooperation with Shenyang and Xi'an High Voltage Switchgear plants. The Swiss export credit agency, ERG (Geschäftsstelle für die Exportrisikogarantie) is providing an export credit guarantee for the purchase of ABB equipment.

In 1999, Harza Engineering (USA) won a contract to supervise construction of the Three Gorges dam.[44]

Other companies involved:

Acres International, a Toronto-based engineering consulting firm, is one of five companies and utilities that formed a consortium, Canadian International Projectmanagers Yangtze Joint Venture (CYJV), to conduct a US$14-million feasibility study for China's Ministry of Water Resources and Electric Power, which gave the green light to the Three Gorges dam. The 3-year study was financed by the Canadian International

Development Agency (CIDA) and completed in 1988. Using the Access to Information Act, Probe International obtained the secret study and had it reviewed by independent experts who expressed outrage over its unsubstantiated conclusions. CIDA withdrew from the Three Gorges project in 1992.[44]

AGRA Monenco, subsidiary of AGRA Industries (Canada) signed a Cdn $17-million (US$12.5-million) contract with the Three Gorges dam's projectmanager, China Yangtze Three Gorges Project Development Corporation, to provide systems management technology and training for Chinese managers of the Three Gorges dam construction. The contract included the expectation of additional work valued at Cdn $17.5 million. Canada's Export Development Corporation (EDC) provided a US$12.5-million loan to finance AGRA Monenco's contract.[44]

Electricité de France, the world's largest state-owned utility, in partnership with the French Technical Supervision Bureau (BV), won a US$5.8-million contract to supervise manufacturing of the dam's generator sets.[44]

In 1996, Knight Piesold won a contract as part of the Balama Primo Consortium to “develop the conceptual designs for high capacity conveyor based concrete systems” for the 18,000 MW Three Gorges dam on China’s Yangtze river.[43]

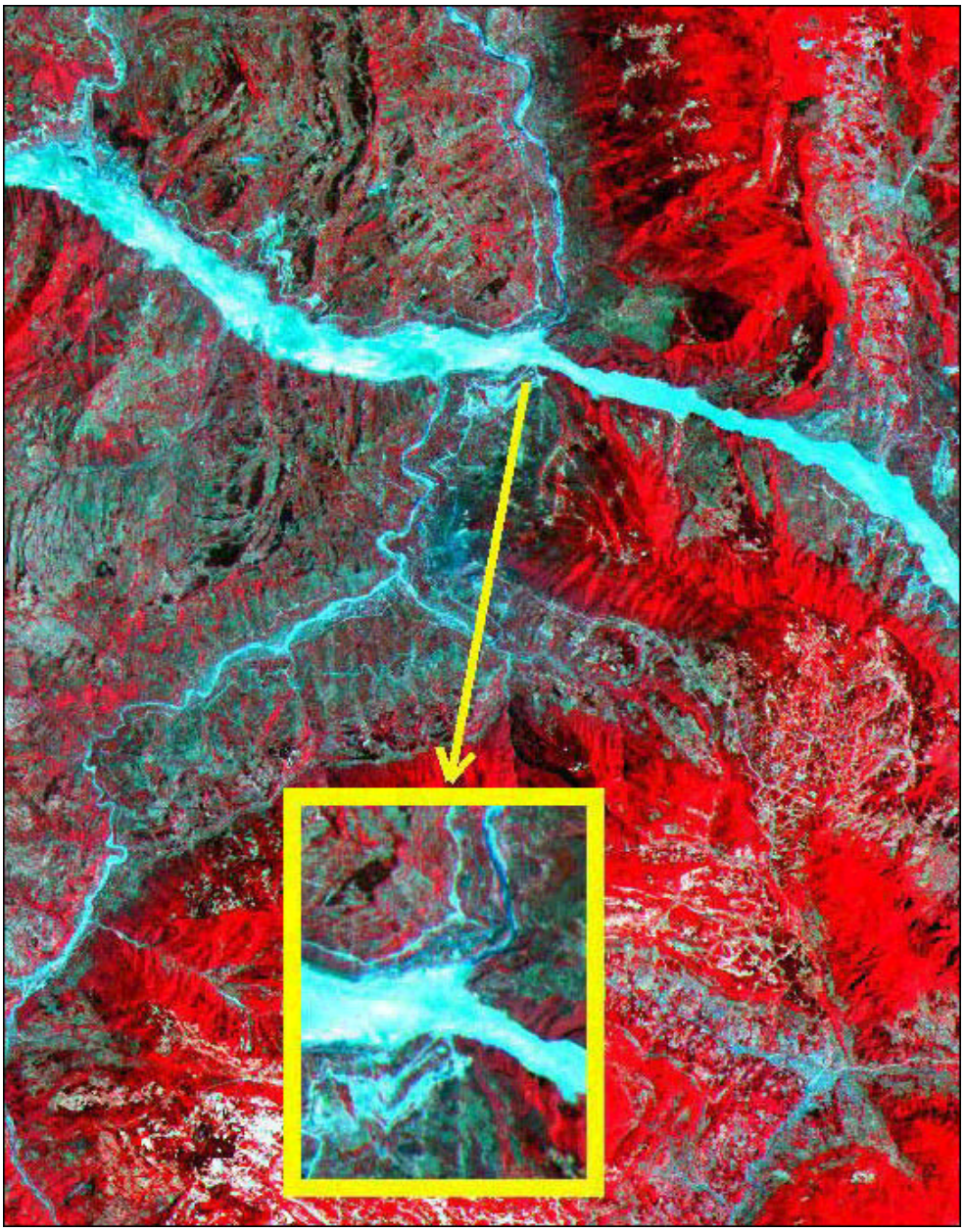

Figure 5: Satellite image This Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) image, acquired on May 21, 2000, shows a stretch of the Yangtze River in China, including the Wu Gorge, the middle of the three gorges. In this false-colour image, red represents vegetated land surface and the light blue ribbon of pixels running left to right is the Yangtze River. A number of its tributaries are visible as well. Blue-green pixels show exposed land surfaces.
In the yellow box is the construction site of the Three Gorges Dam, the world's largest. When the reservoir is filled in 2012, water will rise to a height of 175 meters and extend 600 kilometres. The reservoir will submerge two of the three world-famous gorges, along with irreplaceable cultural and archaeological sites.[45]

3.2.3 Environmental issues and impacts

Devastating endangered species impact

As the American University's Trade and Environment Database summarises: "The project will have a devastating ecological impact. The dam will alter the natural environment, and therefore, an almost infinite number of species will be affected by the project. The endangered species affected by the project include the Giant Panda, Chinese Tiger, Chinese Alligator, the Yangtze Dolphin, the Chinese Sturgeon, and the Siberian Crane. In addition, the project requires extensive logging in the area. The environmental impact of the dam project will be enormous and far-reaching. Affected species including the endangered species could be wiped out. For example, the Yangtze dolphin has a population of only about 200 (although some sources state much fewer than 100 remain) and WWF lists it as one of the most endangered creatures on Earth. The construction of the dam is in progress. Thus, the urgency of the problem is very high and immediate measures to protect these species are required if the dam construction continues".[41]

The Export-Import Bank of the United States refused to support the Three Gorges Dam, due to a lack of substantive information provided to the agency on mitigating environmental and social impacts.[32]

Farewell to Chinese River Dolphin?

Lipotes vexillifer, more endangered than China's flagship species the Giant Panda, is on the verge of extinction. Aquatic zoology researchers warn that the total number of Chinese River Dolphins is now much fewer than 100 and the species will certainly expire within 20 years if special rescue measures are not adopted immediately. Chinese River Dolphins, also known as Baiji or white-finned dolphins, have lived in the Yangtze River for about 25 million years. Baiji, that live only in the middle and lower reaches of the Yangtze River are the least numerous of the five remaining river dolphin species in the world, that is, freshwater dolphins that never enter the sea. They are listed as one of the 12 most endangered species in the world and the world's most endangered cetacean. The Baiji dolphin has been given the highest level of protection by the Chinese government. But fishing and river traffic have already depleted the Baiji population. Dams block access to tributaries and lakes where Baiji once caught fish and nurtured their young. The number of Baiji dolphins *(Lipotes vexillifer)* fell drastically from 6,000 in the 1950s to 400 in 1984.

According to 400 in the early 1980's. Surveys found 300 dolphins in 1986, and less than 200 in 1994. In 1997, the Ministry of Agriculture organised 53 vessels and more than 300 staff to carry on a simultaneous multi-location survey. Divided into 22 groups, they spotted only 25 dolphins, but after further analysis determined that only 13 animals had been observed. In 1998, MoA organised another survey involving 18 vessels spotted only 7 dolphins later determined to represent 3 or 4 individuals. The last simultaneous survey in 1999 observed only 5 dolphin heads. [46, 47, 48, 49]

The World Conservation Union (IUCN) and Chinese experts fear that the Baiji will become the first member of the river-dolphin family to be driven to extinction as a result of human activities. Experts say that changes to the river caused by the Three Gorges dam are likely to put further stress on the Baiji's fragile habitat.[49]

Scientists at Wuhan's Institute of Hydrobiology forecasted in 1987 that "water released from the dam will scour the riverbed and wash the sand beaches and islands where Baiji now feed and reproduce downstream into heavily populated and polluted areas. Forced to follow their migrating habitat, Baiji will find themselves in areas where they are more likely to be killed by boat collisions and fishing gear. The dam may also depress water temperatures for a month or more during the spring Baiji mating period, possibly decreasing their already marginal reproductive success." IUCN said in a news release. "Its causes are partly local and related to the fact that growing human populations are competing with the animals for water and other resources. But the international community is also implicated through its support for projects that ignore the fragility, complexity and vitality of natural freshwater systems".[49]

Siberian Crane at risk

Downstream environmental impacts of the Three Gorges dam could "fatally degrade" an important wintering ground for the world's most endangered crane species, the American writer and naturalist Peter Matthiessen warns in a new book. A cluster of small lakes on the northwest edge of Poyang Lake - 1,000 km from the dam site, in Jiangxi province - were discovered in recent years to be the winter destination of "the last significant flock of the Siberian crane: in effect, 99 per cent of all *Grus leucogeranus* left on earth," Matthiessen writes in The Birds of Heaven: Travels with Cranes. But now, he warns,

"the precious Poyang ecosystem may be destroyed by the construction of a gigantic hydropower dam … upriver on the Yangtze."

Poyang, China's largest freshwater lake, acts as a natural floodwater retention area, fluctuating in size from 4,000 square km in the flood season to less than 1,000 square km in the dry season. When it expands during the summer months, it merges with nine smaller lakes nearby. But after the floodwater recedes, nutrient-rich marshes and mud flats around these small lakes provide a crucial winter habitat for four crane species, including the endangered Siberian crane.

"Manipulation of the water flow by the Three Gorges dam will permanently alter the hydrology of the Poyang lakes - a system already severely damaged by watershed and wetland degradation," Matthiessen writes. "Saving the Poyang habitat might possibly depend on diking the northwest lakes and marshes and pumping water in during the spring and summer to simulate the waxing and waning of the Yangtze; otherwise the dam may fatally degrade the winter habitat of 99 per cent of the earth's last Siberian cranes."

In 1981, Zhou Fuchang and Ding Wenning of the Beijing Institute of Zoology discovered the spot where the "great white crane" (as the Siberian crane is known in China) spends the winter before migrating to summer breeding grounds in Siberia. Ornithologists have counted 2,626 Siberian cranes wintering at Poyang, along with smaller numbers of white-naped, hooded and Eurasian cranes.

The Siberian differs from the 14 other crane species in its almost complete dependence on wetlands, Matthiessen writes. "Because it has never adapted to man's farmlands, it has suffered considerable harm from wetland pollution and destruction by ever-increasing human activity in its northern breeding grounds as well as in its winter sanctuary." The Siberian is one of three crane species that are predominantly white, and these white cranes are considered the most threatened. The Siberian is hunted all along its arduous migration routes, Matthiessen reports, and "despite its higher numbers, it is presently regarded as the most endangered of the three". [50, 51]

Other endangered species

The Three Gorges Dam project threatens many endangered other species that are native to the Yangtze River. The ancient river sturgeon and the finless porpoise depend on the Yangtze for their survival. There is concern that the dam will destroy the natural habitats of many of China's indigenous wildlife species, including the Chinese alligator, and various fish species, such as the prehistoric Chinese sturgeon, a fish unique to Yangtze waters. The dam will reduce downstream water temperature as well as increase downstream water levels during flood seasons. At least four native fish species are sensitive to water level and temperature during their breeding season. Lower temperatures may delay the breeding period by 20 days. Species not able to cope with such changes may suffer substantial reductions in numbers or even face extinction. An example is the rare Chinese Sturgeon, which lives in the middle reaches of the river that will be greatly affected by the change in river flow and natural habitat. Further downstream, in a 1,600-kilometer stretch of the river between the middle reaches and the estuary of the river, the dam will take its toll on the Chinese paddlefish. The dam will reduce the habitat of the paddlefish by 200 kilometres and push their dwindling number of only 300 closer to extinction.[33, 35, 48, 52, 53, 55, 56] The Chinese State Environmental Protection Administration (SEPA) has already observed that: “Due to human activities, some rare birds in the Three Gorges reservoir area have been turned into visitors rather than residents”.[54]

Pollution

The international NGO ECA Watch quotes (without reference) the Chinese Academy of Sciences as stating that in the Three Gorges area alone “there are over 3,000 industrial and mining enterprises which release more than one billion tons of wastewater annually, containing more than 50 different pollutants. Presently, there is very little treatment of industrial wastewater flowing into the reservoir area, and no treatment of residential wastewater; everyone relies on the river’s capacity to flush pollutants out to sea to keep it clean. But following the construction of the large dam, the river’s flow through the reservoir will be significantly and irreversibly reduced and with it any flushing capacity”.[32] Over 265 billion gallons of raw sewage are dumped into the Yangtze annually. Currently the river flushes this downstream and out into the ocean. Upon completion of the Three Gorges project, the sewage dumped upstream of the dam will back up in the reservoir.[48] Reports in the "River Dragon"[55] says the dam will turn the Yangtze into a

giant cesspool. "By severing the mighty river and slowing the flow of its water, the dam will cause pollution from industrial and residential sources to concentrate in the river, rather than be flushed out at sea," writes Chinese journalist Jin Hui. "The result will be a poisoned river".[56] According to the SEPA: "Pollution incidents are on the rise, caused by boats and by the garbage dumped directly into the river, seriously compromising water quality." "No urgent and effective measures have been taken to deal with wastewater. Almost all polluted water is discharged untreated into the main channel of the Yangtze and its tributaries. Most garbage is washed into the river or heaped along its banks, creating a potential problem after the reservoir is filled". [54] In addition, contamination of the river by toxic chemicals may dramatically increase if the 1,600 factories in the area are not cleaned up and moved before the waters begin to rise.[33, 48]

Changes threaten livelihoods ...

Experts warn that, by forever changing the hydrology of the river for thousands of kilometres, the Three Gorges Dam will destroy commercial fish stocks and deprive the complex floodplain agricultural systems of the water and silt they need, thereby threatening the livelihoods of 75 million people who live by fishing or farming along the Yangtze's bank. They also point out that the soon to be flooded land of Waxian prefecture is far more fertile than the high ground to which everyone will soon be moved (Stopping the Yangzi's 1997)". [33, 55, 56] Also the SEPA notes that "The area providing wood fuel is declining, and erosion has become a serious concern in the reservoir area because of the shortage of rural energy sources." "Geological disasters, such as riverbank collapses and landslides, are increasing in the reservoir area, leading to growing economic losses". [54]

... and the Delta

The Yangtze transfers more than a half billion tons of silt to the estuary yearly. Of this amount roughly 50% is deposited near the estuary, extending the coastline about fifty meters each year. Approximately 70% of the sedimentload is expected to be trapped behind the dam, thus drastically decreasing the estuary's ability to function in land formation. [35, 53] In fact, TGP will reverse the current equilibrium of the land formation. The reduced suspended sediment load of the water downstream of the dam will cause not only coastal and riparian erosion in the lower reach, but also the retreat of the coastline during October every year.[53]

The Three Gorges dam could also slow the formation of new delta land through sedimentation in the Yangcheng Nature Reserve further downstream in Jiangsu province. In winter, this area now provides "good habitat for five to seven hundred red-crowned cranes, the largest population of *Grus japonensis* anywhere on earth," Mathiessen writes.[50, 51]

During the dry season, an influx of salty seawater up the river is very common. The seawater may reach the suburb county of Wusong in the northern part of the estuary where it contaminates the area's water supply. During the months between January and April, the Three Gorges Dam will increase the flow of water downstream, thus, reduce the infiltration of salty seawater. However, during the dry season around October when saltwater intrusion is most severe water will be stored in the reservoir. Since the downstream flow of the river is minimal during this time, the salinization process is exacerbated.[35]

Impacts of resettlement

The forced relocation of people will cause an increase in deforestation and soil erosion as they are pushed onto overused land. "The environment of the Three Gorges area cannot sustain the hundreds of thousands of people who are supposed to resettle there," writes Chen Guojie, a research fellow at the Chengdu Geological Institute in "The River Dragon Has Come".[56]

3.2.4 Other issues and impacts

Figure 6: Smoke and dust rise after demolition efforts begin in the town of Guizhou in Central China's Hubei Province to make way for the Three Gorges Dam Project. To date, the Guizhou demolition has been the largest below the 135-metre water level of the future Three Gorges reservoir. (China NewsPhoto, March 24, 2002)

Involuntary resettlement

The number of that need to resettle involuntarily due to the Three Gorges project is enormous. It is estimated at 1.5 - 1.9 million people.[32, 34, 42, 43, 48, 59] More than 160,000 citizens have already been relocated. [48] Chinese farmers have a deep attachment to the land that has traditionally been theirs. Massive resettlement might fail, in light of its scale and the poor record of most other resettlement efforts. Consequently, the project would create millions of reservoir refugees.[39]

"The Three Gorges reservoir will flood 632 square kilometres of land, inundating 22 cities and counties, 115 towns, 1,100 villages, 1,300 factories, 4,000 hospitals and clinics, and 40,000 tombs, the official Xinhua news agency said". [57]

"The reservoir behind the proposed Three Gorges dam on the Yangtze River would drown 13 cities, 1,711 villages, 116 towns and 1,600 factories". [43]

"The reservoir will bury 13 cities, 140 towns, 1,352 villages and about 650 factories". [58] "When the dam is completed, 13 cities, 140 towns and over 1,300 villages will be submerged by the Three Gorges Reservoir". [48]

Political pressure

Official resettlement figures are subject to large scale propaganda and falsification.[34, 59] Human Rights activists point out that internal opposition to the project was suppressed after Tiananmen Square massacre.[39] "The River Dragon Has Come!" was Dai Qing's second volume on the controversial project. Her first, "Yangtze! Yangtze!" was published nine years earlier. It was banned in China and earned her a 10-month prison sentence. Her writings in China were banned for life. Undaunted, she continues to speak out against the dam, under constant police surveillance, from within Beijing. [36, 56]

In this respect the WCD mentioned: "The WCD recognises that coercion and violence have been used against communities affected by dams. All project proponents – public and private – need to commit to the strict prohibition of such acts of intimidation against any stakeholders." In reality, however, outspoken critics of the project have been arrested or forced into exile, differences of opinion being treated as evidence of counter-revolutionary intent. As mentioned above, the well-known Chinese dissident Dai Qing was jailed for 10 months after she published a collection of essays on the dam in 1989. An article in the Far Eastern Economic Review quoted a local villager who will be resettled by the project as follows: '"If you complain, the authorities will do this," he says, cocking his thumb and forefinger to imitate a gun. "It's no use. The local officials just don't care about us". [42]

Participation

The WCD recommends that stakeholders take part in "negotiated agreements for compensation, mitigation, resettlement, development, and monitoring measures affecting them including draft contracts, where necessary." It goes on; "A clear agreement with the affected people on the sequence and stages of resettlement will be required before construction on any project preparatory work begins… The negotiated agreements need to be translated into signed contracts between the developer and affected communities and individuals, with clear targets for assessing compliance." In reality, no such agreements exist. Those who are being forced to move have had no say in the process and no contractual agreements with the resettlement authorities. In 1998, a report by a leading Chinese sociologist revealed widespread mismanagement in the project resettlement program. Corruption and falsification of resettlement figures, inadequate relocation plans, insufficient compensation, and systematic discrimination against rural

residents in distributing compensation were among the problems listed. The program was so poor that one official quoted in the report said the government "will have to rely on the military or a manmade flood to force people out of their homes." In February 1999, 10,000 resettlers filed petitions with the Chinese central government, detailing extensive problems, including rampant corruption, extortion, falsification of data and inadequate compensation. [42]

Corruption

WCD also says: "Corrupt practices are pre-empted through enforcement of legislation, voluntary integrity pacts, debarment and other instruments. All States need to adopt and implement common and consistent anti-corruption legislation…" Reality on the Ground: A government audit revealed resettlement officials have embezzled about US$57.7 million in Three Gorges resettlement funds – nearly 12 percent of the total US$478.8 million allotted by the government for relocating the project oustees. Embezzled money was used to speculate on stocks and real estate and was transferred to personal accounts.

Archaeological sites

"TGP will submerge more than 320 villages and 140 towns, together with some of the most precious artefacts and archaeological sites of China's long civilisation". [34] More than 1,300 archaeological sites will be flooded forever. [48, 52]

"The Three Gorges project will submerge some of China's most famous historical relics and scenery, the subject of myriad paintings and poems. These include Qu Yuan Temple, Yon Yang County's Temple of Zhang fei, the Han watch tower, and the carvings on the Moya Cliff. It was found that about 800 sites of cultural relics would be submerged, including more than 300 sites of above ground cultural relics. Thus, the project will have a negative impact on Chinese culture. However, Chinese officials addressed conservation of these ancient relics and places of historical interest. Some of them will be removed or rebuilt, some will have to be duplicated and the others will be put into museums". [39]

On this issue the WCD recommends: "Where regions and river valleys are known to be rich in cultural resources, landscapes, or archaeological resources, consideration of these elements should be included in Strategy Assessments and used as a criterion in selecting options and avoiding impacts."

But, of the nearly 1,300 known archaeological sites in the reservoir area, archaeologists have determined that between 400 and 500 are worthy of preservation. They estimate, however, that only half that number will be able to be preserved due to lack of resources. Among the 412 experts involved in the assessment of the Three Gorges project, there was not one sociologist, cultural anthropologist, or archaeologist. Both well-known and unexplored archaeological sites (such as human settlements, ancient tombs, buildings and steles) have already been destroyed by dam-related construction.[42]

Farmland

Water will rise throughout most of the Three Gorges area, a fabled lattice-work of waterways, permanently flooding about 14,500 - 32,000 hectares of prime farmland., To compensate this loss, farmers in other areas must increase their outputs from the much-exhausted lands. Towns in other areas must accept the "dam refugees" despite overcrowded conditions already present in the towns. Farmlands near the estuary will also be destroyed as lower than usual river flow during dry seasons allow for the intrusion of salty sea water into valuable farmlands.[35] [56]

TGP will aggravate the drought and affect the productivity of the farmland in the lake areas. The Four Lakes area, especially Lake Hong, has been suffering from drought almost every year. Usually, nearly a half of floodwater in this area is released to the Yangtze River between January and April, when the water level of the river is lower than that of the lakes. After the construction of TGP, in order to improve the navigation condition of the Jing Jiang, the reservoir will release water and elevate the water level of the river by 1-2 meters during this period. As a result, the water level of the river will be higher than that of the lakes in March and April, which will make the spontaneous release of excessive water in this area impossible. Similarly, TGP will also aggravate the drought in the lake areas further downstream, such as Lakes Liangzi and Zhangdu. It is estimated that TGP will turn 20,000 hectares of farmland in this area into marshland. [53]

On the other hand, saltwater intrusion has already become a serious problem for the estuary. Salinization has caused large losses to the agriculture. Because TGP will increase the downstream flow between January and April, it will reduce saltwater intrusion during this period. However, the reservoir

will start to store water in October, when saltwater intrusion is severe. As a result, TGP will reduce the river flow and aggravate the sea water intrusion during October in every year. It is estimated that, unless proper measures are taken in time, a total area of 2,000 square kilometres can be affected (mostly located in the northern branch of the estuary). About 60,000 - 100,000 hectares of farmland will be eroded by saltwater, which will bring down the productivity of this area by 20%. Although the salinization of soil is a reversible process, a large amount of capital and manpower is required to bring it under control. [53]

Dam safety

The underlying bedrock of the TGP site is characterised by frequent weak earthquakes. It is believed that the increased weight of the reservoir and the dam will cause reservoir induced seismicity (RIS). Increased tectonic activity may weaken the dam causing damages ranging from minor to disastrous.[33, 35]

Public health

The most serious threat is that schistosomiasis could become established in the reservoir area. This parasitic disease persists along the Yangtze despite a 40-year control programme, with endemic areas only 40 km below the dam as well as 500 km above Chongqing. Epidemics of schistosomiasis, malaria and other parasitic infections have occurred around many reservoirs created by dams elsewhere. But there is no programme in China to combat the threats of the Three Gorges dam to public health. One Ministry of Health division is assessing the schistosomiasis risk, but other health threats are not under study. No national multisectoral dialogue connects health to other agencies dealing with the dam.[60]

Sedimentation

Over 700 million tons of sediment are deposited into the Yangtze annually, making it the fourth largest sediment carrier in the world.[48] All three of the principal benefits of the dam, flood control, power generation, and improved navigation, depend on a solution to the problem of reservoir sedimentation. However, sedimentation is likely to compromise the operation of the dam, which has only an unproven system of sluice gates to release it, much sooner and more decisively than advertised (as it has already in the diversion channel). For example, much of the live storage volume, perhaps as much as 50%, occurs along tributary channels and outside the gorges, along reaches of the Yangtze with wide valley cross-sections. These areas are likely to be the

first portions of the live storage volume filled with deposited sediment, with coarse bedload deposits in the tributary canyons and fine slackwater deposits in the wide valley reaches. The planned annual drawdown of the reservoir for sediment flushing is unlikely to mobilise these deposits. Loss of live storage translates directly into loss of flood control capacity.[48, 61] Similar concerns were raised by the California-based Sklar-Luers & Associates, an independent engineering consultant group. Sedimentation problems and other engineering miscalculations including potential coffer dam failures "threaten the safety and viability" of the project, say the engineers.[56, 62] Concern was raised that the Yangtze's high levels of silt and sediment will clog drainage outlets and create backlogs, possibly flooding upstream cities. The Wall Street Journal reported that the amount of silt is so large that it could turn the dam reservoir into a giant mud pie in a matter of months. At present, China does not have the technology to control the flow of river silt through the dam project. A detailed four-year evaluation of the Three Gorges Dam project, funded in the late 1980s by the Canadian government and the World Bank at a cost of US$14 million, warned that as the silt is carried downriver and deposited in the reservoir the Yangtze will tend to alter its course, thus increasing the risk of disastrous flood. American engineers who visited the site also concluded that the project would not prevent flooding.[33]

Fisheries and agriculture

Just as sedimentation will affect fisheries downstream, the reservoir will affect fisheries in the middle reaches of the river by transforming it from rapid flowing to slow flowing or still moving waters. This would change the habitats of the fish, which would eventually lead to a drop in the productivity of the fisheries. It is estimated that the dam will trap over 75% of the sediments. These sediments are nutrient rich and in the past have been used as fertiliser for fisheries and agriculture downstream from the dam. With the dam acting as a barrier to the much-needed flow of sediments, downstream fisheries and agriculture will be deprived of much need nutrients. The TGP will also seriously affect the fisheries downstream by preventing the fry bred in the upper reaches of the river from reaching fisheries downstream in the Hubei and Hunan provinces.[35, 39]

Health

The human health impacts associated with the Three Gorges reservoir could create a "Chernobyl of hydropower," warns the

British Medical Association journal The Lancet. Health risks include, among others, a surge of endemic infections, malaria, encephalitis, and schistosomiasis. Billions of tons of industrial wastewater and sewage from cities along the Yangtze could contaminate the reservoir, turning it into what one Chinese scientist calls "a huge, stagnant, stinking pond." There are currently no programs in China to combat the dam's threats to public health, and no funding for treating the area's wastewater or mitigating the environmental problems it will cause.[42]

Precautionary approach

According to the WCD, "Impact Assessments should be guided by the precautionary approach. The precautionary approach requires States and water development proponents to exercise caution when information is uncertain, unreliable, or inadequate and when the negative impacts of actions on the environment, human livelihoods, or health are potentially irreversible." From the above, it is clear that practice in China is different. The dam will block the flow of nutrients and migration routes for countless fish species, as well as the black finless porpoise and the already endangered Baiji dolphin – the legendary goddess of the Yangtze River. It will have severe impacts on livelihoods and health the extent of which is hard to foresee.

Figure 7: Cartoon from www.floodwallstreet.org

3.2.5 Project financing

Project value	US$ 21,700 million. [63]
Financing overview	Although the estimated total project value has recently been revised downwards to 180 billion yuan (US$ 21.7 billion), the Three Gorges dam is the most expensive hydro project ever realised. When project planning started in the 1980s it was intended to finance a large part with foreign funds, by attracting loans and issuing shares.[64] But because of the large social and environmental consequences of the project, multilateral financial institutions declined to get involved. Obtaining ECA financing also was very difficult, especially after the **US Export-Import Bank** (United States) declined financial support for the project. For the same reasons, an international share issuance had to be postponed several times. Also, at the end of the 1990s, foreign private banks (in)directly investing in the Three Gorges project came under heavy pressure.

