

**DAMS INCORPORATED**  
The Record of Twelve European  
Dam Building Companies

February 2000

A Report by The CornerHouse  
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THE COMPANIES

- **ABB (incorporating Alstom):** (Ataturk, Bakun, Batang Ai, Bhumiphol, Cahora Bassa, Ciechocinek, Curui, Guavio, Houay Ho, Ilisu, Itaipu, Karakaya, Maheshwar, Muela, Pangani, Pangué, Salto Caxias, Song Hinh, Tarbela, Theun Hinboun, Three Gorges, Xingo, Zimapan)
- **Balfour Beatty:** (Kainji, Lesotho Highlands, Pergau, Samanalawewa, Victoria)
- **Coyne et Bellier:** (Ban Mai, Birecik, Bui, Daniel Johnson, Ita, Kariba, Kedung Ombo, Lesotho Highlands, Malpasset, Manantali, Ruzizi II)
- **Electrowatt:** (Awash II, Bakun, Glougo, Goubassi, Houay Ho, Khao Laem, Manatali, Nathpa Jhakri, Pangué, Ralco, Samanalawewa, Theun Hinboun, Xe Pian, Xe Nam Noi, Yali Falls)
- **Impregilo:** (Akosombo, Bakolori, Caruachi, Chixoy, Dez, El Cajon, Ertan, Ghazi Barotha, Itezhitezhi, Kainji, Kariba, Kihansi, Lesotho Highlands, Lower Xialangdi, Nathpa Jhakri, Tarbela, Yacyreta)
- **Knight Piesold and Partners:** (Corpus Christi, Ewaso Ngiro, Lesotho Highlands, Nam Theun 2, Omai Tailings, Pergau, Tana River Development, Three Gorges, Turkwell)
- **Kvaerner Energy (now GE Hydro):** (Bakun, Bhumibol, Caruachi, High Aswan, Kaptai, Lesotho Highlands, Naptha Jhakri, Pangué, Song Hinh, Zimapan)
- **Lahmeyer International:** (Arun III, Bakun, Birecik, Chico, Chixoy, Chulac, Kinda, Lesotho Highlands, Nam Leuk, Nam Theun 2, Sentani, Tasang, Yacyreta)
- **Siemens (incorporating Voith Siemens Hydro):** (Itaipu, Maheshwar, Nathpa Jhakri, Three Gorges, Xingo, Yacyreta)
- **Skanska:** (El Guavio, Ilisu, Kishen Ganga, Kotmale, Pergau, Uri, Urra I, Yali Falls)
- **Sogreah:** (Dai Ninh, Lesotho Highlands, Nam Leuk, Pak Mun, Turkwell)
- **VA Tech (incorporating Sulzer Hydro):** (Bhumiphol, Cirata, Ertan, Ilisu, Nathpa Jhakri, Pangué, San Roque, Three Gorges, Urra I)

THE DAMS

- **Ilisu (Turkey):** (ABB, Balfour Beatty, Impregilo, Skanska)
  - **Lesotho Highlands Water Development Project (Lesotho):** (ABB, Balfour Beatty, Coyne et Bellier, Impregilo, Knight Piesold, Kvaerner Energy, Lahmeyer International, Sogreah)
  - **Yacyreta, Itaipu, Corpus (Paraguay/Argentina/Brazil):** (ABB, Impregilo, Knight Piesold, Lahmeyer International, Siemens)
  - **Chixoy (Guatemala):** (Impregilo, Lahmeyer International)
  - **Pangué, Ralco (Chile):** (ABB, Electrowatt, Kvaerner Energy, Voest-Alpine)
  - **Nathpa Jhakri (India):** (ABB, Electrowatt, Impregilo, Kvaerner Energy, Siemens)
  - **Bakun (Malaysia):** (ABB, Impregilo, Lahmeyer International, Siemens)
  - **Three Gorges (China):** (ABB, Knight Piesold, Siemens, Sulzer Hydro)
- European Dam Building Company Contacts
  - Bibliography

**PUBLISHER'S NOTE**

European dam builders, suppliers and consultants continue to promote and export their technologies to the South. The industry projects itself as experts in benign development and providers of

economic prosperity, implying that its work has been tested and perfected at home.

However, European campaigners have waged a long struggle against the same industry. Our campaigns have catalysed legislation that bans the building of new large dams in several European countries — but this has been won only after the loss of most of the free-flowing rivers in Europe. Yet today, when the Northern dam industry pushes its technologies onto the South, it ignores, misrepresents or downplays many of the negative environmental, social and economic impacts of large dams which have discredited the industry in Europe.