For these reasons the financing structure of the Three Gorges dam deviates from the normal pattern for large-scale dams: multilateral banks are not involved in the financing; financing by ECAs is relatively minimal; a very large percentage of the project (possibly more than 60%) is financed by equity; and direct financing by foreign private banks is also relatively minimal.
An estimated break-down of the financing structure of the Three Gorges project is as follows:

Equity:			
	• Electricity levy	US$ 12,000 million	55.3%
	• Profit from Gezhouba hydropower	US$ 1,200 million	5.5%
	• Share issuance	US$ 100 million	0.5%
	• Other equity	US$ 200 million	1.0%
Debt:			
	• China Development Bank loans	US$ 3,600 million	16.6%
	• Other Chinese bank loans	US$ 1,000 million	4.6%
	• Chinese bonds	US$ 1,933 million	8.9%
	• Foreign bank loans	US$ 800 million	3.7%
	• Foreign ECA loans	US$ 400 million	1.8%
Not yet financed:		US$ 500 million	0.3%
Total project costs:		US$ 21,700 million	100%

The high portion of equity financing, as well as the high portion of domestic debt, shows that the Chinese government is able to use its abundant domestic resources to realise a project such as Three Gorges, despite of foreign opposition. Most remarkable is the fact that the Chinese population is directly financing more than half (US$ 12 billion) of the total project costs, by a dedicated, nation-wide levy upon the electricity price. Each of the 1.2 billion Chinese is thus contributing US$ 10 to the project.

Also the Gezhouba hydropower dam was transferred to the China Yangtze Three Gorges Project Development Corporation

(CTGPC), which can use its expected profits during the Three Gorges construction period (US$ 1.2 billion).
To complement these equity contributions, a share listing of China Yangtze Electric Power Corporation is planned for 2003, but probably the share issuance will concentrate on the domestic market predominantly.
Whether the Chinese government also has contributed to the Three Gorges project from its general state budget is not clear. NGOs nevertheless have connected international bond issuances by the Chinese government to the project, but it is doubtful if the clear political connection also is complemented by a strong financial connection. (These bond issuances are described below as "indirect financing")

The debt part of the Three Gorges financing, is also stemming predominantly from domestic sources. The has been issuing a large number of bonds on the domestic market (with a total value of US$ 1.9 billion) and has obtained very large loans from the China Development Bank as well as from some other Chinese banks.

Direct foreign financing plays a minor role. ECAs contributed around US$ 400 million in loans and guaranteed another US$ 800 million of private bank loans. Taken together, direct foreign financing only equals 5.5% of total project costs.

Most important creditor of the project is the **China Development Bank** (CDB), which has committed US$ 3.6 billion in loans. To finance its large loans to Three Gorges and other projects, CDB has realised a number of international bond issuances.
NGOs have strongly protested against the foreign (mostly American) investment banks involved in these issuances. The bond issuances of the CDB have a direct financial link with the Three Gorges project, but it should be taken into account that Three Gorges account for no more than 4.5% of CDB's total loan portfolio. (The CDB bond issuances are described below as "indirect financing")

Concluding: as a result of the controversiality of the project, the Chinese government has mostly used domestic financial sources to finance the Three Gorges project. Direct foreign financing covers no more than 5-6% of the total project costs. Indirectly the foreign funding part probably is somewhat

larger, as funds raised by international bond issuances of the CDB and the China government could have been partly used for the Three Gorges project.
Nevertheless: Three Gorges is not very dependent upon international funding. This can not be said of the Chinese power sector or all Chinese infrastructure projects, however: channelling so much domestic funding to Three Gorges inevitably makes China more dependent on foreign funding for realising its other ambitious development goals.

Equity financing

Possibly more than 60% of the total project value will be financed by the equity of China Yangtze Three Gorges Project Development Corporation (CTGPC).

The equity of CTGPC is financed by contributions from several budgets as well as a levy upon all electricity sold in China: [63,65,66,67]

- Levy on electricity price — US$ 12,000 million
- Profit from Gezhouba powerplant — US$ 1,200 million
- Guangdong province — US$ 27.7 million
- People's Republic of China — Amount unknown

From 1992 a *Three Gorges Tax* of 0.3 - 0.7 cent/kWh has been levied nation-wide, with an exception of poverty-stricken regions and the electricity used for agricultural irrigation and drainage purposes. With annual power consumption expected to rise from 1,000 TWh in 1990 to 2,500 TWh in 2010, this levy will bring in at least 6 billion yuan (US$ 725 million) per year. During the 17-year construction period this would amount to YUAN 100 billion (US$ 12.0 billion). [68]

In September 2002 CTGPC established a new subsidiary: China Yangtze Electric Power Corporation. This subsidiary already holds the Gezhouba power plant and will gradually acquire all 26 power generators belonging to the Three Gorges dam between 2003 and 2009. These acquisitions will be paid by continuous share issuances. China Yangtze Electric Power Corporation is planning an initial public offering (IPO) on the Shanghai stock exchange in 2003, followed by listings in Hong Kong and possibly London later. The IPO is planned to raise US$ 483 to 604 million. [69,70]

China Yangtze Electric Power Corporation is now 89.5% owned by CTGPC. Huaneng Power International (the largest Chinese independent power company), China National Petroleum Corporation and China National Nuclear Corporation each invested 255 million yuan (US$ 30 million) for a 3% stake. Gezhouba Group and the Designing Institute of the Yangtze Commission also contributed 85 million yuan (US$ 10.24 million) and 42.5 million yuan (US$ 5.12 million) respectively to hold a 1 and 0.5 per cent stake in the company. CTGPC intends to entice foreign and Hong Kong power giants, including Mirant (United States) and CLP (Hong Kong) to invest in its subsidiary. [71]

The investment bank **China International Capital Corporation** (China), which is managed and 35% owned by **Morgan Stanley** (United States) is the main advisor of the CTGPC on this issue.[72]

Loans

Loans to CTGPC and its suppliers probably finance around 25% of total project costs. The following information is found regarding these loans:

- **Export Development Corporation** (Canada) committed loans of US$ 23.5 million (1994), US$ 12.5 million (1995) and US$ 153 million (1997) to companies supplying to CTGPC. [73]
- In 1995 CTGPC obtained a US$ 100 million loan from **Bank of China**. [74]
- In 1996, the state-owned **China Development Bank** (China), formerly known as State Development Bank of China, commissioned 30 billion yuan (US$ 3,600 million) in soft loans to the CTGPC. This makes CDB the most important creditor of the project. [75]
- In 1997, Banque Nationale de Paris, which is now part of **BNP Paribas** (France), provided a US$ 94.8 million loan to finance a supply contract by GEC-Alsthom to the Three Gorges Dam. [76]
- In September 1997, a consortium of German banks committed a US$ 271 million loan package to German suppliers of the Three Gorges Dam. The following banks participated in the syndicate: [77]
  - **Commerzbank** - Germany
  - DG Bank (now part of **DZ Bank**) - Germany

- Dresdner Bank (now part of **Allianz**) - Germany
- **Kreditanstalt für Wiederaufbau** - Germany

- Around 1999, BNDES-exim, part of state-owned development bank **BNDES** (Brazil), issued a loan package of US$ 150 million to Brazilian suppliers to the Three Gorges project. [78]
- In April 1999, a syndicated loan of US$ 340 million was committed to ABB (Sweden-Switzerland) for deliveries to the Three Gorges Dam. The following financial institutions participated in the syndicate: [79]
  - **Australia and New Zealand Banking (ANZ)** - Australia
  - **Crédit Agricole** - France
  - **Société Générale** - France
  - **Svensk Exportkredit** - Sweden
- In April 1999, a consortium of German banks committed a US$ 80 million loan to German suppliers of the Three Gorges Dam. The following banks participated in the syndicate: [73]
  - **Commerzbank** - Germany
  - DG Bank (now part of **DZ Bank**) - Germany
  - Dresdner Bank (now part of **Allianz**) - Germany
  - **Kreditanstalt für Wiederaufbau** - Germany
- In July 1999, CTGPC signed loan agreements with: [80]
  - **Bank of China** - China
  - **China Construction Bank** - China - US$ 480 million
  - **Industrial and Commercial Bank of China** - China - US$ 480 million

Bonds

Bonds issued by CTGPC could finance around 10% of total project costs. The following information is found regarding bonds issued by CTGPC:

- In 1996, CTGPC issued domestic bonds with a value of 1 billion yuan (US$ 120 million). [81]
- In early 1999, CTGPC issued domestic bonds with a value of 2 billion yuan (US$ 240 million). [82]
- In July 2000, CTGPC issued 10-year bonds with a value of 3 billion yuan (US$ 360 million) on the domestic market. **China International Trust & Investment Corporation** (CITIC) is the lead underwriter. Six other financial companies are also underwriters. [83]
- In November 2001, CTGPC issued two bond tranches on the Chinese capital market with issue sizes of 3 billion yuan

(US$ 362.5 million) and 2 billion yuan (US$ 241.6 million). The issuance was managed by state-owned **China International Trust & Investment Corporation**. [84]

- In August 2002, CTGPC announced it would issue a new bond tranche on the Chinese capital market with issue size of 5 billion yuan (US$ 604.1 million). This new issuance will bring the total amount raised by bond issuances by the CTGPC to 16 billion yuan (US$ 1,933 million). [85]

Credit guarantees:

The following information is found regarding export credit guarantees for supplies to the CTGPC: [86] -

- **Exportrisikogarantie** - Switzerland - 1997 - US$ 143.1 million
- **Exportrisikogarantie** - Switzerland - 1999 - Unknown amount
- **Hermes Kreditversicherungs** - Germany - 1997 - US$ 40 million
- **Hermes Kreditversicherungs** - Germany - 1999 - US$ 52.7 million

Other direct financing:

A US$ 14 million grant was provided to the Three Gorges project by the **Canadian International Development Agency** (Canada) for a feasibility study in 1985. [87]

Indirect financing:

The People's Republic of China has been issuing a number of international bonds in the past few years. The proceeds are possibly partly used to fund the government's direct contribution from the state budget to the Three Gorges Dam. This concerns the following international bond issuances:

- International US$ 1,000 million bond issuance by the People's Republic of China at the end of 1998, lead managed by: [88]
  - Crédit Suisse First Boston (part of **Crédit Suisse**) - Switzerland
  - **Goldman Sachs** - United States
- International US$ 1,750 million bonds issuance by the People's Republic of China in May 2001 in Hong Kong and Luxembourg, lead managed by: [89,]
  - **Barclays Bank** - United Kingdom
  - **BNP Paribas** – France
  - **Deutsche Bank** - Germany

- **Goldman Sachs** - United States
- **J.P. Morgan Chase & Co.** - United States
- **Morgan Stanley** - United States

To finance its large loans to Three Gorges and other projects, the China Development Bank has been issuing international bonds several times. It should be remembered however that CDB had a total amount of 671.5 billion yuan of loans outstanding at the end of 2000, while *only* 30 billion yuan is committed to Three Gorges (and not yet entirely outstanding). This equals 4.5% of total loans outstanding. [90]

- In 1996, the **China Development Bank** (China) raised US$ 269 million with a bond offering on the Japanese capital market. The bond issuance was underwritten by: [91]
  - **Nomura Securities** - Japan
  - IBJ Securities (now part of **Mizuho Bank**) - Japan
- In 1997, the **China Development Bank** (China) raised US$ 330 million with an international bond offering. The following banks participated in the issuing syndicate (figures refer to amounts underwritten): [92]
  - **Bank of America** - United States - US$ 19.8 million
  - Crédit Suisse First Boston (part of **Crédit Suisse**) - Switzerland - US$ 66.0 million
  - J.P. Morgan & Co. (now part of **J.P. Morgan Chase & Co.**) - United States - US$ 66.0 million
  - **Lehman Brothers** - United States - US$ 66.0 million
  - **Morgan Stanley** - United States - US$ 66.0 million
  - Salomon Smith Barney (now part of **Citigroup**) - United States - US$ 46.2 million
- In May 1999, the **China Development Bank** (China) issued US$ 500 million bonds, due in 2009. The lead managers for this issuance were, including the amounts underwritten: [93]
  - **Merrill Lynch** - United States - US$ 225 million
  - Salomon Smith Barney (now part of **Citigroup**) - United States - US$ 225 million

Other banks involved in this issuance were: [94]

- **ABN AMRO Bank** - The Netherlands
- **Bank of China** - China
- **Barclays Bank** - United Kingdom
- Chase Manhattan (now part of **J.P. Morgan Chase & Co.**) - United States
- Crédit Suisse First Boston (part of **Crédit Suisse**) - Switzerland
- Daiwa Bank (now part of **Resona Bank**) - Japan

- **Deutsche Bank** - Germany
- **Goldman Sachs** - United States
- **HSBC Bank** - United Kingdom
- **ING Bank** - The Netherlands
- J.P. Morgan & Co. (now part of **J.P. Morgan Chase & Co.**) - United States
- **Lehman Brothers** - United States
- **Morgan Stanley** - United States
- **Nomura Securities** - Japan
- Paribas (now part of **BNP Paribas**) - France
- Tokyo-Mitsubishi Bank (part of **Mitsubishi Tokyo Financial**) - Japan

3.3 India: Maheshwar Dam and Sardar Sarovar Dam

3.3.1 Introduction

The Maheshwar and Sardar Sarovar dams are part of the Narmada Valley Development Project (NVDP), a plan to build 30 major, 135 medium and 3,000 small dams on the Narmada River and its tributaries. This is the largest river development scheme in India and one of the largest hydroelectric projects in the world. It will displace an estimated 1.5 million people from their land in three states (Gujarat, Maharashtra and Madhya Pradesh). [95, 96]

The Narmada River originates from the Maikal ranges at Amarkantak, 1057 m above the sea level, in Shahdol district of Madhya Pradesh. In its 1312-km long journey before joining the Arabian Sea, the Narmada flows through the three states of Madhya Pradesh (MP), Maharashtra and Gujarat. Nearly 90% of the river is in MP; it skirts the northern border of Maharashtra, then flows through Gujarat for about 180 kilometres before emptying into the Arabian Sea at Bharuch. The Narmada is the largest westward flowing river in India.[97, 98] It is not part of a Global 200 Ecoregion.

Narmada, which means one who endows with bliss, finds mention as one of the seven most sacred rivers in ancient Indian texts.[99]

The NVDP will inundate large areas of forests and agricultural land. The largest of the dams is the Sardar Sarovar which, when completed, will flood more than 370 square kilometres of forest and agricultural land, displacing more than half a million people. The government claims that the dam would provide water to 40 million people, irrigate 1.8 million hectares, and generate about 1,450 megawatts of power, but the Save the Narmada Movement (Narmada Bachao Andolan or NBA) and other organisations believe these claims are greatly exaggerated.[96]

Back in 1961, Prime Minister Jawaharlal Nehru laid the foundation stone for a 49.8 metre high dam-the midget progenitor of the Sardar Sarovar. Around the same time, the Survey of India drew up new, modernised topographical maps of the river basin. The dam planners in Gujarat studied the new maps and decided that it would be more profitable to build a

much bigger dam. But this meant hammering out an agreement first with neighbouring states. The three states failed to agree on a water-sharing formula. Eventually, in 1969, the Central Government set up the Narmada Water Disputes Tribunal. It took the Tribunal 10 years to announce its Award. The people in the area were neither informed nor consulted nor heard. [100]

Before the Ministry of the Environment even cleared the Narmada Valley Development Projects in 1987, the World Bank sanctioned a loan for US$450 million for the largest dam, the Sardar Sarovar, in 1985. However, pressure from Indian and international environmental organisations forced the World Bank to appoint an independent panel to review the impacts of the project. The Independent Review determined that the environmental and social impacts of the project had not been properly considered and advised the Bank to step back from the Project. The Bank withdrew its support in 1993. In response, the Gujarati government decided to raise US$200 million and push ahead with the project. [96, 98]

Supreme Court

On 18 October 2000, the Indian Supreme Court issued a (2:1 majority) controversial final ruling allowing immediate construction of the Sardar Sarovar Dam to 90 meters. In addition, it allowed for the dam to be built up to its originally planned height of 138 meters. These decrees have "come from the Court despite major unresolved issues on resettlement, the environment, and the project's costs and benefits".[98]

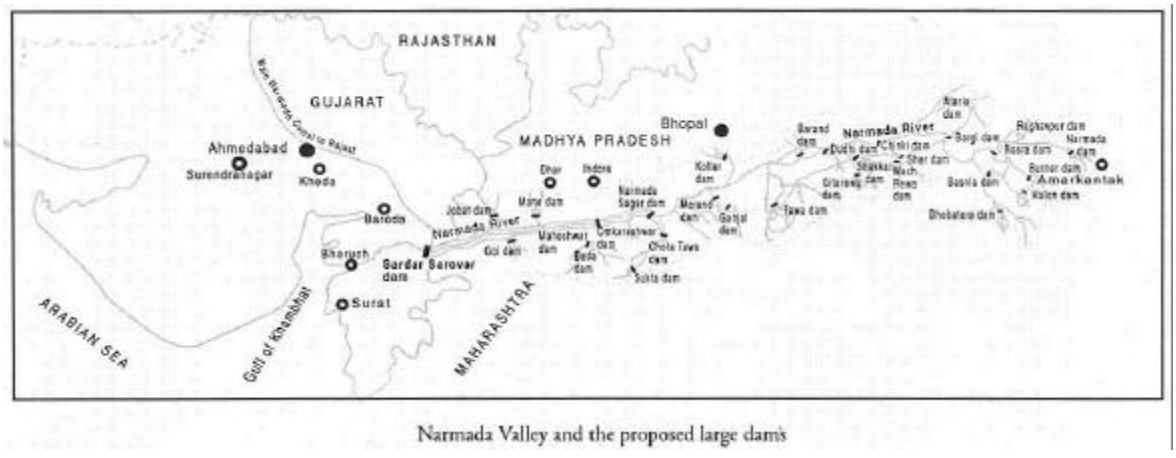

Figure 8: Map of large dams in the Narmada Valley

Figure 9: Map of large dams in the Narmada Valley
Projects under construction:1 Sardar Sarovar 24 Indira Sagar 26 Maheshwar 27 Upper Veda 28 Maan 29 Goi 30 Jobat
Projects completed: 8 Matiari 9 Bargi 17 Barna 18 Tawa 19 Kolar 22 Sukta [101]

3.3.2 Key project data of the Maheshwar Dam

Electricity generated by the dam is projected to cost four to five times more than current electricity produced by Madhya Pradesh state. The Madhya Pradesh Electricity Board, which is supposed to purchase power from the project, is on the verge of bankruptcy and is likely to default on its payments. [102]

Location: Narmada River, Madhya Pradesh, India Nimad region of Madhya Pradesh, 2 km upstream from the town of Mandleshwar.
Global 200 Ecoregion: -
Issue(s): disruption of the hydrological regime, lack of consultation, 35,000 - 40,000 persons displaced [101, 102, 103]
Construction period: 1996 - ? [101]
Height: 36 meters, length 3400 m [105]
Production capacity: 400 MW
Reservoir area / volume: 5,697 ha[101], 483 Mm^3 [105]
Project operator: Shree Maheshwar Hydel Power Corporation (India), which is a joint-venture of the Indian textile company S. Kumars Group with several partners.[104] As part of the privatisation policy in the power sector, the S. Kumars Group was awarded the Maheshwar project on build, own and operate basis in 1993.[105]
Building consortium: SEW Constructions.[105]
Power generation equipment suppliers: Bharat Heavy Industries (India).[106] Siemens[i] (Germany), ABB

[i] Siemens is committed to contributing a non-voting share of 17% of project equity in return for a contract to provide turbines and generators.

(Sweden/Switzerland) [107, 110, 108] ABB-Alstom Power, Portugal [105]
Other companies involved: ERM consultants

3.3.3 Impacts of the Maheshwar Dam

Submergence and resettlement

The Maheshwar Dam has faced intense opposition from villagers, who have shut down construction for months and forced six foreign companies to pull out. The project would affect about 40,000 people and submerge 1,100 hectares of rich agricultural land.

Submergence and resettlement form the main cause of the enormous political controversy over the Maheshwar dam project. According to official data, 61 villages lie in the submergence zone. 21 of these villages would be totally or partially submerged, while in the remaining 40 villages' only agricultural land would be submerged. The agricultural soils here are extremely fertile. In total, approximately 35,000 people will be displaced by the project. [108, 109]

In March 1993, ERM consultants went to India to study the social and environmental impact of the Sardar Sarovar dam and the accompanying resettlement. They concluded the project offered "public health benefits" and "opportunities for environmental improvement". They visited the dam site once, failed to visit the resettlement area at all, and spent most of their time at an office hundreds of miles from the project. One team member claimed that the trees she saw on her visit to the site were dead and therefore concluded the environmental impact would be minimal. The consultant had visited near the end of the dry season when local trees had shed their leaves. A study of the same project by the independent Morse Commission, by comparison, led to the World Bank withdrawing its financial support for the dam. [110]

In 2000, the issue was very critically addressed in a report for the German government. [111] The report notes that despite the fact that the project is already under construction, even the most preliminary demographic and socio-economic data about the impacts is totally unavailable. It says that "Significant uncertainty exist about the amount of land to be seriously affected (submerged or waterlogged) by the project, and there

are no apparent plans by the authorities to remedy the problem." It also says that there is uncertainty about the number of people to be seriously affected and that the authorities are unlikely to "identify the thousands living in areas not yet agreed by the authorities to be affected by the Project or those whose livelihoods are affected."

Human rights violations

Since 1985, a people's organisation that opposes the project, the Narmada Bachao Andolan (Save the Narmada Movement, or NBA) has been organising massive rallies and peaceful demonstrations to protest the destruction of the Narmada valley. Despite the non-violent nature of the protests, the Indian police have often responded to these protests with violence and intimidation. This has resulted in a long history of human rights violations, some of which have been documented by Amnesty International. Use of preventive arrest, detention, excessive use of force during arrest, physical abuse, and threats are just some of the documented violations. In 1992, forest guards and police fired upon and killed several villagers who were cultivating the land in the dam project area. In April 1998, Amnesty International expressed concern that peaceful protesters, who were attempting to stop construction of a dam at the Maheshwar project site in Madhya Pradesh, were arrested and mistreated by police under a section of the civil code preventing unlawful assembly. [96]

Propaganda

The propaganda machinery used by the state as well as decades of political promises have succeeded in "manufacturing" perceptions or myths that reinforce the bounty that is supposed to be the SSP. In Gujarat, the state has "manufactured" one dominant perception of water, namely, the Narmada project as the single solution. [112]

No consultation

It notes that the affected people have never been consulted or properly informed about the project and that in the absence of the same, the project has been sought to be continued with the use of brute force and human rights violations. It clearly says that "the approach of the rehabilitation program till date has failed to be transparent, participatory and democratic, and dissent has been handled with police force rather than communication."

Noting the most flagrant and open violations of the Rehabilitation policy of the Madhya Pradesh government as

well as the statutory clearances of the Central Ministry of Environment and Forests the team concludes that "the Project has not implemented the land for land policy set by the government of Madhya Pradesh and by international standards", and that the "the R&R implementing agency has not allocated land to the landless, as called for in the environmental clearance of the Ministry of Environment and Forests and, in any case, required by international and other national standards."

Misinformation

Instead it found that the Project authorities have misinformed the affected people about their rights in order to compel them to accept cash compensation rather than land, and in some cases where the affected people insisted on their rights and refused to accept cash compensation, stones were dumped onto their lands by the Project authorities in order to bulldoze them into submission. It found that in the cases that people had accepted cash in lieu of land, "the damage to family income and future prospects arising from cash compensation instead of land for land are already evident in the project area and the validity of cash compensation, given the misinformation about the R&R policy, is questionable."

The report concludes that there is no cultivable land for the rehabilitation of the affected people available in sufficient quantity even by the admission of the Government of Madhya Pradesh itself, and that "if the R&R policy were executed as provided, the additional cost to the project would require an entirely new financing package several times larger than currently provided for R&R". [113]

WCD Guidelines

IRN evaluated Maheshwar dam against the Guidelines of the WCD and made the following observations: [102]

Public Acceptance

WCD Recommendation: WCD guidelines call for negotiated decision-making processes that should result in “demonstrable public acceptance of binding and implementable agreements.” The WCD states “For the proposed project to be part of a preferred development plan the acceptance of the project affected people…should be obtained.”

Reality on the Ground: Led by the NBA, the affected people state that they are “prepared to wage a relentless struggle” against Maheshwar and are determined to “not let the dam be

built at any cost." Over the past two years, thousands of people affected by the dam have occupied the construction site ten times, barricaded roads leading to the dam site for three months and held mass demonstrations opposing the project.

Options assessment / alternatives

WCD Recommendation: The WCD calls for studies "to assess the extent to which policy and programme options can meet the development objectives." The WCD says that screening should be done "to remove alternatives that have unacceptable social and environmental consequences." In addition, emphasis should be placed on "optimising existing investments" and "improving productivity" of electricity systems.

Reality on the Ground: Cheaper and more effective energy options exist. A task force set up by the Madhya Pradesh state government suggested alternatives such as demand management measures, biomass generation, optimum use of oil-based plants and existing dams, and micro-hydro plants. The task force also recommended that construction on Maheshwar be halted and a new analysis of costs and benefits be undertaken to establish the viability of the project. [102]

The latter recommendation fits with the observation of another report, that "the cost-benefit analysis for the project is based on erroneous data (poor villages, unirrigated lands, little infrastructure)". "If compensation at replacement value would be undertaken, the project would very likely not be economically viable". [108]

3.3.4 Project financing of the Maheshwar Dam

Project value:

US$ 465 million. [114]

Financing overview:

Organising funding for the Maheshwar dam has been a very difficult process, from the moment the project was first launched in 1993. These problems were mostly caused by the strong resistance of local NGOs and their international supporters against the project, because of its severe social and environmental consequences. Over the years, four foreign electricity companies - PacifiCorp (United States), Ogden (United States), Bayernwerk (now E.on, Germany) and VEW (now RWE, Germany) - have been planning to participate in the equity of the project, but all have withdrawn now. The contractors Bechtel (United States), Siemens (Germany) and

Alstom (France) also have withdrawn. The ECAs **Hermes** (Germany) and **Companhia de Seguro de Créditos (COSEC)** (Portugal), as well as **HypoVereinsbank** (Germany) in the past two years have withdrawn their financial support for the project, or have refused to get involved. In the 1990s, **ABN AMRO Bank** (The Netherlands) and **Australia and New Zealand Banking** (Australia) also have been trying to arrange financing, apparently without success. [115]

Almost the only constant factor in this project has been the project initiator, the S. Kumars Group, which originally is an Indian textile company. During the past year, S. Kumars has been looking for Indian banks, companies and funds to co-fund the project in the form of equity or loans.
Equity is to provide 30% of total financing, of which S.Kumars wants to contribute 20%. Several Indian financial institutions and companies have expressed interest to participate in the other 80% of the shares, but a definitive composition of the shareholder base has not been agreed yet.
Debt is to provide 70% of total financing, but multilateral banks, foreign ECAs and foreign private banks are not interested to participate (anymore). The gap is filled by a number of Indian financial institutions, which have made sufficient loan commitments. The state-owned **Power Finance Corporation** (India) will be the most important creditor, supplying US$ 206.3 million (44.4% of total project costs).

Although foreign financial institutions are not directly funding the project, indirectly they do play a role. **Power Finance Corporation** (India), the main creditor of the project, is attracting foreign funds to finance its domestic loans, among others from the **World Bank**. (This is treated under "indirect financing" below.)

Equity financing

The equity of the Shree Maheshwar Hydel Power Corporation is to provide 30% of the total project costs (US$ 140 million). The following information is found regarding equity financing:

- The following shareholders are willing to participate in the share capital of Shree Maheshwar Hydel Power Corporation: [116]
  -**S. Kumars** - US$ 28 million - 20%
  - **Industrial Development Bank of India** (India) with **Life Insurance Corporation** (India) and

with **General Insurance Corporation of India** (India) - US$ 21 million - 15%
- **Bharat Heavy Industries** (India) - US$ 14 million - 10%
- **Madhya Pradesh government** (India) - ? - few %

- Shree Maheshwar Hydel Power Corporation is still looking for other shareholders. A domestic share listing is also considered. [117]

Debt financing

Around 70% of the project (US$ 326 million) is to be financed with debt. Industrial Finance Corporation of India (India) is arranging bank loans.

- Reportedly the following banks have committed loans, which together would be sufficient to cover for the debt needed: [118]
  - **Bank of India** - India - US$ 12.0 million
  - **Dena Bank** - India - US$ 5.2 million
  - **Industrial Development Bank of India** - India - US$ 20.7 million
  - **Industrial Finance Corporation of India** - India - US$ 10.3 million
  - **Madhya Pradesh State Industrial Development Corporation** - India - US$ 9.3 million
  - **Power Finance Corporation** - India - US$ 206.3 million
  - **Punjab National Bank** - India - US$ 5.2 million
  - **State Bank of India** - India - US$ 32.3 million
  - **Unit Trust of India** - India - US$ 46.3 million

Indirect financing

The main creditor of the Maheshwar dam is the Indian state-owned **Power Finance Corporation** (PFC). At the end of March 2002, PFC owned total assets with a value of Rp 164.7 billion (US$ 3,400 million). Of these assets, US$ 441 million (13.0%) was financed by foreign loans. [119]

The following information is found on the foreign funding of PFC:

- The **Asian Development Bank** (International) in 1997 issued a US$ 250 million loan to PFC. [120]
- In 1997, **IKB Deutsche Industrie Bank** (Germany) issued a line of credit of around DM 100-200 million (US$ 50 - 100 million) for financing imports by Indian power utilities. [121]

- The **World Bank** (International) has issued a loan of US$ 258.5 million to PFC. [122]
- **Export Development Corporation** (Canada) has issued a loan of US$ 75 million to PFC in May 2001. [123]
- In November 2001, PFC concluded two structured interest rate swaps worth a total of US$ 50 million with **Crédit Lyonnais** (France) to hedge a portion of its outstanding dollar floating rate debt.[124]
- In December 2001, PFC approached **ABN AMRO Bank** (The Netherlands), **Standard Chartered Bank** (United Kingdom), **Crédit Lyonnais** (France) and **Royal Bank of Scotland** (United Kingdom) as it is seeking US$ 50 million in foreign currency loans. [125]

Apart from foreign loans, PFC is also hoping to attract foreign shareholders by an Initial public offering (IPO) on a foreign stock exchange. In July 2002, PFC appointed **Morgan Stanley** (United States) to advise on this issue, which should rise around US$ 600 million. [126]

3.3.5 Key project data of the Sardar Sarovar Dam

The Sardar Sarovar Dam is on the Narmada River in Gujarat state, 170 kilometres upstream from where the river flows into the Gulf of Khambhat in the Arabian Sea. [97]

Location: Narmada River, Gujarat, India
Global 200 Ecoregion: Rann of Cutch flooded grasslands (99)
Issue(s): 200,000 [97, 101, 102] / 500,000 [98, 102] people displaced / resettled, loss of wildlife habitat, no comprehensive EIA made; risks of water logging and salinization in irrigated areas, violation of environmental clearance conditions. Seriously disruption of aquatic ecosystems and Hilsa fish and freshwater prawn fisheries. [127]
Construction period: 1987 - [97, 101] preliminary construction began in 1961 [97]
Height: 139 meters (final) [101], 90 (current)[128]; length: 1200 m [97]
Production capacity: 1450 MW [129]
Reservoir area / volume: 37,690 ha submerged [101] The SSP reservoir will submerge about 39,134 ha. land, of which 13,743 ha. is forest land.[131] Length 213 km. About 11,600 ha is officially classified as 'forest land' although the actual amount of tree cover on forest land varies greatly.[97]
Project operator: Sardar Sarovar Narmada Nigam (India)
Building consortium: The construction of the dam is contracted to Jay Prakash (J.P.) Associates, who have a virtual monopoly over major dam projects in India [97]
Other companies involved: ERM (United Kingdom). [95]

3.3.6 Environmental issues and impacts Sardar Sarovar

Procedure

In the WCD Thematic Review on Environmental and Social Impact Assessment for Large Scale Dams the clear view of the independent World Bank Review Commission (cf. underneath) on the environmental procedures for the SPP is presented: "The government of India had developed a comprehensive structure of policies for environmental protection and assessment of environmental impact. Notwithstanding this stringent regime, the history of the environmental aspects of Sardar Sarovar is a history of non-compliance. Instead of environmental impact studies being done before approval of the Projects, they were done concurrently with construction - an approach that undermines the very basis for environmental planning. There was, however, in the conditional environmental clearance, a schedule for the completion of the environmental impact studies by 1989. Most of the studies were not completed by 1989. Without proper EIA effective ameliorative measures cannot be developed". [130]

In its evaluation of the SSP against WCD Guidelines, IRN observes: The WCD states that the precautionary approach should be taken "when information is uncertain, unreliable or inadequate and when the negative impacts of actions of the environment, human livelihoods, or health are potentially irreversible." However, "There are no credible environmental studies or rehabilitation plans. Conditional environmental clearance was given to the project in June 1987 although basic environmental impact studies required under Indian law were never completed and even today remain incomplete". [102] Sardar Sarovar has been progressing without a comprehensive environmental impact assessment ever been prepared. As IRN puts it, "It is shocking that such a large project can be allowed to proceed without such a basic condition being fulfilled". [127, 131]

The conditional environmental clearance granted to the SSP in 1987 could be considered effectively lapsed as the project authorities have not met most of the major conditionalities laid down by the Ministry of Environment and Forests.[131]

Overstated benefits

Furthermore IRN notes: "The WCD report concludes that irrigation and water supply projects have 'typically fallen short' of physical targets and 'have exhibited poor financial cost recovery and economic performance.' Hydropower projects also tend to perform 'below targets.' In light of this, the WCD

recommends that 'the gestation period in delivering benefits, the scale of adverse impacts, and costs' should all be considered in evaluating different options, 'while at the same time not jeopardising or delaying alternatives that can deliver benefits within the short-term.' According to IRN reality on the ground however shows: "The benefits of SSP have been greatly exaggerated. The project is expected to generate only 50 MW (of 1450 MW planned) after seasonal water flow and power consumption for pumping water is accounted for. The project is supposed to irrigate 1.9 million hectares and provide drinking water to over 20 million people. However, these benefits are based on overestimates of annual flow in the river and assume extremely high irrigation efficiency. The costs for building drinking water distribution systems, expected to reach US$1 billion, have not been factored into the project's costs. The arid Kutch region will not receive any water supply benefits until 2025, if ever. Still, the Gujarat state government continues to spend 80 percent of its irrigation budget on SSP at the cost of implementing viable alternatives."

World Bank in and out

In 1992, under intense pressure, the World Bank (which was funding the dam to the tune of US$450 million) was forced to constitute an independent review committee, the Morse Commission. The first independent review of any of the Bank funded projects, the Morse Report indicted the Bank on many counts and tacitly endorsed all the main concerns raised by the NBA. The resultant international furore forced the Bank to finally withdraw from the project (with mutually face-saving measures for the Banks and the Govt. of India, which asked the Bank to leave one day before the deadline for some stipulations was to expire). [128]

Unresolved issues

The WCD Thematic Review presents a number of environmental issues that the Morse Commission had identified as unresolved and therefore contributed to its negative judgement on the SPP. These included:

• significant discrepancies in the hydrological data and analyses indicated that the Sardar Sarovar Projects would not perform as planned;

• the backwater effect of sedimentation upstream of the dam is also an issue that was ignored and a rapid, continuing and

cumulative rise in water level in the river above the reservoir could cause flooding to extensive areas;

• no assessment of downstream impact had been done and the implications of the Sardar Sarovar Projects for the geomorphology of the lower reaches of the river and its estuary and for the fishery and the people living in the region were unknown;

• assumptions used in design of the canal and irrigation network, and on the development of mitigative measures, were questionable. [130]

Biological diversity

The Rann of Kutch is a unique salt desert and wetland ecosystem, not found anywhere else in the world, and several species have adapted to its harsh conditions. Threatened species such as the Wild ass (Equus heminous khur), Wolf (Canis lupis), Houbara bustard (Chlamydolis undulata), and Lesser florican (Sypheotides indica) will be adversely affected by the related (irrigation) canals. [132,133] The Wild ass, one of the world's most endangered mammals, is now under further threat from the Sardar Sarovar Narmada Project (SSP). The canals of the SSP are proposed to extend all around the last habitat of this mammal, the Rann of Kutch, in western India. According to a recent study by the Wildlife Institute of India titled "Impact of Sardar Sarovar Proposed Canal Network Upon Wild Ass Sanctuary in Little Rann of Kachchh" (June 1994), commissioned by the project authorities, both this habitat and the Wild ass will be seriously threatened by the hydrological and vegetational changes which the canals will bring about.

The Wild ass is an endangered mammal, and is classified as such by the World Conservation Union (IUCN). The current official population of this mammal is about 2,000. The Wild ass is one of the world's rarest mammals, this subspecies being found only in the Rann. This population is confined mostly to the Little Rann of Kutch, a unique salt desert-wetland ecosystem that also contains several other rare species.

Although a large area of 4,900 sq. km. of the Little Rann of Kutch had been declared a wildlife sanctuary, the study by researchers from the Wildlife Institute found that the Wild ass mostly uses the fringes of the vast desert area, including the fallow and wasteland which abounds in the adjacent villages.

This is precisely the habitat where irrigation will cause drastic landuse and vegetational changes, including conversion into permanent cultivation, replacement of native vegetation, which is favoured by the Wild ass into unpalatable weed, and waterlogging/salinisation. In addition, the existing Wild ass movement between the Little Rann of Kutch and the Great Rann (to its north), where a small population of the species exists, will be cut off, causing genetic isolation. All these factors, says the study, "would have dire consequences for the long-term survival of the species", *i.e.* would in the end lead to its extinction.

The study reports that, in addition to a threat to the Wild ass, "considerable wildlife habitat will be lost" along some stretches of the command area. Seriously disruption of aquatic ecosystems, both upstream and downstream of the dam, threatens the Marsh crocodile with extinction and adversely affects other aquatic life including the Mahseer fish. [134]
The Rann of Kutch, including the Dhrangadhra Sanctuary, is a unique salt desert and wetland ecosystem, not found anywhere else in the world, and several species have adapted to its harsh conditions. Threatened species such as the Wolf *(Canis lupis)*, Houbara bustard *(Chlamydolis undulata)*, and Lesser florican *(Sypheotides indica)* will also be adversely affected by the canals. The report states that such impacts "have already been observed in the command areas of the Indira Gandhi Canal in Rajasthan". [133]

Parts of the SSP command area have natural habitats of great national and global significance. For instance, Nal Sarovar Sanctuary near Ahmedabad is one of western India's largest wetlands, attracting over 120 migratory species of birds. The Velavadar National Park near Bhavnagar (Saurashtra) has perhaps India's largest concentrations of the threatened Blackbuck *(Antelope cervicapra)*. [131]

Project authorities have claimed that "copious amounts of fresh water" resulting from the project will benefit wildlife in the sanctuaries in the command area. Such blanket assertion display ecological illiteracy. All ecosystems develop in a particular regime of water availability and other climatic and geological conditions. Introduction of canal waters into arid and semi-arid regions drastically changes the dry nature of the land, greatly increasing humidity and soil moisture, and

transforming sparsely vegetated landscapes into relatively lush green ones.

In the SSP command, there is justifiable fear that species of plants and animals unique to the arid areas will be adversely affected by the processes mentioned above. Especially susceptible will be the Rann of Kutch. This unique ecosystem is a complex and delicate mix of arid lands, tidal wave inundation from the Gulf of Kutch, and freshwater flooding from inland. Such a part-desert, part-wetland ecosystem is not found elsewhere in the world. The delicate balance of this ecosystem is bound to be disturbed by the introduction of 'copious amounts of freshwater' - it will push out the xeric flora-fauna, which are uniquely adapted to the Rann, and replace them with generalist species. Particularly threatened could be mammals, like the Wild ass and birds like the Large desert lark *(Alaemon alaudipes)* and the Desert or Creamcoloured courser *(Cursorius cursor).* [131]

Forests

The 14,000 hectares of forests of the SSP submergence zone, while considerably degraded, still contain a large diversity of flora and fauna that is capable of supporting over 70,000 people. Although compensatory afforestation and wildlife conservation measures are being undertaken or planned, there is no feasible way of completely recovering the loss of these forests, or of saving much of the biological diversity that they contain. This is heightened by the fact that compensatory afforestation in the case of SSP is being done in Kutch, an ecological zone completely different from the Narmada Valley. There will therefore be an inevitable loss. [96, 131] The forests at risk are rich in ecological terms, [127, 131] some even indicating "precious habitat for tigers, panthers, sloth bear, barking deer, several rare tree species, and hundred of plants with medicinal potential". [127]

Wetlands

The SSP will seriously disrupt aquatic ecosystems, both upstream and downstream of the dam. Downstream, it threatens the most productive Hilsa *(Hilsa ilisha)* fishery now left in India, and the giant freshwater prawn *(Macrobrachiun rosenbergii)*, in addition to having negative impacts on other aquatic life, including the mahseer fish. After full development of irrigation, virtually no water will be released downstream except during the monsoons. The hilsa has already suffered heavy declines due to large dams in several parts of India.

Upstream the globally red-listed Marsh crocodile *(Crocodylus palustris)* is threatened with extinction. [127, 131] As the silt accumulates behind the massive walls of the dam, fish populations are likely to decline, affecting the more than 10,000 families that depend on them for food. [96, 131]

Because of water and silt flow reduction, pollution, and flash floods, the Narmada estuary is likely to be adversely affected by the SSP. Saltwater ingress at the mouth of the river could be the most serious impact, with consequent declines in fisheries. Salinisation and increased pollution of underground water used for drinking and irrigation could take place around the estuary. Coastal geomorphology is likely to change, and bank erosion could occur. Saline ingress now already affects the river till about 72 km upstream from the river mouth at present, while tidal effects are felt as far up as 100 km upstream. Reduced flow in the Narmada due to the SSP would cause salinity to increase in large parts of the river. The river would literally flow backwards during the tides in the dry season, transferring salt and pollution from Bharuch upstream. Estuarine species are finely attuned to the daily and monthly variations in salt content of the water. Changes in the salt regime can affect the entire ecosystem, disrupting breeding and physiological functioning. In addition to low water flow affecting hilsa and the freshwater shrimp discussed above, the negative effect of salt ingress is likely to have a serious impact on other fauna and flora. [131]

Water logging and salinisation

An important environmental (and economic) risk of the SSP is the possibility of water logging and salinisation in the plains of Nimar (Madhya Pradesh), and in Gujarat, where over half the area (c. 55%) to be irrigated is moderately to severely prone to waterlogging and salinisation due to surface irrigation. The possible loss of about one million hectares of agricultural land due to waterlogging and salinisation is an environmental threat of huge magnitude, and is likely to seriously undermine the stated benefits.[ii, 131]

[ii] In arid and semi-arid areas drainage is usually geared to low rainfall conditions and is usually incapable of handling the much larger water amounts brought by surface irrigation. This, along with seepage from canals, overuse of water by farmers, and other factors depending on the geomorphology of soil and subsoil layers, lead to increasing water accumulation below the surface. Secondly, subsoil water and soils in and regions tend to be saline due to inadequate flushing by rainwater. Irrigation water, being saltier than rainwater, adds more salt to the system, leading to increased likelihood of salinisation.[131]

Resettling people

It has been argued that the impact of moving hundreds of thousands of people to other lands will also have a serious effect on the ecology of the area of relocation, creating serious environmental problems. [96] Over 4,200 ha of forest land in Maharashtra have so far been released for the rehabilitation for SSP displaced persons in Maharashtra. This was despite the statement in the conditional clearance that "no forest land will be used for rehabilitation of oustees". This was also done without any survey of the flora-fauna of the area. It is now anticipated that more such land will be released in Madhya Pradesh, which has the largest number of displaced persons. In addition, rehabilitation will result in increased pressure on the existing natural resources, with particular effect on grazing lands, forests, and waterbodies.[131]

3.3.7 Other issues and impacts of the Sardar Sarovar Dam

Submergence and resettlement

Around 37,000 ha in Gujarat, Maharashtra and Madhya Pradesh (MP) will be flooded by the 133 mile (213 km) long reservoir. Official estimates of the number of families to be displaced (called Project Affected Persons or PAPs; a 'PAP' is a family unit rather than a person) have increased around six-fold since 1979. The latest official estimates from the three states add up to 41,500 PAPs, or 207,500 people, around 80% of them in Madhya Pradesh. Almost all the PAPs in Gujarat and Maharashtra and perhaps half of those in MP are adivasis, or tribal people, belonging to a number of different groups collectively referred to as Bhils. [97]

Thousands of people who have been resettled are struggling to survive on cramped plots with no arable land or source of livelihood. Faced with these future prospects, villagers have vowed to remain on their lands and face submergence behind the partly built dam rather than face a life of certain destitution. [102]

In addition, over 80,000 ha of land in Gujarat will be lost to the canal network if it is ever completed. This may affect in particular the livelihood of the pastoralist Bharwar community, as grazing pastures and migratory routes will be drastically altered by the canals. [133] Estimates for the number of landholders to be affected by the canals range from 140,000 to 222,800. [97] Adding these to those in the reservoir area results in estimations of around half a million displaced persons. [98, 102] A disproportionate number of oustees are tribal people. [102]

Forest products

Submergence of forest area will not only destroy natural habitats but also a rich resource. Local and tribal people benefit from the forest by harvesting fruits and nuts, which provide an important supplement to their diet, and hundred of plants with medicinal potential occur. [96]

Downstream costs

The Narmada estuarine area is an important site for fisheries, and is also the location of the one of India's oldest ports, Bharuch. The loss of fisheries would represent an annual loss of Rs. 400 to 800 million to the fishermen and probably an additional Rs. 400 to 800 million to the fishing industry, since retail costs are at least double that paid to fishermen. [131]

Due to the flow reduction, salinisation and increased pollution of underground water used for drinking and irrigation could take place around the estuary. Large areas on both banks are likely to be affected by an extensive ingress of salt into groundwater after dam construction. Coastal geomorphology is likely to change, and bank erosion could occur, which could affect the Bharuch harbour. [131]

Diseases

A rise in the incidence of malaria is definitely anticipated by the SPP project authorities; the rise may be even more serious than they are expecting, because they have considerably under-estimated the possible extent of waterlogging. Both the reservoir and canals and waterlogged areas can become major breeding centres for malaria vectors. The planned ameliorative measures in the command area are also heavily dependent on chemical control. This could in itself become a major source of health problems. This issue has been raised several times in the meetings of the NCA Environment Sub-group, but has not been satisfactorily resolved. [131]

WCD Guidelines

IRN also evaluated Sardar Sarovar against the Guidelines of the WCD and made the following observations: [102]

Impact Assessments

WCD Recommendation: The WCD guidelines state that "Special attention is necessary to ensure that compensation and development measures are in place well in advance." The WCD also states that the precautionary approach should be taken "when information is uncertain, unreliable or inadequate and when the negative impacts of actions of the environment, human livelihoods, or health are potentially irreversible."

Reality on the Ground: There are no credible environmental studies or rehabilitation plans. Although the legal framework requires that affected people be given land-for-land compensation, there is no land available for resettlement. Conditional environmental clearance was given to the project in June 1987 although basic environmental impact studies required under Indian law were never completed and even today remain incomplete.

Public Acceptance

WCD Recommendation: The WCD states that no project should proceed without the "free, prior and informed consent of indigenous and tribal peoples." It states, "the acceptance of the project-affected people … should be obtained" and those

power imbalances should be addressed to enable stakeholder groups' equal footing at the table.

Reality on the Ground: Thousands of villagers and tribal people living in the Narmada valley are fiercely opposed to the project. Affected people have vowed to face submergence rather than sacrifice their livelihoods for the project. Their voices have gone unheard by project authorities. Affected people have been arrested, beaten and shut out of official meetings.

Defining who is affected

WCD Recommendation: The WCD urges that the "impact assessment includes all people in the reservoir, upstream, downstream and in catchment areas whose properties, livelihoods and nonmaterial resources are affected. It also includes those affected by dam-related infrastructure such as canals, transmission lines and resettlement developments."

Reality on the Ground: People affected by the extensive canal system are not considered as project-affected people and are not entitled to the same resettlement and compensation packages as those living in the reservoir area. Hundreds of thousands of people whose land or livelihoods are affected by either project-related developments or downstream impacts are not entitled to any compensation at all. [102]

3.3.8 Project financing of the Sardar Sarovar Dam

Project value:

US$ 5 billion. [135]

Financing overview:

The financing of the Sardar Sarovar dam has ran into trouble since the **World Bank** (International) pulled out in 1993. The dam is half-finished, and an intense political and legal struggle is continuing between the project organisation, Sardar Sarovar Narmada Nigam, local NGOs and the regional governments of Madhya Pradesh and Gujarat over the future of the project.[136]

In the mean time, Sardar Sarovar Narmada Nigam and its financial advisor **Industrial Credit and Investment Corporation of India** (India) are looking mainly to domestic sources to fund the finishing of the dam. [137]

Equity financing

No information is found on the equity financing of Sardar Sarovar Narmada Nigam.

Debt financing

The following information is found on debt financing of the Sardar Sarovar project:

- In 1985, the **World Bank** (International) had granted a US$ 450 million loan to the Sardar Sarovar Dam. After an international NGO campaign and a squabble with the Indian government, the World Bank was forced to withdraw from the Sardar Sarovar project in March 1993. At this point, US$ 280 million out of the US$ 450 million loan had already been disbursed.[138]
- In 1985, the OECF, which is now part of the **Japan Bank for International Cooperation** (Japan), issued a loan of 2,850 million yen (US$ 13.6 million) to the Sardar Sarovar project.[139]
- In November 1998, **Sumitomo Corporation** (Japan) provided a loan of 2.85 billion yen (US$ 24.7 million) to Sardar Sarovar Narmada Nigam to part finance the import of two 200 MW turbine-generator sets.[140]
- Some years ago, Sardar Sarovar Narmada Nigam has issued domestic bonds guaranteed by the government of Gujarat with a value of Rs 35.2 billion (US$ 725 million).[141]
- In June 2002, over 372 co-operative banks and other co-operative societies from Gujarat received government permission to invest Rs 5.0 billion (US$ 103 million) in the bonds issued by Sardar Sarovar Narmada Nigam.[142]

3.4 Laos: Nam Theun-Hinboun Dam

3.4.1 Introduction

The Theun Hinboun Hydropower Project (THHP) is the first of 5-6 planned dams on Nam [iii] Theun, a major tributary to the Mekong, in central Laos. [143] The Mekong is one of the Global 200 Ecoregions (no.144). Since its inception, controversy exits over its poor decision-making process, inadequate EIA, conflicts of interest, and potential for severe environmental and socio-economic impacts. [144] The power generated from the project is mainly (c. 95%) exported to Thailand, but some output is used for local domestic consumption. [145, 146, 149]

Closure of the Theun dam in December 1997 has created an impounded stretch of water extending some 24-km up the mainstream Theun, 14 km up the Nam Ngouang, and also some 3 km up the Nam Ao, a small stream entering the Theun at the damsite. [145] If Nam Theun 2, to be located further upstream, does go ahead, it will have a major impact on Theun-Hinboun by diverting water out of the Theun River resulting in a diminished downstream flow and a reduced power generation capacity. [148]

The THHP, a 210 MW trans-basin river diversion project located in Bolikhamxai and Khammouane Provinces of central Laos was officially opened on April 4, 1998. [147] It is a 30 year BOT (build-operate-transfer) project run by the Theun Hinboun Power Company (THPC) with a 30 year license. [148, 149] The Government of the Lao People's Democratic Republic (Lao PDR) owns 60%, 40 % is owned by foreign companies. Most of the Lao PDR Government's equity in the THHP was financed by a US$60 million loan from the Asian Development Bank (ADB). In June 1996, the THPC signed a 25-year power purchase agreement with the Electricity Generating Authority of Thailand (EGAT), and the project is presently exporting electricity to Thailand. [149]

Severe and unmitigated impacts were experienced by villagers as a result of the dam, including declines in fish catches,

[iii] Nam means river in Lao.

transportation difficulties, flooding of vegetable gardens, and erosion of fertile river banks (cf. §3.4.3). [147, 148]

A case has been made that the hydropower developments in Laos are the result of the strong influence of western advisors. These were welcomed in the country after the launch of the New Economic Mechanism in 1986, which marked the country's move towards a market economy. According to these advisors Lao PDR, with its large hydropower potential, low level of development, proximity to Thailand, and high level of foreign debt, had no option but to develop its hydropower resources and sell the power to Thailand. The ADB and World Bank encouraged the Lao government to allow private sector participation in the hydropower sector through the BOT mechanism. The private sector would build the project with their own financing; operate, maintain and manage the facility for a period of up to 30 years; and then transfer ownership to the government. Large aid resources were poured into exploring the options for hydropower development in Lao PDR. Numerous reports were produced by western hydropower consultancy companies eager to shore up a future for themselves in one of the most promising hydropower markets in the world. These reports formed the backbone of the Government of Lao's (GoL) development strategy. From 1993 onwards numerous agreements between foreign investors and the GoL were signed to build hydropower projects. By 1995, 23 MoUs had been signed with Korean, Thai, Australian, European and North American companies to build dams with a total capacity of 6,676 MW. The Lao government would have an equity share in all of the projects, and would benefit from royalties, taxes and proceeds from power sales.[150]

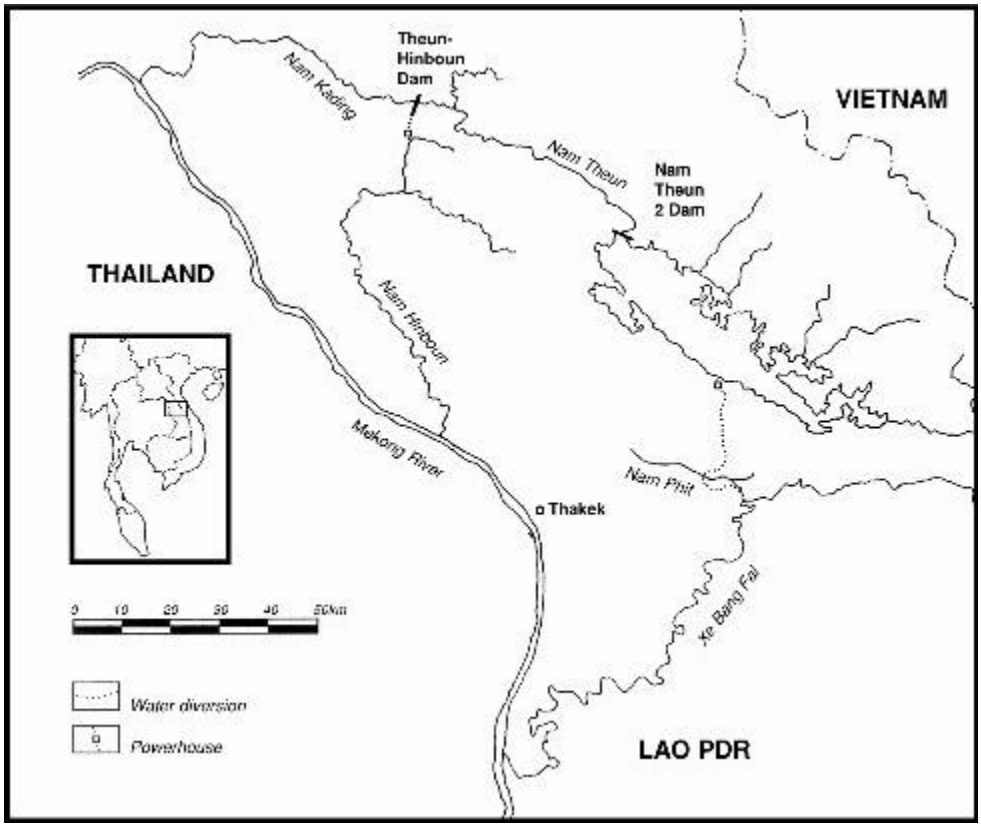

Figure 10: Map of Mekong River and its tributaries Theun and Hinboun[151]

3.4.2 Key project data

The Theun Hinboun Hydropower Project is located in two provinces. The dam (weir) is on the Theun River (Nam Theun) in Bolikhamxay province. The project diverts water from the Nam Theun (called Nam Kading downstream of the dam), down a 5.5-km headrace tunnel shaft, with about 900 m penstock, to a power plant located at the base of the mountain within the Hai/Hinboun river basin in Khammouan province. The water flows on through a 3.5 km tailrace canal and re-regulating pond into the Nam Hai stream, which flows 15 km before joining the Nam Hinboun that flows about 80 km onto the Mekong. [143,145, 148]

Location: Nam Theun / Nam Kading river, tributary of Mekong river, Laos
Global 200 Ecoregion: Annamite Range moist tropical forests (25), Mekong river (144)
Construction period: 1994 - 1998
Height: 25 meters
Production capacity: 210 MW
Reservoir area / volume: unknown
Project operator: Theun Hinboun Power Company (THPC) under a BOT construction with a 30 year license. [148,

[149] THPC is 60 percent owned by the state utility, Electricité du Laos, 20 percent owned by GMS Power (formerly MDX of Thailand) and 20 percent by Nordic Hydropower AB. The latter was taken over in 1993 by Statkraft, the Norwegian state utility, and Vattenfall, its Swedish counterpart. [152]

Building consortium: Nordic Hydropower supervised the dam's construction and won the contract for operation and maintenance. Norwegian and Swedish companies supplied the electrical and mechanical equipment with financing from Nordic export credit agencies and the multilateral Nordic Investment Bank. [152]

Power generation equipment suppliers: Recchi-CMC and Kvaerner in Norway supplied two 105-MW turbines with ABB generators.[153, 154]

Other companies involved:

Norplan (now Norconsult International), a Norwegian consulting company[155]

In 1997, Electrowatt Engineering was responsible for advisory services, technical review and construction supervision of the Theun Hinboun dam. [154]

Figure 11: Nam Theun Hinboun Dam, Laos [153]

3.4.3 Environmental issues and impacts

The main issues regarding the environmental impacts of the Theun Hinboun dam relate to: i) the inadequate and improper procedures followed; ii) changes in river flows; iii) erosion and sediment loads; iv) conservation areas; v) fish.