Southern campaigners fighting battles on issues similar to those faced in the North lack a consolidated source of information from Europe which would help them challenge European dam builders and expose the double standards that they apply at home and in the South.

The Swedish Society for Nature Conservation (SSNC) co-operates with a large number of NGOs in the South to promote information exchange and joint campaigning on issues such as forests, agriculture, international trade and hydropower.

SSNC has therefore commissioned The Corner-House to undertake the present study, • Dams Incorporated• . The study presents — for the first time in one document — the track record of the major European dam building companies. Our hope is that it will serve as a useful tool for NGOs campaigning all over the world against unsustainable large dams.

Although the SSNC has commissioned and published the study, and supports its main conclusions, the authors are responsible for the detailed facts and views presented in the report.

Göran Eklöf

Head of the International Department  
Swedish Society for Nature Conservation  
February 2000

### **ACKNOWLEDGEMENTS**

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Patrick McCully's *Silenced Rivers* was the first book we opened to get started, as it is for anyone investigating large dams. Patrick's colleagues at the International Rivers Network — particularly Susanne Wong, Juliette Majot and Lori Pottinger — provided expert information. Many others did also, including Patricia Adams (Probe International), Peter Bosshard (Bern Declaration), Jacek Bozek (Klub Gaja), Jaroslava Colajacomo (Reform the World Bank Campaign), Oyvind Eggen (FIVAS), Pam Foster (Halifax Initiative), Thabang Kholumo (Highlands Church Solidarity Action Centre), Deborah Moore (Environmental Defense), Juan Pablo Orrego (Grupo de Accion por el Biobio), Charles Chen Osorio, and Heffa Schucking (Urgewald). Of course, no-one except the authors bears responsibility for any factual errors in the report.

Goran Ek, International Secretary of the Swedish Society for Nature Conservation, not only gave of his time and expertise, but also agreed to support and publish the report. Nick Hildyard would like to thank the CS Mott Foundation and NOVIB for funding his work on the project.

Finally, thanks to Sarah Sexton and Larry Lohmann from The CornerHouse. Sarah and Larry were asked to do an editing job but were instead given a full-scale reconstruction; it's painful to imagine what the report might have looked like without their contribution.

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## ABBREVIATIONS

ABB — Asea Brown Boveri  
ADB — Asian Development Bank  
APA — Amerindian People's Association of Guyana

BHC — Bakun Hydroelectric Corporation Sdn Bhd (Malaysia)  
BICC — British Insulated Callender's Cables  
BITS — Board for Investment and Technical Support (Sweden)  
BOT — Build Operate Transfer  
BPKP — Lao Military Logging Company  
BWI — Beca Worley International

CBPO — Companhia Brasileira de Projectos e Obras  
CEO — Chief Executive Officer

DFID — Department for International Development (UK)  
DM — German Marks  
DTI — Department of Trade and Industry (UK)

EBY — Entidad Binacional Yacyreta (Paraguay and Argentina)  
ECAs — Export Credit Agencies  
ECGD — Export Credit Guarantee Department (UK)  
Edelca — Electrificación del Caroni (Venezuela)  
EDC — Export Development Corporation (Canada)  
EDF — Electricite de France  
EGAT — Electricity Generating Authority of Thailand  
EHDC — Ertan Hydroelectric Development Group (China)  
EIA — Environmental Impact Assessment  
EIB — European Investment Bank  
EPR — European Pressurised-Water Reactor  
ERM — Environmental Resources Management  
EWE — Electrowatt Engineering

IDA — International Development Association (World Bank)  
IBRD — International Bank for Reconstruction and Development (World Bank)

FIVAS — The Association for International Water and Forest Studies (Norway)  
GABB — Grupo de Accion por el Biobio (Chile)  
GAP — Turkey's Southeastern Anatolia Project  
GE — General Electric  
GIAK — Guarantee Institute for Export Credit (Norway)  
GTZ — Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)

HSE — Health and Safety Executive (UK)

IBRD — International Bank for Reconstruction and Development (World Bank)  
ICOLD — International Commission on Large Dams  
IDA — International Development Association (World Bank)  
IFC — International Finance Corporation (World Bank)  
INDE — National Institute of Electrification (Guatemala)  
IWPC — Iran Water and Power Development Corporation