Unacceptable procedures

The construction of the Theun Hinboun dam began in 1994. The final impact studies for the project were not completed or released until May 1996, one and a half years after construction had already begun and when it was too late to include some of the recommended mitigation measures. The original EIA conducted in 1993 by Norplan (now Norconsult International), a Norwegian consulting company with links to the Nordic dam building industry, was of such poor quality that the study's financier, NORAD, had rejected it soon after its completion. The final impact studies, by the same firm, were still criticised

for ignoring many key impacts of the project and for not adequately consulting with local communities. Nonetheless, the study did raise many serious concerns and questions about the potential impact of the dam, particularly on fisheries and wildlife - as well the uncertainty caused by the lack of adequate baseline data and inadequate time available to conduct the studies. [155] The World Commission on Dams summarised the procedure by: "Environmental Impact Analysis (EIA): too little, too late". [159]

In violation of the ADB's own guidelines, affected villagers were not consulted prior to construction nor were they ever informed about potential negative impacts arising from the project. [150, 159] The 5,000 people who lost farming land and fisheries to the project were never informed about the project, still less consulted about its construction. [154]

The ADB approved the project based on the proponents' environmental assessment that concluded the dam would have "significant beneficial environmental impacts." Four years later, the ADB was forced by public pressure to admit that the project has caused extensive damage to fisheries and water supplies, affecting an estimated 53 villages and thousands of people in the Theun-Hinboun valley. In April 1998, Bruce Shoemaker, released a report [148] that documented villagers' claims that the dam had caused fish catches to decline as much as 90 percent, disrupted water supplies, and destroyed agricultural land (cf. underneath). Shoemaker also reported that Theun-Hinboun proponents had misled villagers about the project's impacts, and he concluded that THPC should directly compensate affected families. The ADB responded with a warning that efforts to force THPC to pay additional costs would damage the confidence of foreign lenders and investors in Lao PDR. Six months later, the ADB admitted that the damage to fisheries was far more serious than proponents had predicted but insisted that it was up to the Lao government, not THPC, to pay for long-term environmental mitigation costs. [152]

Overall, the Nordic institutions and the ADB approved financing for the dam despite warnings from several government agencies and environmental advisors in Norway that the proponents' environmental assessments were inadequate and misleading. The Norwegian environment

ministry found nine of the proponents' claimed positive effects to be "highly questionable." Vattenfall's senior ecologist, Per Sjostrom, noted that the proponents had failed to develop a plan for fisheries management in the dam's reservoir, rural electrification, irrigation, and mitigation of downstream impacts. The Norwegian state pollution control authority found the assessment "far from satisfactory" and concluded that it "cannot recommend implementing this project on the basis of the existing data". [152]

In 2000, the THPC finally has admitted that over 10,000 households are enduring socio-economic impact, and that there are a number of unresolved environmental impacts too. As a result a "Mitigation and Compensation Program" has been adopted. A review by Bruce Shoemaker suggests that the THPC report still significantly understates the project's negative impacts, and critiques the proposed mitigation and compensation measures as unresponsive to those directly affected. [144, 157]

The fact that Theun Hinboun is the first dam on the until now unexploited Nam Theun river, implies that one should have been especially thorough studying the social and ecological environment of the area and possible negative effects of the project. Norplan (1995) indicated in its report that the negative impacts of the Theun Hinboun project may be severe and thereby affect the entire population of the region. Norplan then also wrote that the Theun Hinboun project risked becoming a major factor in reduction in fish biodiversity in the river, perhaps even so far as to render some species extinct before they are discovered and researched. Experience shows that after one dam is built on a river, this is used as an argument for more dams, as the river ecology will already be disrupted. There is a danger that other dam builders on the Nam Theun will use the Theun Hinboun in this way. Both the fact that Theun Hinboun is the first dam to be built on the Nam Theun river and that it is only one of several planned development projects in the region should have required a thorough investigation of cross-project impacts before NORAD decided to finance the Final Design of the project. [143]

River flows

The Theun Hinboun dam has severely altered river flows, because of its transfer of water from Nam Theun to Nam Hinboun. Both the reduced downstream flow on the Nam

Kading river (as Nam Theun is called downwards of the dam) and the dramatically increased flow and turbidity in Nam Hai and Nam Hinboun have strong impacts on fish populations and (drinking) water availability. [145, 154, 156]

The Norplan (1995) report recommended a minimum downstream release of water below the dam of 10 m^3/sec - and a subsequent assessment of the report by the Norwegian energy utility (NVE) recommended 15 m^3/sec. The Norplan report stated "It is therefore imperative that a minimum release of water is maintained at all times to sustain fish life in the Nam Kading and thereby a diverse wildlife within the NBCA (National Biodiversity Conservation Area)." "This report recommends a minimum flow of 10 m^3/sec to Nam Kading below TH dam, after weighing power sector and environmental interests against each other." Project engineers and economists, however, were unhappy with these recommendations - they worried that a minimum down-stream release of 10 m^3/sec to the Theun River would be too costly in terms of reduced electricity generation (i.e. more water would be released below the dam instead of going through the turbines). They therefore decided set the minimum downstream release at only 5 m^3/sec - ignoring the recommendations of their own studies, and reducing that the down-stream Theun River to a trickle. [155]

This situation is even further aggravated in the recent THPC's Mitigation and Compensation Program report (2000). According to Shoemaker, this report's recommendations would endorse a policy of no longer striving to maintain dry season releases downstream, because of the revenues of electricity production, whereas the THPC formerly made a commitment to maintain a minimum flow of 5 m^3/sec. This despite the fact that "The river section between the Dam Site and the Nam Mouan junction is receiving inadequate post-project flows to prevent profound environmental changes taking place". [144, 157] This will result in completely drying out 40 kilometres of river downstream for most of the year and cutting off 70% of the downstream river flow for 140 kilometres. [154] If there is no minimum water release the project may turn out to totally destroy the ecological system of the area 40 km downstream of the dam, and possibly have serious negative effects on the river down to the confluence with the Mekong. [143]

Erosion and sediment load

The strongly increased flows in Nam Hai and Nam Hinboun rivers have caused erosion leading to loss of riverbank habitats and farmland, and strongly increased turbidity leading to reduced fish populations and problems for drinking water supply. [145, 156]

Conservation Area disrupted

Ironically, immediately downstream from the dam site, the Theun River (known as the Kading River from here on down to the Mekong) flows 40km through the Nam Kading National Biodiversity Conservation Area (NBCA), officially declared a protected area in 1993, as part of a government program supported by the World Conservation Union, to conserve wildlife and fisheries. Meanwhile the dam has cut off flow and decimated fish stocks downstream. [148, 158]

The Nam Theun catchment is one of the few remaining parts of South-East Asia with large areas of undisturbed primary forest with a wide diversity of habitat types and high diversity of wildlife. There are three protected areas near the project site; The Nakai Nam Theun NBCA, The Nam Kading NBCA and Khammouane Limestone Protected area. The Wildlife Conservation Society (WCS) conducted the supplementary study on wildlife and vegetation. According to WCS the lack of flow in the dry season will be the most devastating aspect of the project with regard to impacts on the wildlife: "The loss of dry-season water flow in the Nam Kading could have such a disruptive effect on the large mammal and riparian bird communities that it is possible the entire forest ecosystem of the NBCA would be altered." The WCS emphasised that unless proper mitigation measures are implemented, the project would have far reaching negative effects on the ecosystem, and populations of several globally threatened birds and mammals could be seriously affected. In addition "Ongoing work in the construction and infrastructural area is destroying pristine forest habitat". [143]

The WCS was highly critical of the findings in the first EIA conducted by Norpower/Norconsult, which stated that the project in general will have no negative ecological effects: "None of the numerous threatened species located during the current survey was found by the fieldwork for this EIA, or even suspected to be present. Norconsult (1994) lists various reasons as to why there were no indications of endangered species in the project area. In fact, all these suggestions are irrelevant and

misleading: the conclusion concerning threatened wildlife is inaccurate and was presumably reached because fieldwork was exceptionally brief". [143]

Decreasing fish populations

The best documented ecological impacts of the dam are those on fish populations, not surprisingly as these directly affect an important food source of the local population. Contrary to the first predictions of Norpower's original EIA (1993), fish resources have significantly decreased both upstream of the dam and downstream in Nam Theun/Kading and Nam Hinboun. In the downstream Nam Kading, river levels are lower than normal and in the Nam Hinboun, downstream of the discharge channels from the power station, river flow and turbidity have increased dramatically. Both of these effects have caused of reduced fish catches. [156] As the WCD summarised neatly:

"Adverse impacts on downstream fisheries have been severe, even in projects implemented in the 1990s. These impacts were not adequately assessed in, among others, ... Theun Hinboun in Laos..." [159]

Already the supplementary studies showed that fisheries in the new reservoir would likely decline in the long term after impoundment, both in species diversity and in sustainable yield over time. In the Norplan (1995) study it is suggested that the fish catch upstream of the dam can be reduced with as much as 50 percent. Norplan also wrote that the Theun Hinboun project risks becoming a major factor in reduction in fish biodiversity in the river perhaps so far as to render some species extinct before they are discovered and researched. [143]

The strong public concern about the dam's impact on fish populations and fisheries in both the Theun / Kading river the Hai / Hinboun river systems forced NTPC to commission a monitoring study on fisheries which was carried out by fisheries specialist Terry Warren throughout 1998. He found and published serious impacts on the rivers' fish resources. In addition, Shoemaker has extensively documented the impacts as observed by local fishermen. He reported strongly reduced fish catches over long stretches (up to the Mekong) of Nam Theun, at both sides of the dam, and Nam Hai/Hinboun. [148]

Although Warren's detailed report was submitted to THPC in June 1999, 12 months later (in June 2000) neither the THPC nor the ADB had released the report publicly, nor had any of the recommendations in the report been acted upon. Unable to get a response from THPC or the ADB, Warren finally decided to present a summary of his findings of his study at an international conference in Sydney in June 2000. He concluded that the dam has caused long-term reduced fish catches both in the head-pond area above the dam, and for communities down-stream of the dam in both / Theun / Kading and the Hai / Hinboun rivers. He called for further monitoring, and an increase in the minimum by-pass flows from the current 5 m^3/sec to 10 m^3/sec. His report was also very critical of the lack of adequate fisheries studies carried out prior to the project being approved. [155]

The major impacts to fish populations and fisheries identified by Warren are: 1) The blocking of the upstream wet-season spawning migration in the Theun, 2) The submerging of rapids and the alteration in aquatic environmental conditions in the head-pond area, 3) The temporary reduction in water quality in the Theun head-pond in May 1998, 4) The quantity of dry-season minimum by-pass flows released past the Theun dam, 5) The nutrient-trap effect of the Theun head-pond, 6) The loss of natural hydropower downstream of the dam, 7) The increased dry-season flows in the Hinboun and its associated increased sediment load, and 8) Migratory disorientation in the Nam Hai. [146]

Finally, in 2000, the Theun-Hinboun Power Company has recognised that there exists an array of unmitigated, negative project effects. The THPC's mitigation and compensation program report cites the following. [160]

Downstream donor river (Kading)	• Severe damage to 32.5km of aquatic and riverbank/island habitats and wild populations. • Mild damage to 64.2km of aquatic and riverbank/island habitats and wild populations. • Very severe damage to fish migration route.
Headpond	• Severe damage to 41km of aquatic and riverbank/island habitats and wild populations. • Severe damage to a narrow strip of terrestrial habitats and wild populations above riverbank for 41 km. • Severe damage to fish migration route.
Downstream recipient river (Nam Hai/ Nam Hinboun)	• Severe damage to 19km of aquatic and riverbank /island habitats and wild populations (Nam Hai). • Moderate damage to 108km of aquatic and riverbank/island habitats and wild populations (Nam Hinboun).

3.4.4 Other issues and impacts

Obviously, the impacts on fish resources strongly affected food availability for the local population in the project area. This is further documented underneath, along with other socio-economic impacts such as the need to relocate homes and the loss of agricultural lands. Before that, the totally inadequate treatment of the population's interest is discussed.

General

Bruce Shoemaker's 1998 study, 'Trouble on the Theun-Hinboun', released by the International Rivers Network (IRN), documented detailed claims by villagers that fish catches had declined by as much as 90 percent, water supplies had been disrupted and farming land destroyed. The report also showed how villagers had been misled by the project proponents, and had not received adequate compensation.

The response by the ADB and THPC to the Shoemaker report was to not only brazenly attempt to discredit his findings (claiming for example, that reduced fish catches were due to lower rainfall that year), but also to intimidate and harass villagers that had spoken to Shoemaker. An ADB Mission, which was sent out as a response to the IRN report, had a picture of a villager who had spoken to Shoemaker on its front page, stating that the villager 'could not remember exactly what

he had told Mr Shoemaker two months ago'. In a country where there the political space for dissent is clearly restricted, such tactics raise serious questions about the ADB's role in silencing the voice of affected people. [155] This is illustrated in the following quote:

"The names and positions of villagers consulted during investigations were recorded. However, they cannot be included in this report. This is because previous experiences in the THHP area have revealed that village informants may be subjected to direct or indirect intimidation if their identities are revealed". [144]

The Theun-Hinboun project has created as yet unmitigated social and environmental damages. In 2000, the THPC has admitted that over 10,000 households are enduring socio-economic impact. A somewhat different view of the situation is presented in a review of the THPC's plan by Bruce Shoemaker, commissioned by the International Rivers Network and released in December 2000. It suggests that the THPC report significantly understates the project's negative impacts, and critiques the proposed mitigation and compensation measures.

Shoemaker indicates that the suggested program lacks accountability to local citizens, presents unclear criteria for evaluating project impacts, allocates funds in ways that may not reach the affected villagers, fails to recognise that citizens have a right to direct and immediate compensation for fisheries losses, and relies on development investments that are not certain to result in benefits to the affected persons. He also notes that the THPC report's recommendations would endorse and make permanent a policy of no longer striving to maintain dry season releases downstream, whereas the THPC formerly made a commitment to maintain a minimum flow of 5 m^3/sec.[157]

Procedure and recompensation

Although the EIA, conducted by Norconsult (formerly Norpower), stated the project would have "significant beneficial environmental impacts" it was criticised as inadequate by the Norwegian state agencies required to review the EIA. The ADB, however, used this EIA to justify construction of the dam.

The ADB claimed that “there is little for the environmental lobby to criticise in Theun-Hinboun... there is no flooding, virtually no reservoir, and no need to resettle anyone.” However, following pressure from international groups the ADB conducted two missions to investigate the social and environmental impacts of Theun-Hinboun. The report of the mission of November 1998 admits there are “major impacts related to Project operation” those include damage to village water supplies, vegetable gardens and fisheries. From this mission the ADB recommended that the Project impact zone be redefined and proposed that villages in the newly defined project impact zone be “adequately” compensated by the THPC. However, the ADB’s recommendations for mitigation and compensation fall well short of ensuring local livelihoods are protected and also deflect attention from the fact that the impacts were identified by independent research well before construction started. [161]

The required amount of compensation estimated by environmental groups is around US$3.6 million. [162]

However, Theun-Hinboun is itself a prime example of the flawed process outlined above--for which Lao citizens in the area and the country as a whole are now paying a heavy price.

The poor process of project approval for Theun-Hinboun has been well documented in numerous studies and reports. The original EIA conducted by Norconsult in 1993 was of such poor quality that the study's financier, NORAD, rejected it soon after its completion.

But despite their shoddy performance, the consultant was rewarded with additional management contracts on the project. Additional EIA studies were not finalised until one and a half years after construction had already begun and it was too late to include some of the recommended mitigation measures.

In violation of the ADB's own guidelines, affected villagers were not consulted prior to construction nor were they ever informed about potential negative impacts arising from the project. Despite numerous experiences from other projects around the world, almost no consideration was given to the potential for massive disruptions to fishing resources in the Theun and Hinboun Rivers.

The private developers were freed from liability for negative impacts resulting from the project and almost no money was allocated for compensation. Little or no baseline data on the importance of fishing and riverbank gardens was collected. Thus, when dramatic impacts began to occur shortly after the project was completed, there was no adequate system in place to monitor and document these impacts or to provide adequate compensation in a timely manner. Most importantly, there was no way for local communities to hold the project developers accountable for the impacts their project was having on their livelihoods.

When outside criticism has occurred, the response of the ADB and project developers has been to try to immediately discredit and discount it. Until recently the ADB chose to totally ignore the mounting evidence of severe impacts to the livelihoods of villagers in the Theun-Hinboun area. Only after sustained international criticism and evidence provided by their own consultants, did the ADB and the developers finally begin to acknowledge the extent of the problem. But despite their assurances, a comprehensive and systematic method for documenting losses, providing adequate compensation and holding the project developers accountable to impacted communities has still not been instituted. Financial projections used to gain approval for the project have also recently been shown to be very inaccurate as actual revenues have been much less than expected.

That the MDBs and other hydropower proponents can, despite all the evidence to the contrary, continue to hold up Theun-Hinboun as a positive model for emulation raises many fundamental questions about the competence and sincerity of these institutions. The problems are so severe--and the practices and responses to date of the MDBs, other donors and the international hydropower industry so inappropriate and inadequate--that a moratorium on further involvement until fundamental reforms are made should be strongly considered. Particular attention needs to be ensuring the rights of local communities to control the use of their natural resources and to be adequately compensated for their use. Efforts are also needed to reform the corrupt system of consultant conflict of interest. Hydropower consulting companies and individuals with a history of malfeasance—in Laos or elsewhere--should be disbarred. The many incentives for consultants to become

project promoters, and to downplay the true social, economic, and environmental costs of proposed projects, should be eliminated. Immediate attention should be given to the issue of addressing the problems that have been created by projects already undertaken. This should include a sincere effort to document and understand the impacts already inflicted on thousands of Laotian citizens by Theun-Hinboun and other projects and the timely provision of meaningful compensation. It must be recognised, however, that such material compensation is unlikely to ever fully make up for the social, cultural, and economic disruption many local communities have already endured. [163]

Thousands of Lao citizens now suffering harmful impacts from the Theun-Hinboun project are not receiving direct compensation for their losses and there are no plans to provide them with any such compensation in the future. In October 1994, the Lao government, acting with legal advice from the ADB, signed a license agreement with the THPC, which limited the Company's obligations to provide compensation and environmental mitigation to US$1 million. This apparently arbitrary figure was based on an assumption of minimal environmental impacts as predicted by the discredited Norpower/Norconsult EIA.

In 1996, one and a half years after the beginning of construction, a new environmental study commissioned by NORAD revealed that the environmental mitigation costs would be much higher than originally envisioned and led many observers to question the lack of funding for such measures. In October 1996, the company signed a supplemental agreement with the government that increased the amount that developers would allocate for environmental mitigation and compensation from US$1 million to US$2.59 million. THPC also agreed to a 5m3/second minimum downstream release and to flush sedimentation past the dam. The agreement absolved THPC from any further obligation to assist with mitigation or compensation measures for the life of the project.

Within the entire US$260 million dollar project cost--which includes this US$2.59 million for the mitigation program--a total of only US$50,000 has been allocated for all resettlement and compensation costs for affected local people. The bulk of the mitigation funds, US$1.6 million, were allocated for the

construction of the re-regulating pond at the end of the tailrace canal to help reduce erosion in the Nam Hai during periods of peak flow. Another US$130,000 was allocated for design modifications to the dam to allow for a minimal water flow downstream. Also included was support for a monitoring program (US$300,000), clearing of obstructions in the Nam Hai (US$100,000), modifications to the tailrace canal (US$50,000), treatment and protection of spoil heaps (US$100,000), a local information program (US$15,000), and funding for studies on irrigation, fisheries management, and rural development (US$250,000) to be implemented by foreign consulting firms. No money for the implementation of any activities recommended in these three studies was included. [148]

Shortly after the closure of the dam in early 1998, villagers began suffering increasingly severe impacts to their livelihoods from the project. These impacts have included the loss of fisheries, flooded vegetable gardens, loss of drinking water supply, lowered water tables, impaired boat and pedestrian access to surrounding areas, inundated agricultural lands, bank erosion, and the loss of fishing equipment. This has created great hardships for thousands of local people-reducing their food security, cash income, and overall quality of life. The THPC and the ADB initially refused to acknowledge these impacts. But by late 1998, following overwhelming evidence from both outside sources and the THPC's and ADB's own consultants, the ADB publicly acknowledged for the first time that local people were being seriously harmed by the project. The provision of timely and adequate compensation to all affected villagers was promised by the ADB.

Unfortunately, what followed was a series of delays, poor process, and apparent stalling by the THPC. A survey of the impact zone, which was to begin immediately, was delayed. When it did occur it was of such poor quality that it was of limited use. By August 1999, villagers were frustrated and angry about the project's performance and lack of progress on compensation. A November 1999 ADB mission admitted the survey had been of little use, the THPC was failing to meet expectations regarding compensation measures, and that local people were suffering serious impacts. Finally, the THPC released its Mitigation and Compensation Program report in September 2000. [144]

While some positive measures have been initiated, there are many serious concerns with the MCP. These include [164]:

Lack of Accountability to Local Citizens: Villagers do not appear to have had sufficient opportunity to give input into proposed mitigation and compensation measures or to formally approve of the MCP plan. The MCP provides no system for affected villagers to hold the THPC accountable for its actions. No allowance is made for independent verification of whether the MCP is performing adequately to the satisfaction of local people. This is contrary to recommendations made by the WCD.

Failure to establish criteria for evaluating project impacts: The ADB and THPC may still be underestimating project impacts in some areas. It is unclear why the households in the lower Nam Kading watershed are listed as only suffering "mild impairment" to their fisheries as outside reports have suggested severe impacts are occurring. The MCP fails to provide detailed information on what methodology and criteria it used for evaluating impacts.

Misallocation of resources to consultants and officials instead of villagers: Approximately three quarters of the "definitive or probable" MCP budget will be spent on further studies, assessments, plans, and monitoring. Most of the remainder is for development initiatives of uncertain benefit to local people. Only US$137,500-for the purchase of water pumps for gardens-is allocated as direct compensation to villagers. The "contingent" budget may provide additional funding for direct compensation but no firm commitments are made.

Failure to recognise citizen's rights to direct compensation for fishery losses: The MCP, using a flawed rationale, fails to provide any direct financial compensation to villagers who have suffered from lost food security and cash income due to the destruction of their fisheries. The MCP proposes to make villagers wait-possibly up to ten more years-for unclear benefits to materialise from fish ponds and other development initiatives in order to make up for the harm inflicted on their livelihoods. Permanent losses require permanent solutions and direct compensation will have to be provided. Compensation must be retroactive to the time of dam closure and should continue through the life of the project unless it is proven that alternative and sustainable food production and income generating opportunities have already

been successfully provided to affected villagers to their satisfaction.

Reliance on risky development initiatives without substantiating claims of future benefits: The MCP makes claims of future benefits without any substantiation or evidence that those benefits will in fact materialise. The MCP proposes aquaculture as the solution to the loss of wild fisheries even when the THPC's own fisheries consultant warns that this is a risky strategy not appropriate for the Theun-Hinboun area.

MCP proposes to cut-off downstream flow: The THPC wants to renege on its commitment to allow a minimum 5 m^3/sec of water to flow downstream into the Nam Kading-through a conservation area and past villages already suffering from the impacts of lowered water levels. The THPC claims revenues gained will be used to fund the MCP, but no commitments to expend additional funds on compensation beyond what THPC has already committed to do are provided. Eliminating the minimum flow can be expected to further harm the ecology of the Nam Kading and would exacerbate all of the negative impacts being experienced by villages in the lower Nam Kading basin, creating the need for yet more compensation and mitigation.

There are other concerns with the MCP, including contradictory plans regarding fish pass construction, the failure to fairly assess 1996 flood damage upstream of dam, and the continued problems and misunderstandings at Ban Namsanam, the village situated next to the tailrace canal, and other villages that were forced to move as a result of the project.

While instituting a just system for compensating affected villagers is a long-overdue step for the Theun-Hinboun Hydropower Project, the flaws and inadequacies in the proposed MCP provide cause for concern. The MCP, as proposed, actually represents a step backwards in efforts to gain redress and justice for those Lao citizens now suffering impacts from the project for almost three full years. The loss of villager food security and cash income through impaired fisheries has not been remedied in any way. In effect, very poor rural villagers continue to subsidise the profits of the Theun-Hinboun Power Company. The project is in clear violation of ADB lending guidelines which state that local citizens should be left no worse off by their projects. [144]

Resettlement

The ADB and THPC have made repeated claims that no resettlement is required for Theun-Hinboun. This is a distortion of the actual situation in the project area. While it is true that mass forced resettlement has never been an issue, Theun-Hinboun has caused a considerable amount of displacement of local people and has the potential to cause further dislocation. The project has almost no allocated funds to assist or compensate those villagers who do find they need to move due to the project.

According to a 1995 study commissioned by NORAD, bank erosion problems along the headpond would potentially require 20-30% of families in four villages to relocate. This appears to be occurring now. The villagers are very afraid of flooding and want to move, but are presently reluctant to do so because they have not yet received any assistance. The move will be very disruptive, labour intensive and result in the loss of the gardens and fruit trees they have at their current location. Many other villages along the Nam Hai/Hinboun also express similar fears of flooding and feel they may have to move. The substantial impacts the project is already having on local people's livelihoods may also end up causing further relocation. Project staff, publications, and consultants, when they acknowledge these issues at all, refer to all of this as "relocation" rather than resettlement but the affected Lao people are not making such semantic distinctions. [148] It has been estimated that approximately 6,000 people in 25 villages near the project site may be forced to resettle to other places. [162]

Farmland

Considerable amounts of valuable farmland have been lost, because of inundation (head pond and Hinboun dry season riverbank garden areas), erosion along the head pond and in the receiving rivers (Hai/Hinboun) and project construction, in particular of power lines. [145, 148]

The THPC's mitigation and compensation program report [160] observes that the most often occurring impact on villagers in the project area is the loss of customary use of lands due to power transmission lines.

Drinking water

The increased flows stemming from the dam in Nam Hai and Nam Hinboun have caused the water to become as turbid as “muddy” and fast flowing. Hence, in the bordering villages drinking water is much more difficultly obtained. [145]

Shoemaker illustrates: "Before the dam closed and the water came up we got drinking water from springs down on the riverbank during the dry season. In the rainy season we get water from other nearby streams which flow at that time. Now the springs are all flooded with the muddy river water and we must go long distances to find drinkable water. The project said they would give us 200,000 kip (US$80) for well drilling but until now we have not received the money even though we requested it many times. Even today our village head has gone to the project to ask again. But now we also know that 200,000 kip will not be enough to drill the wells." --Villager at Ban Vang Dao (on the Nam Hinboun just downstream from where the water from the powerhouse enters the Nam Hinboun from the Nam Hai), March 2, 1998. [148]

3.4.5 Project financing

Project value: US$ 240.3 million [165]

Financing overview: The Nam Theun-Hinboun dam was established as a BOT (build-operate-transfer) project. This means that the Theun-Hinboun Power Company (THPC) will build the dam and will operate it during a concession period of 30 years (1998 - 2028). After this period, the dam will be transferred at no cost to the government of Laos. The advantage of this structure for the government of Laos is that it will not be exposed to financial risks such as construction cost overruns.

Estimated total project costs amounted to US$ 270.0 million, but actual costs turned out lower: US$ 240.3 million. This means that committed loans were scaled back. The actual financing structure of the project, for which **Citigroup** (United States) acted as financial advisor, was as follows: [166]

Equity	Theun-Hinboun Power Company	US$ 110.0 million - 45.8%
Debt	Loan from Laos government	US$ 6.9 million - 2.9%
	Loans from foreign ECAs	US$ 58.6 million - 24.4%
	Loans from foreign commercial banks	US$ 64.8 million - 27.0%

The financing structure of Nam Theun-Hinboun shows an exemplary mix of different sources of funding: development agencies and multilateral banks (funding part of the equity), ECAs and commercial banks. Notably though, is that large

Western banks were involved as financial advisors but didn't commit funds themselves. The commercial bank loans were completely funded by a syndicate of Thai banks.

Equity financing

The equity of the Theun-Hinboun Power Company (THPC) equalled US$ 110 million, or 45.8% of total project costs. This equity was financed as follows: [167]

- GMS Power (90%) - Thailand
  with Crown Property Bureau (10%) - Thailand US$ 22.0 million
- Vattenfall (50%) - Sweden
  with Statkraft (50%) - Norway US$ 22.0 million
- Electricité du Laos - Laos US$ 66.0 million

The equity contribution of Electricité du Laos (US$ 66.0 million) as well as a loan from the government of Laos to THPC (US$ 6.9 million) together amounted to US$ 72.9 million. Of this amount, US$ 72.5 million was financed by the following grants and interest-free loans to the government of Laos: [168]

- **Asian Development Bank** - International - US$ 57.7 million
- **Nordic Development Fund** - International - US$ 7.3 million
- **Norwegian Agency for Development Cooperation** - Norway - US$ 7.1 million
- **United Nations Development Programme** - International - US$ 0.4 million

ECA financing

ECA loans with a total amount of US$ 62 million were secured in 1996 by the Theun-Hinboun Power Company. Of these loans, only US$ 58.6 million was actually disbursed: [169]

- Banque Indosuez, which is now part of **Crédit Agricole** (France) and **Australia and New Zealand Banking** (Australia) arranged two ECA-guaranteed loans: [170]
  - A US$ 30.3 million loan from development agency **Absec** (Sweden), which was guaranteed by **Exportkreditnämnden (EKN)** (Sweden);
  - A US$ 21.0 million loan from **Eksportfinans** (Norway),

which was guaranteed by **Garanti-Instituttet for Eksportkreditt (GIEK)** (Norway).

- Another ECA-loan of US$ 10.7 million was extended by the **Export Import Bank of Thailand** (Thailand). [171]

Commercial bank loans:

A consortium of Thai banks in 1996 committed commercial bank loans for the baht equivalent of US$ 121.5 million. Only US$ 64.8 million was actually committed. The following banks (including their commitments) participated in the syndicate: [172]

- **Bangkok Bank** Thailand - US$ 45.3 million
- **Bank of Asia** Thailand - US$ 18.9 million
- **First City Investment** Thailand - US$ 9.5 million
- **Siam City Bank** Thailand - US$ 19.2 million
- **Siam Commercial Bank** Thailand - US$ 19.0 million
- **Union Bank of Bangkok** Thailand - US$ 9.5 million

3.5 Lesotho Highlands Development Project

3.5.1 Introduction

The Lesotho Highlands Water Project (LHWP) – is a massive, multi-dam scheme built to divert water from Lesotho's Maloti Mountains to South Africa's industrial Gauteng (formerly Transvaal) Province. It involves the construction of six dams in Lesotho's Maluti Highlands between 1990 and 2020 (fig. 12) below). The scheme will eventually divert about 40% water of the Senqunyane river basin, via a complex system of dams, pumps and tunnels to the Ash River in the neighbouring Gauteng province of South-Africa. Gauteng includes the major conurbations of Johannesburg and Pretoria, as well as the highest concentration of mining and industrial activities in the country. Water demand in this area is still growing strongly.

Figure 12: The location of the Lesotho Highlands Development Project sites (source: South Africa Department of Water Affairs)

History

The project was initially presented as a development project to generate revenues for Lesotho by sales of water to South Africa and to increase domestic power production. However, the initiative for the project came from South Africa that had been eyeing the freshwater resources of Lesotho since the 1950's.

When General Metsing Lekhanya ousted Leabua Jonathan in 1986 and installed a military puppet, a deal to develop the LHWP was quickly sealed. [173] The overall management of the project lies with Trans Caledon Tunnel Authority (TCTA) and the Lesotho Highlands Development Authority (LHDA), a Lesotho parastatal company. The project is financed by a numerous financial institutions, which include the World Bank (5% of phase 1A).

Subject of this case study

This case describes phase 1A and B of the LHWP. These phases involve the construction of three large dams and associated water transfer infrastructure, two of which have been finished. [174]

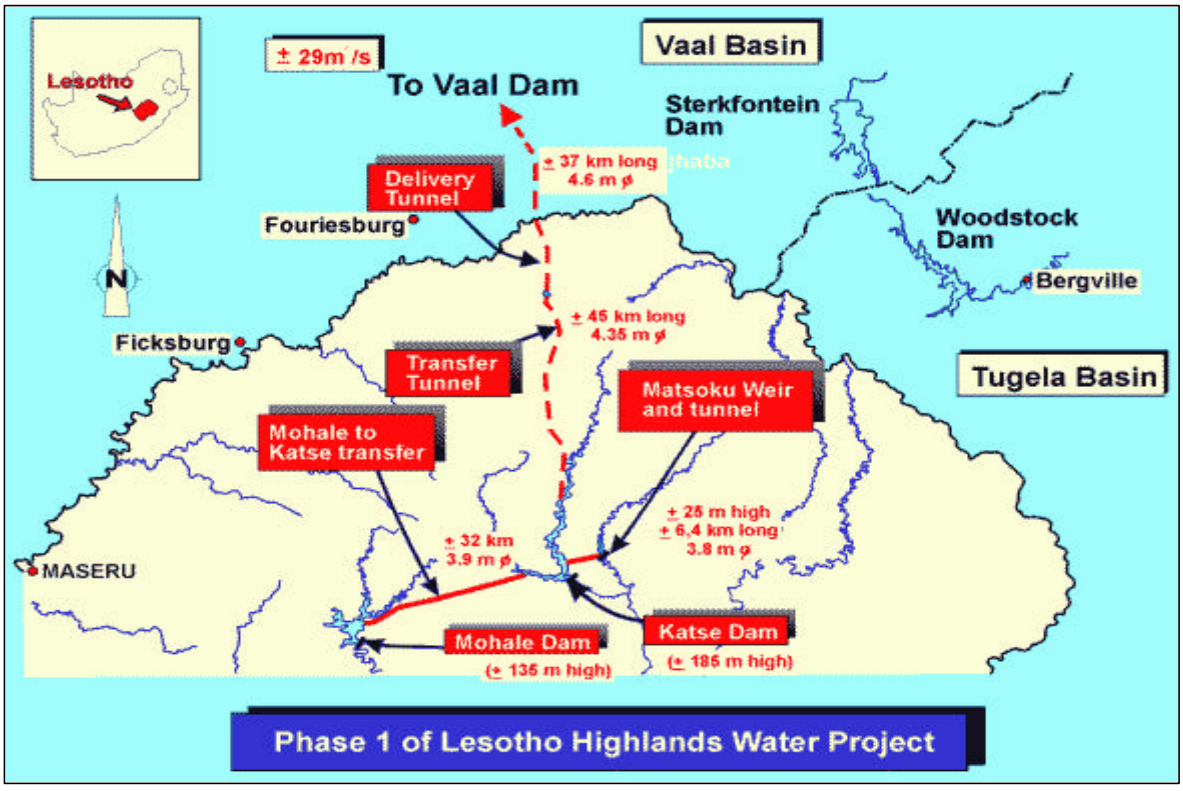

Figure 13: Phase 1A and B of the Lesotho Highlands Water Project. (Source: South Africa Department of Water Affairs)

3.5.2 Key project data

Only phase 1 of the LHWP has been approved so far. Construction of the Katse Dam, the Muela Dam and 82 kilometres of tunnels together comprise Phase 1A of the LHWP, which was finished in 1998 and since then results in a waterflow of 18 m^3/second to the Ash River and the production of hydropower. Phase 1B, which is still under construction, comprises the Mohale dam, 38 kms of transfer tunnels and the Matsoku weir (see fig. 13 above). [175] A total of 5 phases comprising 7 dams and weirs was initially foreseen. Completion or even continuation of the project is uncertain.

Figure 14: The 186 m. high Katse dam (Africa's highest) under construction © Martin Rigby

Katse dam (Phase 1A)

Global 200 Ecoregion: Drakensberg montane woodlands and shrublands (105)
Construction period: 1986-1998
Height: 186 meters
Hydropower capacity: No power generation.
Reservoir area / volume: 3,600 hectares / 1,950 million m^3
Catchment area / mean annual runoff: 186,900 hectares / 560 million m^3 [176]

Water diversion capacity: 18 m³/s (equals 567 million m³ / year at 100% efficiency)
Total tunnel length: 82 km
Project operator: Lesotho Highlands Development Authority (Lesotho) is responsible for the dam component, while Trans Caledon Tunnel Authority (South Africa) is responsible for the water transfer component.[177]
Building consortium: Impregilo (Italy, 30%), Hochtief (Germany), Bouygues (France), Kier (United Kingdom), Stirling (United Kingdom), Concor (South Africa) and Group Five (South Africa).[178]
Other companies involved: Dumez (France), Sogreah (France), Coyne et Bellier (France), Sir Alexander Gibb (United Kingdom), Lahmeyer (Germany), Mott Macdonald (United Kingdom) and Consult 4 (South Africa).[179]

Muela dam (Phase 1A)

Global 200 Ecoregion: Drakensberg montane woodlands and shrublands (105)
Construction period: 1986-1998
Height: 55 m.
Hydropower production capacity: 72 MW
Reservoir volume: 6.0 million m³ [180]
Project operator: Lesotho Highlands Development Authority (Lesotho) is responsible for the dam component, while Trans Caledon Tunnel Authority (South Africa) is responsible for the water transfer component.[181]
Building consortium: Spie Batignoles (France), LTA (South Africa), Campenon Bernard (France), ED Zublin (Germany) and Balfour Beatty (United Kingdom). [182]
Power generation equipment suppliers: ABB (Sweden/Switzerland) and Kvaerner (Norway).[183]
Other companies involved: Dumez (France), Sogreah (France), Coyne et Bellier (France), Sir Alexander Gibb (United Kingdom), Lahmeyer (Germany), Mott Macdonald (United Kingdom) and Consult 4 (South Africa).[184]

Mohale Dam and Matsoku diversion weir (Phase 1B)

Global 200 Ecoregion: Drakensberg montane woodlands and shrublands (105)
Construction period: 1998-2002
Height: 144 meters (Mohale dam) 15 meters (Matsoku weir)
Reservoir area / volume: 2,200 hectares / 938 million m³
Catchment area / mean annual runoff: 93,800 hectares / 315 million m³
Water diversion capacity: 12 m³ / sec (378 million m³ / yr at 100% efficiency)[185]
Project operator: Lesotho Highlands Development Authority (Lesotho) is responsible for the dam component, while Trans Caledon Tunnel Authority (South Africa) is responsible for the water transfer component.[186]
Building consortium: Impregilo (Italy), Hochtief (Germany) and Concor (South Africa) [187]
Other companies involved: Lahmeyer (Germany), Mott Macdonald (United Kingdom) and Consult 4 (South Africa).[188]
Remarks: The Mohale Dam, the Mohale Tunnel (32 kilometres) and the Matsoku Diversion weir together form Phase 1B of the Lesotho Highlands Water Project, which is aimed at increasing the water supply from the Lesotho Highlands to the South-African Gauteng province from 18 to 30 m^3/second.[189]

3.5.3 Environmental issues and impacts

This section discusses direct impacts of the LHWP on natural resources.

Upstream effects

Loss of agricultural lands

The project –if fully implemented- causes the flooding of 11,000 hectares of grazing or arable land, affecting 20,000 – 30,000 mostly subsistence farmers. [190, 191] Food security diminished as a result of the flooding of this highly productive (alluvial) land.

Increased erosion

Deforestation and erosion increased as agriculture, cattle ranching and fuelwood collection shifted to steeper slopes, both in the Katse and Mohale catchments and in the resettlement areas elsewhere in Lesotho. [192] Road construction has induced accelerated erosion and degradation of pastures.

Access to natural resources

The flooding of the valleys limits the access of local populations to resources previously obtained from rivers and river margins. Beside the loss of prime agricultural land, supplies of fuel wood, thatching grass, river sand, fish and medicinal plants have become scarce in project areas. Flooding of the steep and narrow valleys with mild microclimates limits shelter for cattle herds. [193]

Rare or endangered species

A direct result of the LHWP is the loss of biodiversity in the unique mountainous ecosystems (mountain wetlands) in Lesotho. These ecosystems and the specific plant and animal species have a regional and global significance. Due to a change in flow regimes, water quality and human activities, several endangered plant and animal species (i.e. the bearded vulture) in the Senqu / Orange River basin (part of the Global 200 Drakensberg montane shrublands and woodlands ecoregion) will be placed under severe strain and may entirely disappear from the project areas. [194]

On site effects

Reservoir-induced seismicity (RIS) has been reported since the Katse reservoir has been filled, damaging more than 50 houses.[195] The Katse dam was built to withstand earthquakes of 6.5 Richter scale magnitude, where 6.0 quakes are known to have occurred in the area before dam construction. [196]

Downstream effects

Streamflow

An Instream Flow Requirement (IFR) study to assess the impacts of the LHWP dams and diverting tunnels (present and future) on downstream communities and ecosystems found that continuing with the project as proposed will reduce Lesotho's river systems to "something akin to wastewater drains." The study states, that the construction of the next LHWP dam would reduce the natural water flow through river channels into South Africa by 57 percent – but since it is restricted to studying impacts in Lesotho, it does not detail what harm will be caused to the river basin as a whole. [197]

According to the International Rivers Network not even in Gauteng many people will benefit as the majority of the township population simply can't afford the imported water. Additionally, the local water board distributor, Rand Water can (because of LWHP costs) or will not invest in maintaining the leaking pipes in the townships. [198]Furthermore, the dams' impact "will manifest as strongly deteriorating physical and chemical conditions". [199]

Endangered species

The instream flow requirement studies foresee major biological changes for up and downstream areas. It predicts dense algal growths throughout the system, which can be toxic to fish; encroachment of exotic plants (at the expense of native plants--and the species that depend on them); moderate to critically severe increases of blackfly and other pest populations which prey on livestock; reductions in most fish populations, with some species like the Maloti minnow and trout reaching the point of extinction; declines in waterfowl, and an explosion in rodent populations, which could affect crops along the riverbanks. [200]

3.5.4 Other issues and impacts

Resettlement

The construction of the dams dispossess more than 30,000 rural farmers of assets (including homes, fields, and grazing lands) and deprive many of their livelihoods. In an effort to prevent the permanent impoverishment of these people, the governments of South Africa and Lesotho promised in the project treaty that affected people "will be enabled to maintain a standard of living not inferior to that obtaining at the time of first disturbance." Evidence suggests that standards of living for the majority of project-affected people are in fact declining, since the project start. Few affected people have been able to re-

	establish livelihoods, and displaced people have been hurried into resettlement sites without access to water and other resources. [201]
Compensation payments	Although the LHWP had foreseen a resettlement budget that is significantly higher than other World Bank projects (US$ 62,500 per household for people resettled from the Katse dam area and US$ 31,200 per household for Mohale dam residents)[202], the scarcity of arable land in Lesotho forced many of the resettled people to develop a livelihood away from agriculture. Compensation packages were deemed "grossly undervalued" by the affected people and their NGO allies. [203]
Dam safety	Occasional incidents of people and livestock having drowned in the reservoirs, flooded quarries and during flood gate tests have been reported. [204]
Social and health impacts	The huge influx of outsiders applying for construction jobs disrupted the local communities by undermining traditional governance systems, increased prices, crime rates and prostitution. Additionally, HIV infection rates soared from 0.5% in 1992 to 22% in 1999. [205] Sacred burial sites and other places of cultural or religious significance were flooded or destroyed for access road construction.
Corruption	The Lesotho Highlands Development Authority (LHDA) chief executive, Masupha Sole has been prosecuted for corruption during the construction of the LHWP. Thirteen international companies and contractors were involved in bribing Sole. Trials against companies and intermediaries allegedly involved in paying the bribes are proceeding. Although the bribes were small in comparison with the capital investment, the authorities are determined to recover the money from the parties who paid Sole. Where practical, moneys are withheld from the contractors. This year (2002) a World Bank internal investigation exonerated Acres and Gibb. It said it would examine the judgement and the trial transcript before taking any further decisions. Its policy is to debar any company found guilty of corruption on bank- financed projects. The Canadian engineering company Acres International of Ontario is employed on two other controversial dams funded by the bank: the Bujagali dam in Uganda and the Nam Theun 2 dam in Laos. Ryan Hoover of the International Rivers

Network in California, which campaigns for human rights and environmental protection, said: "The Acres verdict throws into doubt the legitimacy of their involvement in other dam projects throughout the world. Anything less than disbarment would undermine not only the World Bank's own corruption policy but also it poverty-alleviation objectives".

Finally, it has been proposed to debate the challenges of addressing corruption in large water projects, during the Earth Summit as part of the programme at the so-called "Water Dome". [206]

3.5.5 Project financing

Project values:

US$ 2,415 million (Phase 1A) [207]

US$ 1,132 million (Phase 1B) [208]

Financing overview:

The Lesotho Highlands Water Project is a joint project between the government of South Africa and the kingdom of Lesotho, carried out by the project operators Lesotho Highlands Development Authority (Lesotho) and Trans-Caledon Tunnel Authority (South Africa). Lesotho Highlands Development Authority (LHDA) is responsible for mobilising capital for project implementation within Lesotho and Trans-Caledon Tunnel Authority (TCTA) is responsible for the South African part of the project. But TCTA is managing all debt of the LHWP, including the debt owed by the LHDA.

The original financing structure of Phase 1A, with total project costs of US$ 2,414.8 million, was as follows: [209]

Equity:	Republic of South Africa	US$ 579.2 million	24.0%
	Kingdom of Lesotho	US$ 57.2 million	2.4%
Debt:	Loans from foreign development banks and agencies	US$ 391.2 million	16.2%
	Loans from foreign ECAs	US$ 411.0 million	17.0%
	Loans from foreign banks	US$ 67.0 million	2.8%
	Loans **Development Bank of Southern Africa**	US$ 241.0 million	10.0%
	Loans & bonds from Southafrican investors	US$ 668.2 million	27.7%
Total:		US$ 2,414.8 million	

Possibly, the loans from foreign development banks and agencies include some grants to the Lesotho government as well. This would mean the debt financing would be somewhat lower than presented here, and the equity contribution of Lesotho would be somewhat higher. Nevertheless: it seems clear that South Africa provided the largest equity portion for the project, while the status of Lesotho as a LDC-country and a member of the ACP-countries made it possible to attract a large amount of development loans. Foreign financing (from outside Lesotho and South Africa) accounted for 36.0% of total project costs.

The original financing structure of Phase 1B, with total project costs of US$ 1,132 million, was as follows: [210]

Equity:	Republic of South Africa (included SA loans below) - pm		
	Kingdom of Lesotho	US$ 26 million	2.3%
Debt:	Loans from foreign development banks		
	.	US$ 162 million	14.3%
	Loans from foreign commercial banks		
	.	US$ 71 million	6.3%
	Loans **Development Bank of Southern Africa**		
		US$ 47 million	4.2%
	Loans & bonds from Southafrican investors		
		US$ 826 million	73.0%
Total:		US$ 1,132 million	

Clearly, South Africa is financing the major part of Phase 1B, although the division between the Southafrican government, Southafrican banks and Southafrican bondholders is not clear. Foreign financing accounts for 20.6% of total project costs. Different from phase 1A, direct financing by bilateral development agencies as well as by ECAs is absent (although ECAs have issued guarantees for part of the foreign commercial bank loans).

The two financing structures presented above, describe the situation at the start of Phase 1A and Phase 1B respectively. Since then TCTA - which is managing the debt of the entire LHWP - is in the process of refinancing some of the debt. Several foreign loans granted for Phase 1A are maturing shortly and are being replaced by funds raised by TCTA on the Southafrican capital market. TCTA has an extensive programme of long-term bond issuances, guaranteed by the Southafrican government, which are sold to Southafrican investors.
At the end of March 2002, the LHWP had a total outstanding debt of R 17,588 million (US$ 1,552 million). At that moment, this debt was financed as follows:

• Bonds issued in South Africa	R 11,339 million	64.5%
• Loans from Southafrican banks	R 2,308 million	13.1%
• Foreign loans	R 3,733 million	21.2%
• Others	R 208 million	1.2%

Already, the foreign financing percentage has clearly decreased. And according to the TCTA, the foreign funding component

will decrease substantially during the 2002/03 financial period as all Phase 1A foreign loans are going to be refinanced in the local capital market. [211]

Equity financing:

The equity financing for the LHWP is provided by the governments of South Africa and Lesotho.

Loan financing:

The following information is found regarding loans issued to TCTA and LHDA to finance the LHWP:

- The following development agencies and multilateral development banks have reportedly committed loans to the funding of Phase 1A of the Lesotho Highlands Water Project (LHWP) in the early 1990s: [212]
  - **African Development Bank** - International - US$ 50.0 million
  - Foreign development agencies - Various - US$ 117.8 million
  - Commonwealth Development Corporation (now: **CDC Capital Partners**) - United Kingdom - US$ 36.1 million
  - **Development Bank of Southern Africa** - International - US$ 241.0 million
  - **European Development Fund** - International - US$ 57.0 million
  - **European Investment Bank** - International - US$ 20.0 million
  - **United Nations Development Programme** - International - US$ 0.3 million
  - **World Bank** - International - US$ 110.0 million
- The following foreign ECAs have reportedly committed loans to the funding of Phase 1A of the Lesotho Highlands Water Project (LHWP) in the early 1990s: [213]
  - **Coface** - France - US$ 104.0 million
  - **Export Credits Guarantee Department** - United Kingdom - US$ 82.0 million
  - **Hermes Kreditversicherungs** - Germany - US$ 118.0 million
  - **SACCE** - South Africa - US$ 107.0 million
- The following foreign banks have reportedly committed loans to the funding of Phase 1A of the Lesotho Highlands Water Project (LHWP) in the early 1990s: [214]
  - Banque Nationale de Paris (now part of **BNP Paribas**) - France - US$ 19.7 million

- **Crédit Lyonnais** - France - US$ 17.0 million
Hill Samuel (now part of **Lloyds TSB**) - United Kingdom
with **Crédit Lyonnais** - France - US$ 14.5 million
- Dresdner Bank (now part of **Allianz**) - Germany
with **Kreditanstalt für Wiederaufbau** - Germany - US$ 15.8 million

- The following development agencies and multilateral development banks have reportedly committed loans to the funding of Phase 1B of the Lesotho Highlands Water Project (LHWP) at the end of the 1990s: [215]
  - **Development Bank of Southern Africa** - International - US$ 47.0 million
  - **European Investment Bank** - International - US$ 109.0 million
  World Bank - International - US$ 45.0 million
  Additionally, US$ 8 million of the **World Bank** loan for Phase 1A was used for Phase 1B.
- In September 1995 Deutsche Morgan Grenfell, which is part of **Deutsche Bank** (Germany), was appointed as financial advisor to the LHDA for the financing of Phase 1B of the LHWP.[216]
- In September 1997, an international banking syndicate provided a loan to TCTA for Phase 1B of the LHWP. Probably, the total value of this loan was US$ 71 million. ECAs guaranteed part of the loan. The banks arranging the syndicate were: [217]
  - **Bankgesellschaft Berlin** - Germany
  - **Crédit Lyonnais** - France
  - Crédit Suisse First Boston (part of **Crédit Suisse**) - Switzerland
  - Dai-Ichi Kangyo Bank (now part of **Mizuho Bank**) - Japan
  - Fuji Bank (now part of **Mizuho Bank**) - Japan
  Other banks participating in the syndicate were: [218]
  - Banc Agricol i Comercial d'Andorra
  (now part of **Andbanc Grup Agricol Reig**) - Andorra
  - Bank of Tokyo-Mitsubishi (part of **Mitsubishi Tokyo Financial**) - Japan
  - **Banque et Caisse d'Epargne de l'Etat** - Luxembourg
  - BfG Bank (now part of **SEB**) - Sweden
  - **Caixa Geral de Depósitos** - Portugal
  - **Frankfurter Sparkasse** - Germany
  - **National Bank of Abu Dhabi** - Abu Dhabi
  - **National Bank of Greece** - Greece
  - **Norinchukin Bank** - Japan

- **Nedbank** (South Africa) and **Standard Bank** (South Africa) supplied a loan of M 40 million (US$ 8.2 million) to the LHDA for the construction of the Maseru-by-pass road in November 1997.[219]
- **HSBC Bank** (United Kingdom) and **Crédit Lyonnais** (France) supplied a loan of M 230 million (US$ 51 million) to the LHDA for the Mohale Tunnel in December 1997.[220]
- In November 1998, **Nedbank** (South Africa) supplied a loan of M 60 million (US$ 10.5 million) to the LHDA for refinancing of loans for the Muela Hydropower station. [221]

Bond financing:

The following information is found regarding domestic bond issues of TCTA to (re)finance the LHWP:

- In November 2001, TCTA started issuing its fifth series of domestic bonds on the South African capital market. All bonds are guaranteed by the Southafrican government, making them more attractive to domestic investors. The first four series had fixed interest rates, the fifth is inflation-linked and matures in 2015. The total value of all five series, when fully issued, is R 23.5 billion (US$ 2.1 billion). Total value of TCTA bonds outstanding at the end of March 2002 was R 11,339 million (US$ 1.0 billion). [222]
  Each month a number of bonds of various bond series is being auctioned to South-African investors. Six banks are responsible for this selling process: [223]
  - **Deutsche Bank** - Germany
  - **Gensec Bank** - South Africa
  - **Investec** - South Africa
  - **J.P. Morgan Chase & Co.** - United States
  - **Rand Merchant Bank** - South Africa
  - **Standard Bank** - South Africa

Credit guarantees:

The following ECAs are reported to have provided credit guarantees for Phase 1B of the Lesotho Highlands Water Project: [224]

- **Hermes Kreditversicherungs** - Germany
- **SACE** - Italy

3.6 Brazil: Tucurui Hydropower Complex

3.6.1 Introduction

The Tucurui Hydropower Complex is situated on the lower Tocantins River within the Tocantins-Araguaia River Basin adjacent to the Amazon basin in north-eastern Brazil.

Figure 15: Location of the Tucurui dam. Map: World Commission on Dams

The Tucurui complex produces 4,000 MW of power, which constitutes 70% of all electric power produced in Northern Brazil and is the largest dam ever constructed in a rainforest environment. Eletronorte, a state-owned regional electricity producer, operates the dam. The complex was built with the primary objective to produce hydropower although the secondary goal of providing a navigable river route was later introduced. The latter is unlikely to materialise due to financial constraints. The completion of phase I (the Tucurui dam, upper locks and 4,000 MW generation capacity) took from 1975 till 1984. Phase II is planned to be finished in 2002 and involves the building of a new powerhouse for the installation

of 11 additional turbines with a total power rating of 4,125 MW. The plans to finish the canal and lower locks as part of phase two seem to be stalled. [225]

Approximately 60% of the generated power is distributed to predominantly foreign-owned electro-metallurgical plants (mostly aluminium smelters) at subsidised rates. The power distribution contracts were tied to the international price of aluminium, which has dropped. Critics question whether the beneficiaries have made Tucurui a good investment, while two thirds of Tucurui's electricity has been exported, in the form of aluminium, at a loss of around US$ 4 billion (TVE, 2001). The remainder 40% is used to meet consumer demand in the surrounding states. In 2000, the States of Pará and Maranhão relied for 97% and 100% respectively, on Tucurui power. It took until 1997 to link Tucurui village at the foot of the dam to the electrical network, and by June 1998 only three towns in the lower Tocantins region had been electrified.[226] [227]

Figure 16: The 77 m. high, 12.5 km wide Tucurui dam. Photo: © Fernando Clark [228]

Integrated hydropower program

The Tucurui Hydropower Complex is part of the integrated hydropower program for the Tocantins and Araguaia River Basins. Upstream from Tucurui, the Serra da Mesa Power Plant (1,275 MW) is completed, with the Canabrava and Lajeado power plants currently under construction. For the long term, a total of 13 hydroelectric dams are planned for the Tocantins-Araguaia basin.

History

The initial drive behind the construction of the hydropower complex was to provide electricity for the town of Belém and the surrounding region. By the time the Tucurui complex was under serious consideration, the primary focus of the project changed to one aimed at providing power for the energy intensive electro-metallurgical industry in the region. Additionally, a secondary purpose, the implementation of two locks linked by a canal was considered in order to ensure the navigability of the river so that ore from Carajás region could be shipped out along the Tocantins River for export through ports in the Belém region. Ultimately, industrial interests drove the building of the Tucurui complex.

During phase I of the implementation of this power complex, only the upstream lock head was built. The construction on phase II began in June 1998 with the first turbine scheduled to be operational by December 2002. As described above, finishing the lock and canal system has been postponed due to a lack of finance. [229]

Subject of this case study

Since phase II of the Tucurui dam has not yet been finished, this case study will focus on phase I. However, some data on phase II have been included where available.

3.6.2 Tucurui Hydropower Complex key project data

The completion of Tucurui phase I was budgeted for about US$ 7.5 billion, with a 77% cost overrun. 26% of these costs were made up of interest during construction. For phase II, US$ 1.35 billion is foreseen for the hydropower component and US$ 340 million for the (uncertain) lower locks component. [230]

Construction period: 1975-1984 (Phase 1); 1998-2002 (scheduled; Phase 2)
Height: 70 meters
Width: 12,515 meters, of which 6,900 meters main dam wall
Hydropower capacity: 4,000 MW (operational) + 4,125 MW to be installed by 2002
Reservoir area / volume: 285,000 hectares / 45,500 million m^3 (or 45,5 km^3)
Useful volume: 32,000 million m^3
Catchment area / mean annual runoff: 758,000 km^2 / 334,000 million m^3 (or 334 km^3)[iv]
Project operator: Eletronorte (Brazil).
Building consortium: Oderbrecht (Brazil).[231]

[iv] Catchment area for the entire Tocantins basin; more than 95% is located upstream of the Tucurui dam.

Power generation equipment suppliers: ABB (Sweden/Switzerland), General Electric (United States) and Inepar (Brazil). [232]
Other companies involved: Engevix (Brazil) and Themag (Brazil). [233]

3.6.3 Environmental issues and impacts

Upstream impacts

Habitat loss and ecosystem changes

2,850 km² of land was submerged, which was mostly covered by rainforest. Most settlements and 280,000 animals were relocated in the direct surroundings of the reservoir. Apart from the loss of the region's most important breeding grounds for fish and many other animals in forests, waterfalls and flood forests, the connection between the upper and lower Tocantins was severed. [234] Ecological reserves for terrestrial species have been designated but there is pressure from environmental and social NGOs to change their status to extractive reserves. [235]

Biological diversity

In the reservoir area, fish diversity declined almost 30%, from 173 to 123 species. In the upstream areas, the decline was 25%, from 150 to 113 species. The environmental and ecological surveys (carried out by INPA, the Brazilian Amazon Research Institute) commissioned by Eletronorte was carried out years after the construction work started, and therefore lacks a proper ecological baseline. These surveys recorded 531 non-fish vertebrates and plans were made to maintain viable communities for all species. However generally, these studies and the resulting recommendations did not have the scope to enact significant changes to the project. [236] Endangered aquatic species especially affected by the Tocantins-Araguaia complex are the two river dolphin species (*Inia geoffrensis*, or Pink dolphin and *Sotalia fluviatilis*, or Tucuxi dolphin) and the yellow-spotted Amazon River turtle, or Tracajá (*Podocnemis unifilis*). [237]

Water quality

Once the reservoir was filled the water eutrophicated, which resulted in a dense mat of water weeds covering up to 25% of the reservoir (approx. 70,000 hectares). The latter contributed subsequently to high fish mortality. In 1994, 10 years after the flooding the weed cover had been reduced to approximately 10%. Water quality is deemed 'adequate' by the WCD, but in the same paragraph it states that [waters of] "…the riverbank sections, most accessible for daily use by local communities, are not always adequate for human use". [238] An indirect but

significant impact of the construction of the Tucurui dam is the severe pollution of the Tocantins river upstream of the dam with mining waste from the iron and aluminium industries supplied by the Tucurui dam. [239]

Greenhouse gases

Greenhouse gas (GHG) emissions from the Tucurui reservoir (methane, CH_4 and carbon dioxide, CO_2) have not been monitored extensively. Data from 1998 and 1999 indicate that emissions per kWh are lower than coal or diesel plants, and comparable to natural gas combined cycle plants. Based on these figures, Tucurui is mentioned as a relatively 'clean' dam. [240] Based on the same data, the International Rivers Network claims Tucurui produces 50% more GHG's than a gas fired plant and warns that there are a lot of uncertainties involved in measuring greenhouse gas emissions from reservoirs [241,242.] GHG emissions in the initial stages of flooding may have been much higher, as only slightly more than 10% of the forest in the reservoir area was cleared prior to flooding, and significant eutrophication of the reservoir occurred in the first ten years of the dam's existence.