JICA — Japan International Cooperation Agency  
KfW — Kreditanstalt für Wiederaufbau (Germany)  
KHRP — Kurdish Human Rights Project (UK)  
KWU — Kraftwerk Union (Siemens Power Generation Group)

LHWP — Lesotho Highlands Water Development Project

MDBs — Multilateral Development Banks  
MOX — Mixed-oxide (nuclear fuel)  
MW — megawatts

NAFTA — North American Free Trade Area  
NBA — Narmada Bachao Andolan (Save the Narmada Valley)  
NDF — Nordic Development Fund  
NEA — Nepal Electricity Authority  
NGO — Non governmental organisation  
NJPC — Nathpa Jhakri Power Corporation (India)  
NOK — Norwegian Kroner  
NORAD — Norwegian Agency for Development and Cooperation  
NTEC — Nam Theun 2 Electricity Consortium (Laos)

NVE — Norwegian Water Resources and Energy Administration

ODA — Overseas Development Administration (UK, now DFID)  
OECD — Organisation for Economic Cooperation and Development  
OECF — Overseas Economic Cooperation Fund (Japan)  
OED — Operations Evaluation Department (World Bank)

PFI — Private Finance Initiative (UK)  
PPA — Power Purchase Agreement

RID — Royal Irrigation Department (Thailand)

SALCRA — Sarawak Land Consolidation and Rehabilitation Authority  
SHYDO — Sarhad Hydel Development Corporation (Pakistan)  
Sida — Swedish International Development Cooperation Agency  
SMHPC — Shree Maheshwar Hydro Power Corporation (India)

UNDP — United Nations Development Programme  
UNEP — United Nations Environment Programme  
USAID — United States Agency for International Development

VA Tech — Voest-Alpine Technologie

WAPDA — Water and Power Development Authority (Pakistan)  
WCD — World Commission on Dams  
WCS — World Conservation Society

YRC — Yellow River Contractors (China)  
YRWHDC — Yellow River Water and Hydroelectric Power Development (China)

Note: All monetary figures quoted in this report are in US dollars, unless otherwise stated

## INTRODUCTION

### *Under Scrutiny: Europe's Dam Building Industry*

Dams do not build themselves. Nor are they the outcome of impartial decision-making by impartial political and economic actors responding to the pre-existing needs of society. On the contrary, underpinning each of the 40,000 large dams that now straddle the world's rivers is a well-developed political infrastructure that has enabled a small but powerful group of vested interests to direct water for their own benefit; to capture public subsidies; to crush, co-opt or bypass opposition; to filter out or suppress alternative solutions to water and energy problems; and to ensure their own institutional survival, even expansion.

Key players in this infrastructure are consultancies, construction companies, Northern and Southern governments, multilateral and bilateral development agencies, machinery suppliers, academics, politicians and even NGOs. Working in loose alliance — often based on informal contacts — they have been phenomenally successful in reshaping the political and social landscape in ways that are friendly to them.<sup>1</sup>

Consultants, for example, help identify new market opportunities. They propose, plan and design new products and projects. They give • objectivity• to the projects that construction companies and equipment suppliers would like to implement — often, as this report documents, on the basis of seriously flawed (and manipulated) studies.

Bilateral aid agencies, meanwhile, provide an accessible — and easily pressured — source of public money that can be used to offload the risks of projects onto the taxpayer, or to allow home country industries to undercut their rivals abroad. Other national agencies, such as export credit agencies, are also important players, constantly on the look-out for new markets for goods produced in their countries — and ever willing to stump up concessional credits and guarantees if they help boost export figures. Meanwhile, the embassies of national governments have proved critical to extending the reach of companies into new countries with which the companies are unfamiliar, providing diplomats to make appropriate introductions, to argue industry's case and guide hydro companies through the complexities of local politics. Industry associations further grease the subsidy mill, lobbying governments for tax-breaks and other incentives, influencing environmental and labour regulations and protecting the industry's image from opponents, real or imaginary.

And then, of course, there are the Multilateral Development Banks (MDBs) — such as the World Bank — ever handy sources of still more subsidies, advice and political muscle, not least in • tutoring• the water bureaucracies of Southern governments of the • need• to adopt dam-based development strategies. Since it was founded in 1944, the World Bank alone has splashed out some \$58 billion on 527 dams in 93 countries. As with bilateral loans, much of this money is actually spent in Northern countries, paying for consultants or construction and equipment suppliers.