Downstream impacts

Flow regime changes

The regularisation of the river flow after the dam's construction prevented seasonal flooding of downstream riverbanks, affecting the natural fertilisation process. Nutrient content of floodwaters has decreased as well as nutrient rich sediments are trapped in the reservoir. [243]

Water quality

Water flowing in the lower Tocantins River released by the dam is of lower quality than before dam construction. Especially during dry season, dissolved oxygen levels are low. Anoxic (i.e. zero oxygen content) water from the tailrace [v] does not mix with more oxygen-rich spillway water over a stretch of forty kilometres, inducing recurrent large scale fish mortality. [244]

Biological diversity

The dam imposes a physical barrier to migratory species, the reduction of seasonal floods, the entrapment of nutrient rich sediments behind the dam and the decreased oxygen content of the water has severely impacted biological diversity in the

[v] The water used for power generation derived from oxygen-poor deeper zones in the reservoir.

Tocantins river and floodplain. The number of fish species in the lower Tocantins decreased from 164 to 133, a 19% decline. The decline in fish species is seen as an indicator for overall disruption of downstream ecosystems. [245] As mentioned above, the two river dolphin species (*Inia geoffrensis*, or Pink dolphin and *Sotalia fluviatilis*, or Tucuxi dolphin) and the yellow-spotted Amazon River turtle, or Tracajá (*Podocnemis unifilis*) are threatened by the construction of dams in the Tocantins-Araguaia basin. [246]

Transmission lines

Phase II of the Tucurui hydropower complex includes the construction of high voltage connections to Maranhão and Pará. These transmission lines cut through indigenous areas and intact forest landscapes, which will be opened up for colonists and fortune seekers. Claims of indigenous communities were ignored or denied ([247], see also disrupted communities below).

3.6.4 Socio-economical issues and impacts

Resettlement and compensation

Initially, approximately 3,000 people were estimated to be resettled. Based on various reports, WCD estimates that eventually 25,000 to 35,000 people were forced to move. In the compensation scheme provided by Eletronorte and implemented by INCRA, the Brazilian Colonisation Agency, the criteria to assess assets of those to be relocated by the dam only took some material aspects into consideration. Investments in land, social and significance values were not considered, nor were actual livelihoods, when relocating families. Fishing families were resettled away from water bodies and forest extractivists were relocated in farmland. Compensation packages were generally assessed as too meagre. In 1981, seven years after the construction started and under great pressure from grassroots groups, Eletronorte established a committee to consider a total of 2,247 relocation cases. In 1994, 126 cases remained unresolved.

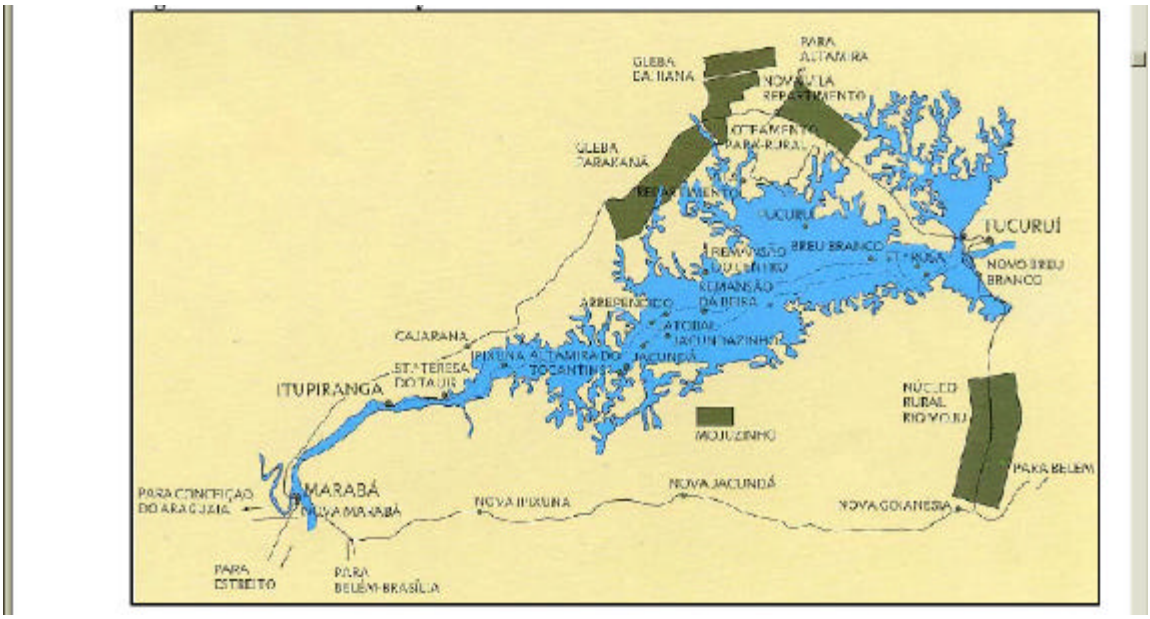

Figure 17: Resettlement areas (dark grey) and flooded towns (blue dots) in and around the Tucurui reservoir

Access to natural resources

Flooding and ecosystem degradation lead to decreasing availability of forest and freshwater resources to resettled and surrounding communities. Many villagers were resettled in environments not matching their natural resource management skills (see above). Depletion of fish stocks downstream of the dam is severe (for example, the commercially important ubarana (*Anodus sp.*) became almost extinct locally), but compensation has been limited to villagers living in the area flooded by the reservoir. [248] [249] Ecological reserves on islands in the reservoir have been colonised and are requested to be declared extractive reserves by an alliance of environmental and social NGOs to provide a source of livelihood to these colonists.

Disrupted communities

The start of the dam construction in the mid-70's of the last century triggered a huge inflow of labourers; much more than the project could employ. The population of the immediate area around the dam construction site increased sixfold. Immigrant labour and fortune seekers increased levels prostitution and alcoholism. [250] Indigenous groups have been particularly affected: three Parakanã village groups whose (formally established) indigenous territories were drowned by the reservoir were split up, moved around various unsuitable relocation sites until they threatened to block the Transamazonia highway and "employ terror tactics". A

programme was subsequently agreed that resulted in the Parakanã culture being assimilated in mainstream Brazilian culture. The downstream Asurini and Gavião da Montanha tribes were harassed by Eletronorte to give up their lands to accommodate road and powerline construction. Claims for compensation were never settled or denied by Brazilian courts.

Health effects

The occurrence of waterborne diseases such as malaria, filariasis and schistosomiasis exploded after the reservoir was established and migrant workers poured in. In addition, AIDS and other sexually transmitted diseases increased. During project execution, infant mortality in Tucurui was six times higher than the Pará state figure. Health problems have also been associated with the alleged extensive use of Agent Orange-like defoliants. The Brazilian government admitted use of defoliants but denied health impacts. [251]

Dam safety

The Tucurui complex was the first major dam in the Brazilian Amazon. Its design was based on limited knowledge of the area's geography, which lead to an underestimation of reservoir area (163,000 ha estimated vs. 285,000 ha actual or 75% higher) and volume (34 km³ estimated vs. 45.5 km³ actual or 34% higher). On top of that, 1980 flow rates turned out to be higher than the maximum flow rate ever recorded for the Tocantins River, on which the dam design was based. Based on the latter event, the spillway capacity was increased by 10%. [252]

3.6.5 Project financing phase I

Project value:

US$ 5,541 million [253]

Financing overview:

The Tucurui dam was built between 1985 and 1994 at a total cost of US$ 5,541 million. The project was financed as follows:

Equity:	Equity Eletronorte	US$ 2,533 million	45.7%
Debt:	Loans Eletrobrás and Brazilian banks	US$ 2,175 million	39.3%
	Loans foreign banks and ECAs	US$ 833 million	15.0%
Total:		US$ 5,541 million	

Equity financing: Eletronorte invested US$ 2,533 million of its own equity in the Tucurui dam, equivalent to 45.7% of total project costs. [254]

Debt financing: Domestic and international loans financed 54.3% of total project costs. The following information was found regarding the debt financing of the Tucurui dam: [255]

- Domestic loans accounted for US$ 2,175 million, or 39.3% of total project costs. Loans were provided by Eletrobrás itself as well as by the following Brazilian financial institutions:
  - BNH (now part of **Caixa Econômica Federal**)
  - **Banco do Brasil**
  - **Caixa Econômica Federal**
  - FINAME (part of **BNDES**)

- In June 1981, Eletrobras secured a US$ 300 million loan from an international banking syndicate comprising 32 banks. The proceeds would be used for financing the construction of the Tucurui dam. Lead managers for the loan were:
  - **Arab Banking Corporation** Bahrain
  - **Bank of America** United States
  - **CIBC** Canada
  - Chase Manhattan (now part of **J.P. Morgan Chase & Co**.) United States
  - Dresdner Bank (now part of **Allianz**) Germany
  - **Libra Bank** (now dissolved) United Kingdom
  - **National Bank of Canada** Canada
  - Nippon Credit Bank (now part of **Aozora Bank**) Japan

- In July 1981, Eletrobras secured a US$ 50 million loan from an international banking syndicate comprising 7 banks. The proceeds would be used for financing the construction of the Tucurui dam. Participating in the loan syndicate were:
  - **Bank of America** United States
  - Bankers Trust (now part of **Deutsche Bank**) Germany
  - Continental Illinois (now part of **Bank of America**) United States
  - Crocker National Bank (now part of **Wells Fargo & Co**.) United States
  - First Chicago (now part of **Equiserve**) United States

- First Interstate (now part of **Wells Fargo & Co**.) United States
- **Royal Bank of Canada** Canada

- In July 1981, Eletronorte secured a US$ 150 million loan from an international banking syndicate. The proceeds would be used for financing the construction of the Tucurui dam. Participating in the loan syndicate were:
  - **Banco do Brasil** Brazil
  - **Bank of America** United States
  - Continental Bank of Canada (now **Continental Corporation**) Canada
  - **European Brazilian Bank** (now dissolved) United Kingdom
  - Manufacturers Hanover Trust (now part of **J.P. Morgan Chase & Co**.) United States
  - **National Bank of Canada** Canada
  - Nippon Credit Bank (now part of **Aozora Bank**) Japan

- In October 1984, Eletronorte secured a US$ 170 million loan from an international banking syndicate headed by Manufactures Hanover Trust, which is now part of **Morgan Chase & Co.** (United States). The proceeds would be used for financing the construction of the Tucurui dam.

3.6.6 Project financing phase II

Project value: R$ 2,630 million (US$ 1,096 million) [256]

Financing overview: Between 1998 and 2006 the annual production capacity of the Tucurui dam is expanded from 4,000 MW to 8,125 MW at a total cost of R$ 2,630 million (US$ 1,096 million). The expansion project was financed purely by domestic sources, in the following way: [257]

Equity:	Equity from Eletronorte	R$ 978 million	37.1%
Debt:	Loans from **BNDES**	R$ 850 million	32.3%
	Domestic bonds issued by Eletrobras	R$ 802 million	30.5%
Total:		R$ 2,630 million	

Separate from the capacity expansion of the power plant, Brazil's national electricity agency Aneel has awarded two 30-year concessions to build and operate two high-voltage transmission lines connecting the Tucurui dam with neighbouring states. These are a 323 kilometre line from Tucurui to Vila do Conde in the state of Para and a 920 kilometre line between Tucurui and Presidente Dutra in the state of Maranhao. Both concessions were won in February 2001 by a consortium of electrical services company Alusa (Brazil) and construction company Schahin (Brazil). Project costs for the first line are estimated at US$ 76 million and for the second line at US$ 306 million. Both projects will be financed primarily by domestic sources. [258]

Equity financing:

Equity provided by Eletrobras and its subsidiary Eletronorte is financing 37% of the capacity expansion of the Tucurui dam. To finance its equity contribution, Eletrobras probably has used international and domestic loans and bonds. [259]

Debt financing:

The following information was found regarding the debt financing of the capacity expansion of the Tucurui dam:

- In October and November 2001, Eletrobras secured loans totalling R$ 850 million (US$ 354 million) from state-owned development bank **BNDES** (Brazil). Eletrobras will use these funds in the expansion of the Tucurui hydroelectric project. [260]

Transmission line financing:

The following information was found regarding the financing of the new transmission lines connecting the Tucurui dam with the states of Para and Maranhao:

- In July 2002 the consortium of Alusa and Schahin raised a loan of R$ 488 million (US$ 175 million) from state-owned development bank **BNDES** (Brazil) to finance the 920 kilometre high-voltage line between Tucurui and Presidente Dutra in the state of Maranhao. The reinsurance companies **IRB-Brasil Resseguros** (Brazil) and **UBF Garantias & Seguros** (Brazil) provided guarantees. **Unibanco** (Brazil) acted as financial advisor. ABB (Switzerland/Sweden) is building the project, which should be operating in 2003. [261]

4 Discussion

Introduction

All over the world many large dams have been constructed, are under construction or have been planned. The ten dams presented in the six case studies of chapter 3 and 16 cases in annex 1 constitute an overview from different parts of the world.

The provision of hydropower and regulation of water resources (irrigation, flood control, potable water supply and sanitation) form the main goals for building large dams, which in turn is guided by the underlying motivation of economical gain and development. These gains and positive developments are frequently exaggerated while the severe environmental and socio-economic impacts on and around the dam project sites are often neglected. Despite the fact that those negative impacts result in tremendous loss of livelihoods, socio-economic loss and deprivation of development for people living in the project area. These often lose equity, autonomy and livelihood options.

In the previous chapter the situation for six large dams was analysed and described in more detail. The main objective of these case studies was to evaluate the environmental impacts of dams and the role of financing institutions. The following dams were analysed:

1. Three Gorges Dam, China
2. Maheshwar Dam and Sardar Sarovar Dam, Narmada, India
3. Nam Theun-Hinboun Dam, Laos
4. Lesotho Highlands Development Project, Lesotho
5. Tucurui Hydropower Complex, Brazil
6. Birecik Dam and Ilisu Dam, Turkey

In the next section, the environmental impacts of large dam construction are discussed, whereas the financing of these projects in discussed in § 4.2.

4.1 Environmental aspects

The construction of dams results in a multiplicity of environmental impacts. The actual closure of a dam not only results in an inundated stretch of land upstream of the dam, but also affects the whole natural riverbasin up- and downstream from the dam. Besides these direct impacts on the

riverbasin, relocation areas also suffer from severe environmental impacts. These areas, away from the dam project area, are used to relocate affected villages and people. In brief, the following impact area groups can be distinguished:

- submerged areas
- areas upstream
- areas downstream
- relocation areas

Submerged areas

Firstly, the environmental impacts related to the submerged areas or the so-called head-ponds are summarised below:

- flooding of extensive areas due to rapid, continuing and cumulative rise in water levels in front of the dam
- loss of farmland
- loss of (riverbank) habitats, natural populations, and migratory routes
- erosion along the head pond
- inundation of rapids eliminates the traditional dry season ecosystems in the head-pond area
- increased evaporation of water
- water quality reduction in the head-pond
- silt accumulation results in nutrient-trap effect of the head-pond
- eutrophication of the reservoir water may result in a dense mat of water weeds covering up the reservoir, which subsequently may result in
  - high fish mortality
  - increase in disease vectors
- greenhouse gas emissions from the reservoirs
- reservoir-induced seismicity (RIS) and other geological reaction

Upstream areas

Beside the effects caused by flooding, the areas upstream in the riverbasin will also suffer from the physical barrier of the dam, in particular populations of aquatic fauna that lose their migratory route.

Downstream areas

In many cases no assessments of downstream impacts was carried out prior to the construction of dams, despite the serious implications of dam projects on downstream areas:

- decreased water release, which can destroy the ecological system downstream
- decreased suspended sediments
- changes in flood regimes (timing and volumes)
- flash floods caused by unnatural dam water releases
- damage to aquatic and riverbank/island habitats and natural populations
- changes in (fish) migration routes
- isolation of small populations of species may result in biodiversity loss
- degraded water quality (oxygen, nutrients, pollutants)
- water logging and salinisation in irrigated areas
- severe changes in the geomorphology of the lower reaches of the river and its estuary
- saltwater intrusion at the mouth of the river and thus changes in the ecosystems and land use
- tidal effects may be felt upstream due to the reduced river flow

Indirect effects

Next to the above-mentioned direct effects of a dam project, also indirect effects caused by the relocation of people and villages result in negative impacts on the environment. Dam projects can attract large amounts of people and human activity, which impacts the project area. Furthermore, the impact of moving (hundreds of) thousands of people to other lands will have a serious effect on the natural ecosystems of the relocation areas, creating serious environmental problems. In addition, rehabilitation will result in increased pressure on existing natural resources, particularly affecting grazing lands, forests, and waterbodies. Thus, the following indirect environmental impacts of large dam construction need to be considered:

- loss of natural habitats and biodiversity
- drastic changes in land and water use (irrigation) and vegetation changes including conversion into permanent cultivation
- increased pressure on or overexploitation of ecosystems in relocation areas due to too high population pressure.

Poor decision-making process

Timely and thorough Environmental Impact Assessments (EIA) are essential in order to prevent severe and unmitigated impacts as a result of the construction of a dam, including changes in flow regimes (floods and droughts), declines in fish

populations, loss of biodiversity, disruption of migration, and erosion of fertile river banks. In practice, EIA studies are often of poor quality and do not foresee a complete picture of the potential impact on the ecosystems, on and around the project sites. Many key impacts of the project are ignored or not adequately studied. Additionally, local (affected) communities are not or poorly consulted during these EIA, nor informed about potential negative impacts arising from a dam project. A reoccurring deficit is the lack of adequate baseline data on plant and animal species. Even where an EIA is available, its recommendations are often not implemented and in many cases construction started before EIA's were approved or even commissioned.

Summarising

In general, the closure of a dam results in an inundated stretch of water upstream, while downstream the flow regime is severely altered. In the case of irrigation or diversion dams such as Theun Hinboun in Laos or The Mohale dam in Lesotho often only a small trickle is left. Another reoccurring situation is the diversion of the natural river flow through tunnels and canals. Both the upstream inundation and the altered and/or diminished downstream flow have a tremendous impact on ecosystems and the population relying on these natural resources.

The main issues regarding the environmental impacts of dam projects relate to:

- changes in river flows and disruption of hydrological regimes
- erosion
- disrupted flows of (suspended) sediment and nutrients
- damage to natural ecosystems
- salinisation
- waterlogging
- increased greenhouse gas emissions

In addition large socio-economic damage occurs, strongly related to the environmental impacts mentioned. Affected communities are often not informed and consulted or even misled about projects' consequences and compensation is lacking or insufficient.

4.2 Financing aspects

Changing mechanisms

The financing of large hydropower dams is very much in evolution. Until the 1980s, large hydropower projects in the South were largely financed by public funds. The government of the host country played a very important funding role, either directly or indirectly through state-owned electricity companies. Multilateral development banks and foreign development aid agencies often added substantial funds. Funding by commercial bank loans or bonds was rare, and foreign Export Credit Agencies (ECAs) were not as prominent as they are today. The Manantali case (see Annex 1, § 3.1) is a good example of this "old" way of financing dams.

Starting in the 1980s, this situation has changed decisively. Several developments play a role in this process of change, of which the on-going liberalisation of global electricity markets undoubtedly is the most important. But the further internationalisation of commercial banking operations, and the more sophisticated stage into which global capital markets have developed, certainly also play a role.

Increased private financing

These developments have increased the amount of private financing in hydropower projects, especially on the equity side. Direct financing by the host government obviously has declined, as many state-owned electricity companies were privatised. Most countries that still have state-owned electricity companies, have at least given room to the construction of (hydro)power plants by so-called Independent Power Producers (IPPs).

Also in the debt financing of large dams private capital plays a growing role, mainly through loans from local and foreign commercial banks. ECA financing has augmented as well during the past decades, spurred mainly by the globalisation of equipment markets.

Public funding still important

The larger role for commercial banks and ECAs in financing hydropower projects does not imply that the traditional public funds have become oblivious. As Chris Head points out in an analysis published by the World Bank in July 2000, the liberalisation of energy markets has made establishing large hydropower projects much more difficult. In most countries, hydropower projects are no longer unilaterally planned by the

government. They have to compete with other power projects, mainly thermal, for market share and scarce investment funds.

Dams very dependent on capital

Comparing them with thermal power projects, hydropower projects lose out in many important respects. The construction costs of a hydropower project are typically 100 to 200 percent higher than those of a thermal power station on a $/kW basis. Construction risks are higher and hydropower has to deal with extra (hydrological) risks. The construction period is also longer, which causes higher interest charges.

As a consequence, and because no costly fuel is needed, hydropower tariffs are determined to a large extent by the capital costs of the project. As a result, hydropower projects will generally not be able to compete with thermal power plants when financed completely with commercial bank loans and ECA loans, which both usually have a maximum tenure of 12 to 15 years: the large annual loan repayments would drive up electricity prices too much.[262]

Long lifespans ?

Of course, it doesn't need emphasis that hydropower projects still have many proponents, among governments, electricity companies, equipment producers, and financial institutions. There are many reasons for their enthusiasm, but the main economic reason is that a hydropower project is supposed to have a much longer lifespan than a thermal power plant. This means that in the long-term hydropower projects could produce cheaper electricity and higher profits. As was noted before, however, in practice silting up of reservoirs often significantly reduces effective lifespans.

Financing difficult

The financial key to successfully developing a hydropower project, therefore is to - at least partially - finance the project with funds bearing a low interest (or no interest at all) and/or a long tenure. These kinds of funds, however, are relatively scarce and/or bounded by all kind of restrictions.

To cope with this dilemma, recent financing plans for hydropower plants often show a myriad of different sources and forms of financing. The various parties involved in financing large dams, often include:

Private and public companies, including:

- Electricity companies
- Construction companies
- Equipment suppliers

Private financial institutions, including:

- Commercial banks
- Investment banks
- Bond investors, such as insurance companies, pension funds, saving banks, etc.

Public financial institutions, including:

- International development banks
- National development banks and dedicated financing agencies (in the host country)
- Export credit agencies (from countries exporting equipment)
- Foreign aid agencies (often from countries exporting equipment)

The financing package for each individual dam generally seems to be provided by a combination of financial institutions belonging to several of these different categories. Financing schemes that do not include private financial institutions are very rare, while the opposite is also the case: generally one or more public financial institutions are involved. The Birecik case (§ 3.1) is rather unique in this respect, as no development banks are involved.

Piecing together such a variety of financial instruments and financial institutions into a financing plan, requires the specialised project finance skills of large commercial banks. In almost every large dam project, a (foreign) commercial bank is assigned as financial advisor to establish and negotiate a financing plan.

Solutions applied

As regards to the dilemma of bringing interest-rate and tenure of the financing structure on par with the (supposedly) particular strong point of a hydropower project (its long lifespan), various answers involving various actors came apparent in our case studies.

Raising equity

The most obvious answer towards the dilemma mentioned, is to raise the equity percentage in the financing plan. As equity is interest-free and has an unlimited tenure, this obviously has advantages. The disadvantage however is, that the larger the equity percentage the lower the return on equity will be. The initiators of a project, most often electricity companies, strive for a certain minimal return on equity to please their shareholders, which will limit the percentage of equity they are prepared to invest.
In Chris Head's study of ten hydropower projects developed on a BOT basis, an average of 25% equity is mentioned, ranging from 15 to 40%. [263]
Most of our case studies falls in this range as well, although in the Deriner case the equity component seems to be lower (10%), while the Theun-Hinboun (45%), Tucurui (45%), Caruachi (47%), Ertan (around 50%) and Three Gorges (60%) cases have a higher portion of equity. Generally, cases with a high amount of equity are developed by state-owned electricity companies, which can be satisfied with a lower return on investments. Electricity companies that are developing a series of dams, such as Edelca in Venezuela and Eletrobras in Brazil, can therefore use the returns of running projects to invest in the equity of new dams.

The high amount of equity in some cases is also caused by the fact that various means are used to raise the project's equity above the amount the operator is prepared to invest:

- Construction companies and equipment suppliers can be lured to invest in the dam's equity, in return for contracts. Such is the case with Italian-Thai Development in the Nam Theun II case, Bharat Heavy Industries in the Maheshwar case, and a large number of construction companies involved in the Birecik case.
- Multilateral banks are sometimes prepared to invest directly or indirectly (through the host country) in the equity of a dam project, such as the ADB did in the Theun-Hinboun case. This is mainly an option in low income countries.
- Private financial institutions can be lured to take a share in the project, as a form of passive investment. Such is the case in the Maheshwar case.

- In less-liberalised markets, the government can step in by raising a levy over all electricity sales, which is the case in the Three Gorges case.

Raising more long-term loans from development banks and aid agencies

This traditional answer to the sketched dilemma is still applied. But increasingly multilateral development banks and aid agencies are under NGO pressure, which for instance caused the World Bank to pull out of the Sardar Sarovar project and the Pangue project, and to be very hesitant towards Nam Theun II.
Moreover, the costs and delays associated with obtaining multilateral development bank financing (for instance the required environmental impact assessments and stakeholder dialogues) are becoming increasingly prohibitive.

Role development banks

Multilateral development banks still play an important role in funding large dams, but increasingly less in terms of their direct financial commitment. Their role is increasingly geared towards facilitating other funding, by legitimising and guaranteeing investments in a project. The main reason why many project initiators still apply for a partial financing by a multilateral development bank is that such financing opens doors towards other financiers. Loans committed by development banks are in fact often partially or completely financed by commercial banks, such as in the Bujagali Falls and Yacyretá cases.

Nevertheless, it can be expected that more project initiators will just not apply anymore for financing by multilateral development banks, as happened in the Three Gorges, Birecik and Tucurui cases, because of the high costs and exposure associated with their involvement. Partially for the same reasons multinational development banks themselves increasingly seem to prefer financing national development banks and specialised financing agencies (which in turn finance large dams) instead of getting involved in all controversies surrounding specific dam projects. For the time being, this form of indirect financing is less controversial and less under attack of NGOs.

Using credit guarantees to extend the tenure of loans

Credit guarantees, issued by ECAs of multilateral banks, are increasingly used to extend the tenure of loans. The recently concluded Bujagali Falls case shows that through a combination of ECA and World Bank guarantees, which is a

novelty, all loans to the project could have a tenure of 16 years, despite the political instability of the host country Uganda.

It could be possible however that the prominent role played by ECAs will decrease again in the future. Many ECAs are under high pressure to apply more environmental and social criteria to their financing activities, making ECA loans a less simple and reliable funding source for project operators. NGOs for instance forced the US Exim bank to pull out of the Three Gorges dam and Hermes and COSEC to abandon Maheshwar.

A very different factor, possibly pointing in the same direction, is the fact that large economies such as Brazil, India and China are increasingly developing their own equipment industry, which is able to compete with foreign suppliers. More domestic supplies to large dams of course would diminish 'western' ECA involvement, which in itself could be a reason for project operators to prefer imports. The outcome of this development, in other words, is far from certain.

Domestic long-term bonds

Another answer to the dilemma sketched, is to look for more long-term financing on the domestic capital market. Especially in larger economies in the South, the domestic capital markets have also developed over the years. Selling long-term bonds to domestic insurance companies, pension funds, saving banks and other institutional investors, is becoming an increasingly attractive alternative for foreign financing. Especially when these bonds are guaranteed by the government of the host country, which reduces interest rates and augments demand. It is noteworthy that this instrument is used in most of our case studies: Three Gorges, Sardar Sarovar, Lesotho Highlands and Tucurui. It is used as a means of raising initial project financing, but also to refinance other - more expensive and more short-term - forms of financing when the project is underway, such as in the Lesotho Highlands case.

5 Conclusions

Continuing environmental damage

Large dam projects continue to fail in delivering sustainable solutions in water management and energy production. These failures are related to a general (severe) underestimation of environmental and socio-economical impacts on both the area and the people living on or around the project site. This situation has resulted in poor compensation for affected people and tremendous loss of habitats and ecosystems. This reality has caused strong resistance by local and international NGOs.

As has been recognised by the WCD, the process of project development for large dams often shows astonishing deficiencies, such as the lack of EIAs, of baseline studies, of informing and consulting affected people and biased cost-benefit analyses.

Lack of adequate EIAs for dam projects undermines the very basis for environmental planning and biodiversity conservation. Where EIAs exist, project engineers and economists are often dissatisfied with the results and recommendations from the EIA, because they imply substantial higher project cost. As a result, large dam construction frequently involves poor decision-making processes, unmitigated conflicts of interest, and severe environmental and socio-economic impacts.

It is apparent that the present situation of dam development doesn't even come close to the by the WCD recommended precautionary approach, which should be taken "when information is uncertain, unreliable or inadequate and when the negative impacts of actions on the environment, human livelihoods, or health are potentially irreversible".

Changing financing

The on-going liberalisation of global electricity markets during the past two decades, the further internationalisation of commercial banking operations, and the more sophisticated stage into which global capital markets have developed, have changed the way in which large dams are usually financed. Direct financing by the host government has declined, as many state-owned electricity companies are privatised. Multilateral development banks also play a less prominent role. The amount of private financing, by electricity companies and

commercial banks, is increasing. ECA financing has also augmented, spurred mainly by the globalisation of equipment markets.

In this changing environment, the financial key to successfully developing a hydropower project, is to - at least partially - finance the project with funds bearing a low interest (or no interest at all) and/or a long tenure. This kind of funds, however, is relatively scarce and/or bounded by all kind of restrictions. Different ways to cope with this dilemma are being sought, such as:

- raising the equity component by bringing in other shareholders or using other funds;
- raising long-term debt from (multilateral) development banks and development agencies;
- using credit guarantees from ECAs and development banks to extend the tenure of loans;
- issuing domestic long-term bonds.

As a result of the preceding points, the financing plan for each large (hydropower) dam has to be tailor-made. Generally a variety of financial institutions - private and public, domestic and foreign - is involved. The exact composition of each financing plan is depending on many factors - including commercial, regulatory, political and institutional factors - and generally requires lengthy negotiations. Consequently, no single financial institution or single type of financial institution can be singled out as the most important financier(s) of large hydropower projects world-wide.

National financial institutions

Within specific countries, however, often national development banks or national financial institutions dedicated to the development of the power industry play a crucial role. The national development banks featuring most prominent in this report are:

- BNDES Brazil
- China Development Bank China
- Power Finance Corporation India

Multilateral development banks

Multilateral development banks still play an important role in the development of large dams world-wide, but their role is decreasing in terms of their direct financial commitment.

Multilateral development banks more and more play a role in facilitating other funding, by legitimising and guaranteeing investments in a project. NGO pressure on multilateral development banks to abstain from environmentally and socially destructive projects is often countered by high political pressure from the host countries, project operators, construction companies, equipment suppliers and other financiers to keep multilateral development banks aboard.

But on the other hand, an increasing number of projects does not even apply for multilateral development bank funding because of the high costs and exposure associated with their involvement. Partially for the same reasons multinational development banks increasingly seem to prefer financing national development banks and specialised financing agencies (which in turn finance large dams) in stead of getting involved in all controversies surrounding specific dam projects.

The multilateral development banks featuring most prominent in this report are:

- World Bank
- Asian Development Bank
- Inter-American Development Bank
- Corporación Andina de Fomento

ECAs and Foreign Development Banks

In the past few decades Export Credit Agencies (ECAs) and foreign development banks have increased their role in financing large dams world-wide, to assist supplies by equipment manufacturers. It could be possible however that the prominent role played by ECAs will decrease again in the future. Many ECAs are under high pressure to apply more environmental and social criteria to their financing activities, making ECA loans a less simple and reliable funding source for project operators. Also, large economies such as Brazil, India and China are increasingly developing their own equipment industry, which is able to compete with foreign suppliers. Domestic supply to large dams of course diminishes ECA involvement.

The ECAs and foreign development banks featuring most prominent in this report are:

- Export Development Corporation — Canada
- Exportkreditnämnden — Sweden
- Exportrisikogarantie — Switzerland
- Hermes Kreditversicherungs — Germany
- Kreditanstalt für Wiederaufbau — Germany

Private commercial banks

Private commercial banks also play an increasingly important role in financing large dams, but mostly in combination with guarantees from ECAs and multilateral development banks. Possibly more important than their direct financial contribution, are their skills in piecing together a variety of financial instruments into a financing plan. In almost every large dam project, a (foreign) commercial bank is assigned as financial advisor to establish and negotiate a financing plan.

The private commercial banks featuring most prominent in this report are:

- ABN AMRO Bank — Netherlands
- Allianz / Dresdner Bank — Germany
- Australia and New Zealand Banking (ANZ) — Australia
- BNP Paribas — France
- Citigroup — United States
- Crédit Agricole — France
- Crédit Suisse — Switzerland
- Deutsche Bank — Germany
- J.P. Morgan Chase & Co — United States
- Mitsubishi Tokyo Financial — Japan
- Société Générale — France
- UBS — Switzerland

Local banks

In larger economies, such as Brazil, China, India and South Africa, an increasingly important role in financing large dams is played by loans from local commercial banks, and by issuing long-term bonds to the domestic capital markets, including domestic saving banks, pension funds, insurance companies, et cetera. Identifying the most important players in these domestic capital markets with respect to the financing of large dams, would need further research.

Financial institutions' responsibility

Financial institutions cannot neglect their responsibility for the consequences of projects that they finance. As this

report shows, the negative impacts of large dam projects are often huge. Consequently, financial institutions need to very carefully and transparently evaluate both the decision making process and impacts before according large dam projects.

Foreign pressures

In some developing countries hydropower developments and projects are very much the result of the strong influence of, and owned by, foreign advisors, constructors and financiers. These foreigners regularly benefit from a change within the country like a move towards a market economy, a change in political regime, low level of development and a high level of foreign debt. Additionally, multinational financial institutions like the ADB and World Bank actively encouraged private sector participation (national and international) in these projects. Efforts are needed to reform the corrupt system of consultant conflict of interest.

NGO campaigning needed

By means of public pressure exerted by NGOs, project executors can be held responsible for the extensive damage to ecosystems and livelihoods. The timely involvement of NGOs or other public pressure groups is crucial to prevent negative impacts on ecosystems and affected communities.

It appears that only under extreme pressure (by NGOs) financial institutions refrain from financing damaging dam projects. Examples are the withdrawals of the World Bank and Hermes from the Sardar Sarovar Dam and Maheshwar Dam and the relatively small foreign financial involvement in the Three Gorges Dam.

From an international campaigning point of view, attention could focus on the most important multilateral development banks, ECAs and commercial banks. While the activities of the first two categories in the financing of large dams are already critically followed by the international NGO community, the activities of the third category hardly are. There seem to be sufficient reasons to correct this imbalance.

When the NGO focus is limited to dams in a specific country, all three categories mentioned in the previous paragraph are relevant. But additionally, attention could focus on national development banks or financing agencies, domestic commercial banks as well as the domestic capital market.

Further analysis would be needed to determine the most important players on a national level.

Local community rights

Particular attention is needed for ensuring the rights of local communities to control the use of their natural resources and to be adequately compensated for their use. The WCD guidelines state that "Special attention is necessary to ensure that compensation and development measures are in place well in advance."

Overall, regrettably …

Overall the conclusions are that the building of dams causing major environmental and social damage continues to date and that much remains to be learned and implemented of the recommendations of the World Commission on Dams (WCD). This should be a first demand to any company involved in dam building or its financing.

Strong pressure by national and international environmental organisations is crucial to force project designers and financing institutions towards sustainable solutions.

6 Recommendations

1. In this report a large number of financial institutions involved in financing the construction of large dams is identified (see Annex 2). The disastrous environmental and social impacts of many of these projects can be clearly demonstrated. NGOs need to campaign to hold the financial institutions involved (co-)responsible for these consequences.

2. For such a campaign to be effective, the varying and changing roles and forms of involvement of private and public financial institutions, as described, need to be taken into account. This could imply different priorities in different countries.

3. In the preparations for addressing financial institutions, some of these should be selected for detailed further study on policies, portfolios, etc. This can be based upon the present analysis of involvement and consequences and a survey of opportunities as regards greening policies or development at such institutions.

4. There is ample opportunity for financial institutions to improve the sustainability of dam projects. The recommendations of the WCD should be taken as minimum demands before getting involved in any such project. Adequate and timely EIAs, social, environmental and financial risk assessment, participation and independent review form essential elements of such an approach.

5. This study results in the following list of most prominent candidates to be addressed:

<u>National development banks</u>

- BNDES Brazil
- China Development Bank China
- Power Finance Corporation India

<u>Multilateral development banks</u>

- World Bank
- Asian Development Bank
- Inter-American Development Bank

- Corporación Andina de Fomento

ECAs and Foreign Development Banks

• Export Development Corporation	Canada
• Exportkreditnämnden	Sweden
• Exportrisikogarantie	Switzerland
• Hermes Kreditversicherungs	Germany
• Kreditanstalt für Wiederaufbau	Germany

Private commercial banks

• ABN AMRO Bank	Netherlands
• Allianz / Dresdner Bank	Germany
• Australia and New Zealand Banking (ANZ)	Australia
• BNP Paribas	France
• Citigroup	United States
• Crédit Agricole	France
• Crédit Suisse	Switzerland
• Deutsche Bank	Germany
• J.P. Morgan Chase & Co	United States
• Mitsubishi Tokyo Financial	Japan
• Société Générale	France
• UBS	Switzerland

Annex 1 Inventory

1 Europe

1.1 Turkey: Deriner Dam

1.1.1 Key project data

Location: Coruh River, East Turkey
Global 200 Ecoregion:
Issue(s):
Construction period: 1998-2005
Height: 247 m
Production capacity: 670 MW
Reservoir area / volume: 2000 Mm^3
Project operator: State Hydraulic Works (Turkey).
Building consortium: ERG Insaat Ticaret ve Sanayi (Turkey) and Technostroyexport (Russia). [264]
Power generation equipment suppliers: Voest-Alpine Technologie (Austria), ABB (Sweden/Switzerland), Stucky (Switzerland), and Sulzer Hydro (Switzerland). [265]
Other companies involved: Krupp Fördertechnik (Germany).[266]

1.1.2 Project financing

Project value: US$ 711 million. [267]

Equity financing: Equity participation by State Hydraulic Works is estimated at US$ 66 million (9.3% of total project costs).

Debt financing: Debt is probably funding US$ 645 million, or 90.7% of total project costs. The following information is found regarding loans provided to the Deriner project:

- In November 1997 SBC Warburg Dillon Read, which is now part of **UBS** (Switzerland), arranged a US$ 315 million package of syndicated bank loans for the Deriner project. The package one export credit facility guaranteed by the Swiss and Austrian export credit agencies, and two additional uncovered facilities. Among the eight European banks participating in the syndicates were ABB Structured Finance, which is now part of **GE Commercial Finance** (United States) and Generale Bank, which is now part of **Fortis Bank** (The Netherlands/Belgium). [268]
- In April 2001 an international banking syndicate arranged by **ABN AMRO Bank** (The Netherlands) and **Akbank** (Turkey) arranged a 6-year US$ 330 million loan to the Deriner project. Akbank itself participated with US$ 220 million in the syndicate. Other banks participating in the

syndicate were **Isbank** (Turkey) and **Pamukbank** (Turkey).[269]

Credit guarantees:

Credit guarantees for part of the loans issued in November 1997 to the Deriner project were issued by the following ECAs:[270]

- **Exportrisikogarantie** - Switzerland
- **Österreichische Kontrollbank** - Austria

2 Asia

2.1 China: Longtan Dam

2.1.1 Key project data

Location: Hongshui River, Guangxi Autonomous Region, China
Global 200 Ecoregion: 170 - Xi Jiang (the Hongshui is a tributary of the Xi Jiang or Pearl River)
Issue(s): Second largest dam in Asia (after Three Gorges), displacement of 75,000 people, one of ten planned hydrodams in the river, siltation. [271] Plan temporarily suspended in 1989 because of protests regarding social and environmental impacts. [272]
Construction period: 2001-2009 [273]
Height: 192 meters
Production capacity: 5,400 MW [274]
Reservoir area / volume:
Operator: China National Power (China), Guangxi Development (China), Guangxi Power (China) and Guizhou Capital (China).
Building consortium: Gezhouba Water Resources and Hydropower Engineering Group (China) and Jiangnan Water Resources and Hydropower Engineering Bureau (China). [275]
Power generation equipment suppliers:
Other companies involved:

2.1.2 Project financing

Project value:	US$ 2,980 million. [276]
Equity financing:	No information found.
Debt financing:	Financial advisor for the financing of the Longtan Dam is **China Construction Bank** (China). [277] There is no foreign funding for the project - money has been raised by power companies in Guangxi and neighbouring Guizhou province. [278]

2.2 China: Xiaowan Dam

2.2.1 Key project data

Location: Lancang or Mekong River, Yunnan province, China
Global 200 Ecoregion: 144 - Mekong
Issue(s): Since 1986 a number of hydropower stations such as those at Manwan, Dachaoshan (dam now nearing completion) and Xiaowan (not yet begun) have been established on the Lancang River, and five more hydropower stations will be built within 20 years.

The Xiaowan dam in China is planned in the Lancang River, which is part of the huge Mekong river basin. The Lancang-Mekong River is considered a promising route for linking west China with the south-east Asian countries. At the same time, the river area is rich in hydropower, non-ferrous metals, tourism and biological resources. The construction of the dam will result in numerous environmental and social impacts, among others water pollution (due disposal of effluent from paper production, cement manufacture, sugar-cane processing and beer production), riverbank erosion, biodiversity loss, impacts on river flows, floodplains degradation, livelihoods deprivation (fisheries, food crops), fish (migration) loss of cultural heritage sites and an imbalance of the ecological environment. Probably the worst affected area is currently the Yangbi River gorge which carries the outflow of Erhai Lake to its confluence with the Lancang, just below the site where Xiaowan Dam will be built.

In order to compensate the tremendous environmental losses caused by the number of hydropower stations, the UNDP has launched a comprehensive project for environment protection of the Lancang River drainage area[279].

An important social impact of the dam construction will be the displacement of over 38,000 people. [280] "In May 2001, a report by the Stockholm Environment Institute (SEI) singled out the eight-dam cascade in Yunnan as a very significant threat for the lower Mekong. The report stated that the restraint of water and natural sediment could severely harm the livelihoods of millions of people, wildlife, water and natural ecosystems throughout Laos, Thailand, Cambodia and Vietnam, and could cause intensified flooding, wreck fisheries and disrupt transport links." [281] The dams will have a major effect on the downstream Mekong. Fish feeding and spawning conditions will be disrupted, leaving river fisheries devastated along with the communities that depend on them. The dams will stop silt and nutrients, which are vital to downstream agriculture. Increased water in the dry season will result in the loss of riverbank vegetable gardens, which hundreds of thousands of downstream communities currently use. The quality of the water will be changed as the free flowing river is converted to a series of vast, sluggish reservoirs. [282]
Construction period: 2002 - 2012 [283]
Height: 292 meters
Production capacity: 4,200 MW [284]
Reservoir area / volume: 15 billion m^3 [285]
Project operator: The Yunnan Lancang River Hydropower Development Co. is developing the project. This company was formed by National Power Corporation, Yunnan Provincial Electricity Group, Yunnan Provincial Development and Investment Co. and Yunnan Hongta Industrial Co. [286]
Building consortium:
Power generation equipment suppliers:

Other companies involved: Feasibility studies and EIA has been completed by the China International Engineering Consultancy Co. [287]

Remarks: The Xiaowan is the third in a series of eight hydroelectric power stations China is planning to build at the middle and lower reaches of the Lancang River. The total installed capacity of the power plants will reach 15,550 MW. The first dam, Manwan, was completed in 1993 and the Dachaoshan dam is nearing completion. Part of the electricity output of these dams will be sold to Thailand, starting in 2013.[288]

2.2.2 Project financing

Project value:	US$ 2,710 million.[289]
Equity financing:	No information found.
Debt financing:	No information found.

2.3 China: Ertan Dam

2.3.1 Key project data

Location: Yalong River, Sichuan Province, China
Global 200 Ecoregion: 149 - Yangtze River (the Yalong river is a tributary of the Yangtze river)
Issue(s): 35,000 people displaced
Construction period: 1991-1999
Height: 240 meters
Production capacity: 3,300 MW
Reservoir area / volume: 101 km^2, 5,800 Mm^3
Project operator: Ertan Hydroelectric Development Corporation (China).
Building consortium: Impregilo (Italy), Torno (Italy), Dumez (France), GTM (France), Holzmann (Germany), Hochtief (Germany), and Changian Gezhouba Engineering Bureau 8B (China). [290] Also Lyonnaise des Eaux (France) has been mentioned. [291]
Power generation equipment suppliers: Voest Alpine Technologie (Austria). [292] "Ertan was China's first hydropower plant to be built through international bidding. Canada's General Electric Co (GE) won the contract for the manufacture of the six generating units. The contract called for GE to manufacture the first two 582MW Francis turbines in Canada, while the third and fourth would be a joint project of GE and Harbin Electrical Machinery Works in north-east China's Heilongjiang Province and the Shanghai-based Dongfang Electrical Machinery Works. The fifth and sixth would then be produced by the Chinese firms alone. Dongfang in particular is an important partner for GE. In September 1999, Ertan unit five, the first Chinese domestic-made 550MW hydropower generator, went into formal operation. The previous largest hydro turbine built in China was 320MW. Dongfang and Harbin have also formed a joint venture company with Austria's VA Technologie for domestic hydro turbine production." [293]
Other companies involved: Mitsubishi Heavy Industries supplied switchgear. Harza Engineering, Lahmeyer International, Electricité de France and the Advisory Group of Norway provided consultancy services. Harza's contract included design review, construction planning, cost estimates and tender evaluation services. Siemens provided a Chinese language version of its BFS plant management system for the Ertan plant, its first implementation in a hydro plant. [294]

2.3.2 Project financing

Project value:	US$2,383.8 million [295] or US$ 2,550 million [296] or US$ 3,400 billion.[297]
Equity financing:	According to some reports, the Chinese government and the Sichuan province have both invested US$ 795.4 million in the Ertan Dam. Total equity financing would therefore equal US$ 1,590.8 million (45-65% of total project value).[298]
Debt financing:	According to some reports, Ertan Hydroelectric Development Corporation has a total debt of around US$ 3.1 billion.[299]

The following bank loans to the Ertan project have been reported: [300]

- **World Bank** - International - 1992 - US$ 380 million
- **World Bank** - International - 1995 - US$ 400 million
- **US Export-Import Bank** - United States - Unknown - US$ 30 million
- Commercial banks - Various - 1995 - US$ 149.7 million

However, another report puts total **World Bank** (International) financing for the project at US$ 1.8 billion. [301]

The following banks were involved in the loan syndicate providing a US$ 149.7 million loan to the Ertan Dam project in September 1995: [302]

- Asahi Bank (now part of **Resona Bank**) - Japan
- **Bank of America** - United States
- Daiwa Bank (now part of **Resona Bank**) - Japan
- Fuji Bank (now part of **Mizuho Bank**) - Japan
- Industrial Bank of Japan (now part of **Mizuho Bank**) - Japan
- **Korea Development Bank** - South-Korea
- Long-Term Credit Bank of Japan (now: **Shinsei Bank**) - Japan
- Mitsubishi Trust and Banking Corporation (now part of **Mitsubishi Tokyo Financial**) - Japan
- Sakura Bank (now part of **Sumitomo Mitsui Banking**) - Japan
- Sanwa Bank (now part of **UFJ Bank**) - Japan
- Sumitomo Bank (now part of **Sumitomo Mitsui Banking**) - Japan
- **Sumitomo Trust & Banking** - Japan
- Tokai Bank (now part of **UFJ Bank**) - Japan
- Yasuda Fire & Marine Insurance (now part of **Sompo Japan**) - Japan
- Zenshinren Bank (now: **Shinkin Central Bank**) - Japan

Credit guarantees:

The syndicated US$ 149.7 million loan of September 1995 was guaranteed by the **World Bank**. [303]

2.4 India: Kameng Dam

2.4.1 Key project data

Location: Bichom and Tenga rivers, Arunachal Pradesh, India
Global 200 Ecoregion: 67 - Eastern Himalayan Broadleaf and Conifer Forests (Bichom river is a tributary of Tenga river, which is a tributary of Kameng river, which is a tributary of Brahmaputra river)
Issue(s):
Construction period: 2002-2011
Project operator: North Eastern Electric Power Corporation (NEEPCO), which is a state-owned company.
Height: The project will encompass the Bichom Dam (96.5 meters) at 4 km downstream of the confluence of Bichom and Digien rivers and the Tenga Dam (60.5 meters) which is 16.5 km downstream of Jamiri Gauge & discharge site.[304]
Production capacity: 600 MW
Reservoir area / volume:
Building consortium:
Power generation equipment suppliers:
Other companies involved:

2.4.2 Project financing

Project value: US$ 611.1 million.[305]

Equity financing: Equity will reportedly finance 50% of the total project costs of the Kameng dam. The Indian Ministry of Power will supply all equity. 90% will be financed by a grant from the Ministry to the State of Arunachal Pradesh. The other 10% will be financed by a loan from the Ministry to the State of Arunachal Pradesh.[306]

Debt financing: Debt is reportedly intended to cover 50% of total project costs.[307] The following information is found on loans awarded to the Kameng project:

- In May 2000, NEEPCO has applied to the **Kuwait Fund for Arab Economic Development** (Kuwait) for a loan of US$ 210 million, which would equal 34% of total project costs. It is unclear if this loan has been granted.[308]

2.5 Laos: Nam Theun II Dam

2.5.1 Key project data

Location: Theun River, Khammouane Province, Laos

Global 200 Ecoregion: 144 - Mekong (the Theun river is a tributary of the Mekong river)

Issue(s): Decline of fish catches, erosion, severe environmental impacts.

Construction period: 2003-2006

Height: 50 meters

Production capacity: 1,070 MW, of which 995 MW will be sold to Electricity Generating Authority of Thailand (EGAT) and 75 MW to Electricité du Laos. [309]

Reservoir area / volume: 45,000 hectares

Project operator: Nam Theun 2 Power Company (NTPC), which is owned by: [310]

Electricité du Laos	Laos	25%
Electricité de France	France	35%
Italian-Thai Development	Thailand	15%
Electricity Generating Public Company Limited (EGCO)	Thailand	25%

Building consortium:

Power generation equipment suppliers:

Other companies involved: Knight Piesold (United Kingdom), Beca Worley (New Zealand) and Lahmeyer (Germany).[311]

2.5.2 Project financing

Project value: US$ 1,227 million. [312]

Financing overview: The Nam Theun II dam is established as a *Build-Own-Operate-Transfer project* (BOOT). This means that the Nam Theun 2 Power Company (NTPC) will build the dam and will operate it during a concession period of 25 years (from 2006 to 2031). After this period, the dam will be transferred at no cost to the government of Laos. The advantage of this structure for the government of Laos is that it will not be exposed to financial risks such as construction cost overruns.[313]

The intended financing structure for the project is as follows: [314]

Equity	Equity of the NTPC	US$ 368 million - 30.0%
Debt	Loans from ECAs and commercial banks	US$ 400 million - 32.6%
	Loans from multilateral banks	US$ 459 million - 37.4%
Total		US$ 1,227 million

The project has been delayed for several years however, during which the shareholder composition of the NTPC changed considerably. Funding has not yet been secured, as negotiations on a power purchase agreement (PPA) between NTPC and Electricity Generating Authority of Thailand (EGAT) dragged on. Serious doubts were raised in Thailand if EGAT would need the output of the Nam Theun II dam and if the electricity price would not be too high. Lowering the electricity price would make the project unprofitable, however. Without a signed PPA the **World Bank** was not prepared to issue a partial-risk guarantee, and without such a guarantee ECAs and foreign commercial banks were not prepared to provide loans.[315]

Finally, in February 2002 an initial PPA was signed between EGAT and NTPC, and the final PPA now is expected to be signed in mid-October 2002. In the mean time the government of Laos awarded the BOOT-concession to the NTPC in October 2002.[316]

But in July 2002 the **World Bank** announced it is only prepared to issue a partial-risk guarantee if it receives wider support among the international donor community and from social and environmental groups. If the project, which is now planned to be in operation in 2008, will find funding therefore is still uncertain. [317]

Despite the difficulties experienced in realising Nam Theun II, the Thai power company GMS Power (also involved in Nam Theun I) in April 2002 announced it would start developing the Nam Theun III hydropower project.[318]

Equity financing:

Around 30% of the project (US$ 368 million) is intended to be financed by Nam Theun 2 Power Company Limited (NTPC), which is owned by: [319]

• Government of Laos	Laos	25%
• Electricité de France	France	35%
• Italian-Thai Development	Thailand	15%
• Electricity Generating Public Company Limited (EGCO)	Thailand	25%

EGCO is a publicly-listed Thai electricity producer, whose major shareholders are Electricity Generating Authority of Thailand (25.4%) and China Light & Power (Hong Kong,

21.5%). **HSBC Bank** (United Kingdom) holds a 2.1% shareholding in EGCO.[320]

Debt financing:

Around 70% of the project (US$ 859 million) is intended to be financed by equity.[321] The following information is found on the debt financing of the Nam Theun II project:

- In 1993, when the project was awarded to the Australian joint-venture Transmec formed by Transfield International and Snowy Mountains Engineering Corp., Citicorp was appointed by the Laotian government to advise it on Nam Theun 2. Citicorp, which is now part of **Citigroup** (United States), probably has left the field just as Transmec.[322]
- In 1996, three banks were appointed to arrange financing: BZW, which is part of **Barclays Bank** (United Kingdom), Deutsche Morgan Grenfell, which is part of **Deutsche Bank** (Germany) and **Société Générale** (France). But in 1998 it was reported that this arranger group had fallen away, although Barclays Bank continued to advise the NTPC.[323]
- At present, the following financial institutions are reportedly advising the NTPC on financing the Nam Theun II Dam: [324]
  - Australia and New Zealand Banking (ANZ) - Australia
  - **Crédit Agricole** - France
  - SBC Warburg (now part of **UBS**) - Switzerland
  - **Krung Thai Bank** - Thailand
  - **Thai Farmers Bank** - Thailand
- The search for banks willing to arrange a banking syndicate is expected to start in late October 2002. Thai and international banks will be invited. The target is to have the banks in place before end-December. [325]
- The NTPC is in the process of selecting contractors. Bidders are being asked to quote pricing, as well as letters of support from their respective export credit agencies. The NTPC and its financial advisers are also holding talks with ECAs.[326]
- The NTPC is in advanced talks with the **World Bank** (International) and **Asian Development Bank** (International) to commit financial support totalling US$ 150-200 million, or about 20% of total costs.[327]

Credit guarantee:

In 1995 the NTPC asked the **World Bank** (International) to provide a US$ 94 million partial-risk guarantee, without which

the project is unlikely to get commercial funding and to proceed. In February 2000 the World Bank said it would not give its endorsement until the government of Laos commits itself to significant political and economic reforms. In July 2002 the World Bank decided not to extend the guarantee until it receives wider support among the international donor community and from social and environmental groups. [328]

Other financing:

In 1986/87 the World Bank was the executing agency for a pre-feasibility study of Nam Theun II funded by the **United Nations Development Programme** (International). In 1989, the **World Bank** (International) and **United Nations Development Programme** (International) funded a feasibility study of Nam Theun II by Australian hydropower consultants Snowy Mountains Engineering Corporation (SMEC). [329]

2.6 Malaysia: Sungai Selangor III Drinking Water Project

2.6.1 Key project data

Location: Sungai River, Malaysia
Global 200 Ecoregion: 30 - Peninsular Malaysian Lowland and Montane Forests
Issue(s):
Construction period: Under construction.
Height:
Production capacity:
Reservoir area / volume:
Project operator: Syarikat Pengelur Air Sungai Selangor (Malaysia), which is a joint-venture of the Malaysian companies The Sweet Water Alliance (40%), Gamuda Berhad (30%) and Kumpulan Darul Ehsan (30%).[330]
Building consortium: Biwater (United Kingdom) and Rohas-Euco (Malaysia).[331]
Power generation equipment suppliers:
Other companies involved:

2.6.2 Project financing

Project value: US$ 790 million.[332]

Equity financing: No information found.

Debt financing: The following information is found regarding loans to the Sungai Selangor III project:

- In July 2000, Commerce International Merchant Bankers, which is part of **Commerce Asset-Holding** (Malaysia), received a mandate to arrange a US$ 484.7 million bond offering to finance Sungai Selangor III.[333]

3 Africa

3.1 Mali: Manantali Dam

3.1.1 Key project data

Location: Bafing River, Mali
Global 200 Ecoregion:
Issue(s): Livelihood destruction (fisheries, grazing), environmental destruction (fish breeding, 12,000 ha forest lost, altered flooding regime); 180,000 displaced persons; waterborne diseases; ethnic conflict
Construction period: 1981-1987 (dam), 1998-2001 (power plant)
Height: 65 meters
Production capacity: 200 MW
Reservoir area / volume: 47,700 hectares
Project operators: Organisation pour la Mise en Valeur du Fleuve Senegal (OMVS), which is owned by the governments of Senegal, Mali and Mauritania.[334]
Building consortium: Zublin (Germany) and Losinger (Switzerland) for the dam, and Cubiertas (Spain) for the power plant.[335]
Power generation equipment suppliers: ABB (Sweden-Switzerland), Sulzer (Switzerland) and Norelec (France).[336]
Other companies involved:

3.1.2 Project financing

Project value: US$ 500 million (dam); US$ 433 million (power plant) [337]

Equity financing: The equity financing of both the Manantali Dam as well as the hydropower plant was probably covered completely by foreign development grants (see below). [338]

Debt financing: The following information is found regarding bank loans and development grants for the Manantali Dam in the 1980s: [339]

- **African Development Bank** - International
- CFD (now: **Agence Française de Développement**) - France
- **Canadian International Development Agency** - Canada
- **European Union** - International
- **Islamic Development Bank** - International
- **Italian government** - Italy
- **Kreditanstalt für Wiederaufbau** - Germany - US$ 90 million
- Several Arab governments - Various

The following information is found regarding loans and development grants for the construction of the Manantali power plant at the end of the 1990s: [340]

- **African Development Bank** - International - US$ 26 million
- **Arab Fund for Economic and Social Development** - International - US$ 29 million
- CFD (now: **Agence Française de Développement**) - France - US$ 95 million
- **Canadian International Development Agency** - Canada - US$ 27 million
- **European Investment Bank** - International - US$ 46 million
- **European Union** - International - US$ 37 million
- **Islamic Development Bank** - International - US$ 21 million
- **Kreditanstalt für Wiederaufbau** - Germany - US$ 66 million
- **West African Development Bank** - International - US$ 20 million
- **World Bank** - International - US$ 39 million

Credit guarantees:

The following information is found regarding export credit guarantees committed by ECAs for the construction of the Manantali Dam in the 1980s: [341]

- **Exportrisikogarantie (ERG)** - Switzerland - US$ 100 million
- **Hermes Kreditversicherungs** - Germany - US$ 90 million

3.2 Uganda: Bujagali Falls Dam

3.2.1 Key project data

Location: Nile River, Uganda
Global 200 Ecoregion: 89 - Sudanian Savannahs, 182 - Rift Valley Lakes
Issue(s): Violates WB's policies on involuntary resettlement, environmental assessment, natural habitats, disclosure of information and economic evaluation of investment operations.
Construction period: 2002-2006
Height: 30 meters
Production capacity: 200 MW
Reservoir area / volume:
Project operator: AES Nile Power, which is a joint-venture of AES Corporation (United States - 94%) and Madhvani International (Uganda - 6%).[342]
Building consortium: Skanska (Sweden) and Veidekke (Norway). [343]
Power generation equipment suppliers: General Electric (United States), ABB(Sweden/Switzerland) and Ahlstom (United Kingdom). [344]
Other companies involved:

3.2.2 Project financing

Project value: US$ 550 million [345]

Financing overview: Originally, the Bujagali project would be financed by a mixed financing structure, comprising multilateral development bank loans as well as commercial bank loans backed by ECA-guarantees. But several ECAs and development agencies, including the **Overseas Private Investment Corporation (OPIC)** (United States), the **Export Credits Guarantee Department (ECGD)** (United Kingdom) and **Deutsche Investitions- und Entwicklungsgesellschaft (DEG)** (Germany) declined support for Bujagali.[346]

Other ECAs were prepared to step in, but objected to the large political risk they had to carry. In an innovative solution, in July 2002 **World Bank**-subsidiary Multilateral Investment Guarantee Agency (MIGA) was brought in to carry the political risk. ECA-linked banks such as **Svensk Exportkredit** (Sweden) and **Eksportfinans** (Norway) are now financing the ECA-guaranteed loans. This means that the role of commercial banks in the total financing structure is much reduced.[347]

The new financing structure, which will probably be signed in the fall of 2002, looks as follows: [348]

Equity	Equity of AES Nile Power	US$ 116.7 million	19.7%
Debt	Loans by (multilateral) development banks		
		US$ 130 million	22.0%
	IDA-guaranteed commercial bank loans		
		US$ 115 million	19.4%
	ECA-guaranteed loans	US$ 210 million	35.5%
	Bonds	US$ 20 million	3.4%
Total		US$ 591.7 million	

As total funding commitments exceed total project costs (US$ 550 million), the figure for total project costs is underestimated or actual funding will be scaled down.

Equity financing:

Around 20% of the total project value (US$ 116.7 million) will be financed by the equity of AES Nile Power. This is a joint venture of: [349]

- AES Corporation - United States - 94%
- Madhvani International - Uganda - 6%
- AES is a large independent power producer (IPP). More information on Madhvani is not found.

Development bank loans:

Around 22% of the total project value (US$ 130 million) will be financed by 16-year loans from (multilateral) development banks. The following information in found on development bank loans which will be provided to the Bujagali Falls project: [350]

- **African Development Bank** - International - US$ 55 million
- **FMO** - The Netherlands - US$ 15 million
- International Finance Corporation (part of the **World Bank**) - International - US$ 60 million

Commercial bank loans:

Around 19% of total project value (US$ 115 million) will be covered by 16-year commercial bank loans. These loans will be guaranteed by the International Development Agency (IDA), a subsidiary of the **World Bank** (International), under the *partial risk guarantee* programme.

The arranging banks for this banking syndicate originally were **Westdeutsche Landesbank** (Germany) (Germany) and **Australia and New Zealand Banking (ANZ)** (Australia). But ANZ has dropped out because it has already lent considerable amounts to AES in other countries and a new arranging bank is being sought. **Société Générale** (France) is mentioned as a candidate.[351]

ECA-guaranteed loans:

Around 36% of total project value (US$ 210 million) will be covered by 16-year ECA-guaranteed loans The following ECAs have extended export credit guarantees for the Bujagali Falls project: [352]

- **Exportkreditnämnden (EKN) -** Sweden - US$ 90 million
- **Exportrisikogarantie** - Switzerland - US$ 55 million
- **Finnvera** - Finland - US$ 15 million -
- **Garanti-Instituttet for Eksportkreditt (GIEK)** - Norway - US$ 70 million -
- Multilateral Investment Guarantee Agency (part of the **World Bank**) - International

Overall amount will be reduced to US$ 210 million. Loans will be provided by ECA-linked banks such as: [353]

- **Svensk Exportkredit (SEK)** - Sweden
- **Eksportfinans** - Norway

Bonds:

AES Nile Power is planning the domestic issuance of a US$ 20 million equivalent Ugandan shilling-denominated eight-year bond. **FMO** (The Netherlands) will backstop the principal payments. **Standard Chartered Bank** (United Kingdom), **Standard Bank** (South Africa) and **Westdeutsche Landesbank** (Germany) are expected to participate in the issue. [354]

4 Latin America

4.1 Chile: Pangue Dam

4.1.1 Key project data

Location: Biobio River, Chile
Global 200 Ecoregion: 76 Valvidian Temperate Rainforests, 122 - Chilean Mattoral
Issue(s): Strong impacts on Pehuenche indigenous people, including logging of forests.
Construction period: 1992-1996
Height:
Production capacity: 400 MW
Reservoir area / volume:
Project operator: Empresa Nacional de Electricidad (Endesa - Chile).
Building consortium:
Power generation equipment suppliers: ABB (Sweden/Switzerland), Kvaerner (Norway), Mecanica Pesada (Chile) and Voest-Alpine Technologie (Austria). [355]
Other companies involved: Electrowatt (Switzerland), Norconsult (Norway). [356]
Remarks: The Pangue Dam and the Ralco Dam are the first in a series of six dams Endesa is planning to build on the Biobio River. Total production capacity would be 2,300 MW. [357]

4.1.2 Project financing

Project value: No information found.

Equity financing: In December 1992, the International Finance Corporation, which is part of the **World Bank** (International), invested US$ 4.7 million in a shareholding in the Pangue project.[358]

Debt financing: The following information is found regarding loans to the Pangue project:

- In December 1992, the International Finance Corporation, which is part of the **World Bank** (International), arranged a US$ 212 million financing package for Endesa to build the Pangue Dam, probably all loans. The following financial institutions and development agencies provided loans: [359]
  - International Finance Corporation (part of the **World Bank**) – International - US$ 70 million
  - **Board for Industrial and Technical Cooperation** - Sweden - US$ 28 million
  - **Norwegian Agency for Development Cooperation** – Norway - US$ 14 million
  - Ten European banks - Various - US$ 100 million

- In September 1997, Dresdner Bank, which is now part of **Allianz** (Germany), and Chase Manhattan, which is now part of **J.P. Morgan Chase & Co.** (United States), arranged a US$ 380 million syndicated loan for Endesa, to finance the Pangue and Ralco Dams. Reportedly, this loan was used partly to pay back the IFC financial package of 1992 for the Pangue Dam for which the IFC demanded repayment because of a breach of the environmental standards agreed. [360]

Other banks participating in the loan syndicate were: [361]

- Argentaria Banco Exterior de España (now part of **Banco Bilbao Vizcaya Argentaria) -** Spain
- **Banca Monte dei Paschi di Siena** - Italy
- Bank of Nova Scotia (now: **Scotiabank**) - Canada
- Bank of Tokyo-Mitsubishi (part of **Mitsubishi Tokyo Financial**) - Japan
- Banque Nationale de Paris (now part of **BNP Paribas**) - France
- **Bayerische Landesbank** - Germany
- **Caja de Madrid** - Spain
- Crédit Suisse First Boston (part of **Crédit Suisse**) - Switzerland
- Deutsche Morgan Grenfell (part of **Deutsche Bank**) - Germany
- Deutsche Girozentrale-Deutsche Kommunalbank (now part of **DekaBank**) - Germany
- ING Barings (part of **ING Bank**) - The Netherlands
- J.P. Morgan Securities (now part of **J.P. Morgan Chase & Co.**) - United States
- Paribas (now part of **BNP Paribas**) - France -
- **Société Générale** - France
- Union Bank of Switzerland (now: **UBS**) - Switzerland

4.2 Chile: Ralco Dam

4.2.1 Key project data

Location: Biobio River, Chile
Global 200 Ecoregion: 76 Valvidian Temperate Rainforests, 122 - Chilean Mattoral
Issue(s): Displacement of 400 indigenous Pehuences, inundation of 70 km biodiverse forested river valley.
Construction period: 1999-?
Height: 155 meters
Production capacity: 570 MW
Reservoir area / volume: 3,400 hectares
Project operator: Empresa Nacional de Electricidad (Endesa - Chile).
Building consortium:
Power generation equipment suppliers:
Other companies involved: Electrowatt (Switzerland). [362]
Project value: US$ 540 million.
Remarks: The Pangue Dam and the Ralco Dam are the first in a series of six dams Endesa is planning to build on the Biobio River. Total production capacity would be 2,300 MW. [363]

4.2.2 Project financing

Project value: No information found.

Equity financing: No information found.

Debt financing: The following information is found regarding loans to the Ralco project:

- In September 1997, Dresdner Bank, which is now part of **Allianz** (Germany), and Chase Manhattan, which is now part of **J.P. Morgan Chase & Co.** (United States), arranged a US$ 380 million syndicated loan for Endesa, to finance the Panque and Ralco Dams. Reportedly, this loan was used partly to pay back the IFC financial package of 1992 for the Panque Dam for which the IFC demanded repayment because of a breach of the environmental standards agreed. [364]

Other banks participating in the loan syndicate were: [365]

- Argentaria Banco Exterior de España (now part of **Banco Bilbao Vizcaya Argentaria)** - Spain
- **Banca Monte dei Paschi di Siena** - Italy
- Bank of Nova Scotia (now: **Scotiabank**) - Canada
- **Bank of Tokyo-Mitsubishi** - Japan
- Banque Nationale de Paris (now part of **BNP Paribas**) - France

- **Bayerische Landesbank** - Germany
- **Caja de Madrid** - Spain
- Crédit Suisse First Boston (part of **Crédit Suisse**) - Switzerland
- Deutsche Morgan Grenfell (part of **Deutsche Bank**) - Germany
- Deutsche Girozentrale-Deutsche Kommunalbank (now part of **DekaBank**) - Germany
- ING Barings (part of **ING Bank**) - The Netherlands
- J.P. Morgan Securities (now part of **J.P. Morgan Chase & Co.**) - United States
- Paribas (now part of **BNP Paribas**) - France
- **Société Générale** - France
- Union Bank of Switzerland (now: **UBS**) - Switzerland

In 1997, the **Export Development Corporation** (Canada) granted a loan of US$ 17 million to the Ralco Dam.[366]

4.3 Colombia: Urrá Dam

4.3.1 Key project data

Location: Sinú River, Colombia
Global 200 Ecoregion: 39 - Choco-Darien Moist Forest, 40 North Andes Montane Forest
Issue(s): The number of people directly affected by the Urra dam construction is estimated at 60,000, about 15.4% of the total population of the lower Sinu basin. Since the filling up of Urra Dam on the Sinu River in 1999, a series of impacts have occurred and affected both down and upstream from the dam. For example, the decline ecosystems of the Sinu River basin and the survival of thousands of indigenous, peasant and fishing families who rely on those systems. The main impacts include: Loss of biodiversity due to the modification of the chain of aquatic ecosystems, the impediment of spawning migration by the principal species of rheophilic fish (Prochilodus reticulatus, Brycon morei, Sorubin lima, Leporinus sp., etc.), significant decrease in the fish population in the main bodies of water, and as a result, unemployment and general deterioration of the quality of life in the small fishing, peasant and indigenous towns, deterioration of the food supply in all the towns in the region which depended on fishing as a principal source of low-cost protein, downstream from the dam, the river level has decreased dramatically, letting the banks of the river collapse and thereby damaging the sensitive ecosystem balances along the riverbanks.

The most valuable fish, bocachicos, are dying massively in the quickly drying wetlands. While on the other hand, the Embera Katios indigenous peoples living upstream are powerless to prevent the drowning of their fields, sacred sites, cemeteries and houses thus destroying their traditional culture. Fishing production, previously estimated at approximately 6,000 tons annually (ASPROCIG, 1997) has decreased to 1,700 tons (INPA, 1999).The URRA dam project started in 1977. Since the start of the Urra dam project, a lot of irregularities have taken place with respect to the violations of human rights. Meanwhile, most of the more prominent opponents of the project (Embera Katio leaders, fishermen representatives, scientists and intellectuals, advisers of the indigenous) have been murdered, threatened or forced to exile in total impunity.[367]
Construction period: 1993-2000
Project operator: Empresa Multiproposito Urrá S.A., which is a semi-public company under the supervision of Colombia 's Mines and Energy Ministry.[368]
Height: 73 meters
Production capacity: 340 MW
Reservoir area / volume: 7,400 hectares
Building consortium: Skanska (Sweden), Conciviles (Colombia) and BFC, which is now part of Aecon (Canada). [369]
Power generation equipment suppliers: Energomachiexport (Russia). [370]
Other companies involved: VA Technologie (Austria). [371]

4.3.2 Project financing

Project value:	US$ 800 million [372]
Equity financing:	The equity of Empresa Multiproposito Urra reportedly accounts for 40% of the project value. This equity is supplied

by the Colombian government, which has secured funds from other sources: [373]

Part of a US$ 185 million loan of the **Inter-American Development Bank** (International) to the Colombian electricity sector is used for the financing of the Urrá project, probably in the form of equity.[374]

Debt financing:

Debt reportedly accounts for 60% of the project value. [375] The following information is found on loans provided to Empresa Multiproposito Urra and its suppliers:

- **Corporación Andina de Fomento** (International) provided a long-term loan to the Urrá project.[376]
- The **Nordic Investment Bank** (International) has reportedly also granted a loan to the Urrá project.[377]
- In September 1997, a US$ 60 million 14-year loan was provided by Nordbanken, which is now part of **Nordea** (Finland/Sweden/Denmark). [378]
- The **Export Development Corporation** (Canada) has provided a US$ 18.2 million loan to the project.[379]
- In March 1998, **Financiera Energética Nacional** (Colombia) approved a US$ 115 million five-year loan to the Urrá project. Of this amount, US$ 57 million was used to refinance outstanding debt that was due in 1998 and 1999. The rest of the loan was used for investments needed to complete the project.[380]
- **Credit guarantees:** (Export) credit guarantees have reportedly been granted by: [381]
- **Exportkreditnämnden (EKN)** Sweden Amount unknown
- Government of Colombia Colombia US$ 197 million

4.4 Paraguay / Argentina: Yacyretá Dam

4.4.1 Key project data

Location: Paraná River, Paraguay / Argentina
Global 200 Ecoregion: 48 Atlantic Forest
Issue(s): Landscape damage, displacement, no local benefits, corruption
Construction period: 1978-1998
Project operator: Entidad Binacional Yacyretá (Paraguay / Argentina)
Height:
Production capacity: 2,700 MW
Reservoir area / volume:
Building consortium: Impregilo (Italy), Empresas Reunidas (Spain) and Dumez (France). [382]
Power generation equipment suppliers: Voith (Germany), Dom. Eng. Works, Impsa, Cometarsa, General Electric (United States), Siemens (Germany), Ansaldo, Mitsubishi (Japan), Hitachi (Japan) and Toshiba (Japan). [383]
Other companies involved: Lahmeyer (Germany), Harza (United States), CIE, Sade and Iglys.[384]

4.4.2 Project financing

Project value: US$ 11.5 billion. [385]

Equity financing: No information found.

Debt financing: Information was found on the following bank loans for the Yacyretá Dam:

- The **World Bank** (International) committed loans with a total amount of US$ 860 million to the project. [386]
- Between 1978 and 1994, the **Inter-American Development Bank** (International) has made four loans totalling US$ 840.0 million to partially finance the Yacyretá Hydroelectric Plant.[387]
- In March 1996, a US$ 131 million loan package was provided by an international banking syndicate arranged by the **Inter-American Development Bank** (International) to the company Líneas de Transmisión del Litoral S.A. (LITSA). This is a private company which constructed and operates the second link between Yacyretá and the Argentinean high-voltage transmission system. The total loan amount was divided up as follows: [388]
  - **Inter-American Development Bank** - International - US$ 43.0 million
  - Finamex (now: **BNDES-exim**) - Brazil - US$ 43.7 million
  - Commercial banks - Various - US$ 44.0 million

  The Finamex loan was guaranteed by: [389]

- **Banco de la Nación** - Argentina
- Citibank (part of **Citigroup**) - United States

The commercial banks participating in the US$ 44 million syndicated loan were: [390]

- Dresdner Bank (now part of **Allianz**) - Germany
- **Crédit Lyonnais** - France
- Banque Nationale de Paris (now part of **BNP Paribas**) - France
- Mediocredito Centrale (now part of **Capitalia**) - Italy
- Fuji Bank (now part of **Mizuho Bank**) - Japan
- Long-Term Credit Bank of Japan (now: **Shinsei Bank**) - Japan

4.5 Venezuela: Macagua II Dam

General

One of the biggest hydropower projects of the nineties and is located in the state of Bolívar in south-eastern Venezuela located in a 215 kilometre long stretch along the Caroni River. The Lower Caroni Development scheme is made up of five major components: Macagua I, Guri, Macagua II, Tocoma and Caruachi. Of these, Macagua I and Guri have already been built, Macagua II is under construction while Tocoma is still at the design stage.

4.5.1 Key project data

Location: Caroní River, Bolívar, Venezuela

Global 200 Ecoregion:

Issue(s): The Macagua II project will cause serious impact on ecosystems, plant and animal species, human resources and archaeological sites, particularly while these are part of cumulative effects of the dams that are already built on the Caroni River. Among the most stringent impacts are; the flooding of islands, loss of fish populations and forests, which represent a unique and scarce habitat for several life forms. The disappearance of these ecosystems will be irreversible. Other environmental impacts include: river compartmentalisation, power lines open Guyana shield forests for logging, gold mining and settlement, intrusion of indigenous areas.[391]

Construction period: 1988-1997

Project operator: CVG Electrificación del Caroní (Edelca), which is a subsidiary of Corporación Venezolana de Guayana (CVG). CVG is a state-owned Venezuelan conglomerate.

Height: 72 meters

Production capacity: 2,540 MW

Reservoir area / volume: 4,740 hectares

Building consortium: Clark Construction (United States).[392]

Power generation equipment suppliers: Hitachi (Japan).[393]

Other companies involved:

Remarks: Macagua II Dam is one of the five dams in the Caroní riverbasin in the Bolívar state in south-eastern Venezuela, together comprising the Lower Caroní Development scheme. Of these, Macagua I was finished in 1961, Guri in 1978 and Macagua II in 1997. Caruachi will start operating in 2003 and will be finished in 2006. Preparation for the construction of Tocoma started in the spring of 2002 and the dam should be finished in 2010. When completed the development project will generate, in total, an estimated 16,300 MW. Already, the Lower Caroní dams supply 70% of Venezuelan electricity consumption.[394]

Transmission lines from the Lower Caroní Development scheme to other regions are being continuously expanded and in 1997 the construction started of a 1,500 kilometre power line system intended to carry electricity from the Guri dam to the state of Roraima in northern Brazil.[395]

4.5.2 Financing of Macagua II dam

Project value: US$ 1,970 million

Equity financing: Equity supplied by Edelca contributed US$ 700 million, or 36% of total project costs.[396]

Debt financing: The following financial institutions reportedly granted loans to the Macagua II project:[397]

- **Corporación Andina de Fomento** - International - US$ 100 million
- Export-Import Bank of Japan, which is now part of the **Japan Bank for International Cooperation** - Japan - US$ 400 million
- **Inter-American Development Bank** - International - US$ 200 million
- **World Bank** - International - US$ 200 million

4.5.3 Financing of transmission lines

Project value: US$ 400 million (transmission line to Brazil).[398]

Equity financing: No information found.

Debt financing: The following financial institutions reportedly granted loans to Edelca for the development of transmission lines:

- In December 1996, **Corporación Andina de Fomento** (International) granted a US$ 110 million loan to Edelca for the development of a high-voltage transmission line between Macagua II and Las Cristinas in Bolívar state.[399]
- In December 2000, Edelca secured a US$ 100 million syndicated loan for expanding its high-voltage transmission system in Venezuela. The loan syndicate was arranged by **Corporación Andina de Fomento** (International), which contributed US$ 25 million, and **Banco Santander Central Hispano** (Spain).[400]

4.6 Venezuela: Caruachi Dam

4.6.1 Key project data

Location: Caroní River, Bolívar, Venezuela
Global 200 Ecoregion:
Issue(s): The Caruachi project is part of one of the biggest hydropower projects of the nineties and is located in the state of Bolívar in south-eastern Venezuela located in a 215 kilometre long stretch along the Caroni River. The Lower Caroni Development scheme is made up of five major components: Macagua I, Guri, Macagua II, Tocoma and Caruachi. Of these, Macagua I and Guri have already been built, Macagua II is under construction while Tocoma is still at the design stage.

The Caruachi project site is 59 kilometres downstream from the Raul generating station at Guri, and 22 kilometres upstream from Macagua. The effects discussed below refer only to direct impacts of the Caruachi reservoir, which will flood an area of 238 square kilometres. It does not refer to the cumulative effects of the dams that are planned and already built on the Caroni River. About 170 islands are found in the area of the river to be flooded. Approximately eighty percent of these will be submerged by the reservoir. The islands and the forests along the Caroni River represent a unique and scarce habitat for several life forms. The disappearance of these ecosystems will be irreversible. The reservoir will also flood natural rapids along the river in five sections of the river, each with an average length of one kilometre. Today these areas are a tourist attraction. Besides affecting the river ecology, the scenic beauty of the river will be lost by the flooding of the rapids. In addition the reservoir will submerge natural beaches along the river, which today are used as a recreational area for people from nearby cities. Other environmental impacts include; River compartmentalisation, power lines open Guyana shield forests for logging, gold mining and settlement, intrusion of indigenous areas.[401]
Additionally, the project will disrupt local settlements, affecting infrastructure and services. At least 1 014 people will have to be moved because of the project. Associated with this is the loss of homes and farmland.

The reservoir will form a body of water with extensive shallows that has relatively little circulation. Large volumes of organic mater and minerals are expected to accumulate in the impounded water. These conditions create an ideal breeding ground for carriers of tropical diseases.

A thorough survey of archaeological sites in the flood zone and areas adjacent to the future reservoir has not been carried out, and there is a possibility that the reservoir could submerge sites of historical and cultural interest. For example, the San Ramon de Caruachi mission is known to have been founded in 1763 on the banks of the Caroni. Its ruins have not yet been located. Similarly, pre-Colombian peoples established settlements on the banks of the river. These have as yet not been found.
Construction period: 1995-2006 [402]
Project operator: CVG Electrificación del Caroní (Edelca), which is a subsidiary of Corporación Venezolana de Guayana (CVG). CVG is a state-owned Venezuelan conglomerate.
Height: 55 meters
Production capacity: 2,160 MW
Reservoir area / volume: 23,680 hectares
Building consortium: Dragados y Construcciones (Spain), Vialpa (Venezuela), and Ingenieros Civiles Asociados (Mexico). [403]

Power generation equipment suppliers: Kvaerner (Norway), General Electric (United States), NEI Peebles (United Kingdom), and Elin (Austria).[404]
Other companies involved: Impregilo (Italy) and Voest Alpine Technologie (Austria).[405]
Remarks: Caruachi dam is one of the five dams in the Caroní riverbasin in the Bolívar state in south-eastern Venezuela, together comprising the Lower Caroní Development scheme. Of these, Macagua I was finished in 1961, Guri in 1978 and Macagua II in 1997. Caruachi will start operating in 2003 and will be finished in 2006. Preparation for the construction of Tocoma started in the spring of 2002 and the dam should be finished in 2010. When completed the development project will generate, in total, an estimated 16,300 MW. Already, the Lower Caroní dams supply 70% of Venezuelan electricity consumption. [406]

4.6.2 Project financing

Project value: US$ 2,130.4 million [407]

Financing overview: Banque Indosuez, which is now part of **Crédit Agricole** (France) acted as financial advisor for the financing package for the Caruachi dam. This was structured as follows: [408]

Equity	Equity provided by Edelca	US$ 1,000.0 million	46.9%
Debt	Multilateral bank loans	US$ 620.0 million	29.1%
	ECA-guaranteed bank loans	US$ 504.0 million	23.7%
	Unknown	US$ 6.4 million	0.3%
Total		US$ 2,130.4 million	

Equity financing: Equity provided by Edelca reportedly contributes US$ 1,000 million or 47% of total project costs. [409]

Multilateral bank loans: Multilateral bank loans reportedly accounted for US$ 620 million, or 29% of total project costs.[410] The following information is found on multilateral bank loans provided to Edelca for the Caruachi project:

- In November 1993, the **Inter-American Development Bank** (International) approved a US$ 500 million loan to the project.[411]
- Around 1994, the **Nordic Investment Bank** (International) provided a US$ 60 million loan for the Caruachi Dam.[412]
- Around 1994, the **Corporación Andina de Fomento** (International) supplied a US$ 60 million loan to Edelca for the Caruachi project.[413]

Probably to refinance other loans and cover additional costs, the **Corporación Andina de Fomento** (International) in June 2002 supplied a new 14-year US$ 100 million loan to Edelca for the Caruachi project.[414]

ECA-guaranteed loans:

Reportedly, an international banking syndicate supplied ECA-guaranteed loans with a value of US$ 504.0 million, contributing 24% of total project costs.[415]

The following banks and ECAs probably took part in this syndicate:[416]

- Creditanstalt-Bankverein, which is now part of **HypoVereinsbank** - Germany
- **Eksportfinans** - Norway
- **Export Development Corporation (EDC)** - Canada
- Finnish Export Credit, which is now part of **Sampo** - Finland
- **SEB** - Sweden

Credit guarantees:

The following ECAs probably have provided export credit guarantees with a total value of US$ 504.0 million for the ECA-guaranteed loans to the Caruachi project: [417]

- **Compañía Española de Seguros de Crédito a la Exportación (CESCE)** - Spain - Amount unknown
- **Export Credits Guarantee Department** - United Kingdom - Amount unknown
- **Export Development Corporation (EDC)** - Canada - Amount unknown
- **Exportkreditnämnden** - Sweden - Amount unknown
- **Finnvera** - Finland - Amount unknown
- **Garanti-Instituttet for Eksportkreditt (GIEK)** - Norway - US$ 190 million
- **Österreichische Kontrollbank** - Austria - Amount unknown

4.7 Venezuela: Tocoma Dam

4.7.1 Key project data

Location: Caroní River, Bolívar, Venezuela
Global 200 Ecoregion:
Issue(s): River compartmentalisation, power lines open Guyana shield forests for logging, gold mining and settlement, intrusion of indigenous areas.[418]
Construction period: 2002-2010 [419]
Project operator: CVG Electrificación del Caroní (Edelca), which is a subsidiary of Corporación Venezolana de Guayana (CVG). CVG is a state-owned Venezuelan conglomerate.
Height: 80 meters
Production capacity: 2,160 MW
Reservoir area / volume: 8,734 hectares
Building consortium:
Power generation equipment suppliers: Edelca is in the process of selecting suppliers. The Chinese companies China National Machinery and Equipment Corporation, China Camc Engineering and Harbin Electric Machinery Company have expressed interest.[420]
Other companies involved:
Remarks: Tocoma dam is one of the five dams in the Caroní riverbasin in the Bolívar state in south-eastern Venezuela, together comprising the Lower Caroní Development scheme. Of these, Macagua I was finished in 1961, Guri in 1978 and Macagua II in 1997. Caruachi will start operating in 2003 and will be finished in 2006. Preparation for the construction of Tocoma started in the spring of 2002 and the dam should be finished in 2010. When completed the development project will generate, in total, an estimated 16,300 MW. Already, the Lower Caroní dams supply 70% of Venezuelan electricity consumption. [421]

4.7.2 Project financing

Project value:	US$ 2,000 million [422]
Equity financing:	Equity will reportedly cover 50% of total project costs. Edelca is negotiating with two other companies willing to invest in the project. [423]
Debt financing:	Loans will reportedly cover 50% of total project costs. Edelca is looking for financing from multilateral development banks. [424]

Annex 2 Index of financial institutions

Annex 3 Notes

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