In addition, the World Bank offers massive indirect subsidies in the form of business opportunities identified through its country appraisal reports and other research it finances. Companies regularly meet with Bank staff to identify dam projects; invite project staff to company seminars; and involve themselves in the project cycle. Those who do not have ready access to MDB officials are able to call upon officials in trade ministries and embassies. In Britain, for example, the World Aid section of the UK Department of Trade and Industry (DTI), which helps bring World Bank business to UK companies, has a listing of • agents• with access to Bank officials. The DTI also holds regular seminars for businesses wishing to win contracts with the Bank and other MDBs.

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### ***Damned at Home, Damming Abroad***

Among the key players who have helped construct this political infrastructure, and who have benefited to the tune of billions of dollars from it, have been the European construction companies, equipment suppliers and consultants that are the subject of this report.

Until the late 1960s, few of these companies operated outside Europe. By the late 1970s, however, the industry's operations in Europe were under severe threat. In Sweden and Switzerland, widespread public opposition has now stopped all but the smallest projects. Sweden's 1987 Natural Resources Act now prohibits any hydropower exploitation of the country's last four free-flowing rivers — the Torne, Kalix, Pite and Vindel. In Norway, after a bitter struggle in the early 1980s, the Alta dam was eventually built only on condition that it would be the last of its kind.<sup>2</sup> In France, the proposed Serre de la Fare dam on the Loire River was scrapped in 1994.

The Third World was the industry's saviour. As their home markets shrank, companies began to extend their networks of power abroad, using development aid as the means to secure new contracts and break into new markets. Exploiting the Nordic countries' reputation as enlightened donors, the Nordic hydropower industry expanded into South-East Asia. The two largest state-owned hydro companies, Statkraft and Vattenfall, built their first dam outside Sweden and Norway in Laos in 1994.<sup>3</sup> As Karl-Erik Norlander, then Senior Manager of Sweden's Vattenfall, told Ann Danaiya Usher, a journalist who has investigated the connection between the Nordic hydropower industry and Nordic aid: • There are very few new projects in Sweden and Norway. But we still need professionals in the field, so we go abroad to find possibilities to use our skills. •<sup>4</sup> Indeed, by the mid-1990s, about half of the hydro-related exports of ABB Generation (part of the Swedish-Swiss multinational Asea Brown Boveri) were linked to aid money. Likewise, half of the dam-related contracts for the consultancy Swedpower were paid by the Swedish bilateral agencies SIDA and BITS, while multinational agencies like the World Bank and the Asian Development Bank provided the rest.<sup>5</sup>

Britain's construction industry has been no less adept at using Third World contracts to climb out of industrial recession in Europe. In a comment that reflects the strategy of UK companies across the industry as a whole, the then Chief Executive of Tarmac told the Financial Times in 1984:

• We used to concentrate on the oil rich countries just like every other contractor in the world. That meant there were huge tender lists with 50 or 60 companies bidding for every project, which put our chance of getting work down to 50 or 60 to one and meant we could only get the job on price. So our philosophy now is to forget the oil-rich countries and to look at the underdeveloped and developing world where we can ensure funding before we get the work and provide them with a total design, construct and finance package. •<sup>6</sup>

### ***Profits for the Few, Immiseration for the Many***

The use of Third World aid as a rescue package for the hydro industry has inevitably been accompanied by rhetorical claims of the developmental benefits of dams. Such claims, as this report makes clear, are threadbare at best. Whilst dam building has undoubtedly brought profits for European equipment suppliers, consultants and construction companies, the impacts on project-affected communities have been severe. Overall, the record has been one of:

- Cultural alienation;
- Adverse environmental and macro-economic impacts;
- Dispossession, both from their land and other resources;
- Lack of consultation;
- Lack of compensation or inadequate compensation;
- Human rights abuses;
- Exacerbation of gender and class inequalities; and
- Lowering of living standards.

Not only have the companies detailed in this report continued to remain involved in projects where human rights abuses have been demonstrated or where resettlement plans have been inadequate; they have in many cases actively promoted such projects against local opposition and often in contravention of their own corporate environmental guidelines.

For many affected communities, the results have been devastating. Indeed, a 1990 World Bank review of the Latin American region was • unable to find a single study of a Bank-financed project [in the region] which quantitatively demonstrated that a resettlement population has been adequately

rehabilitated in terms of income, health or other social welfare measures. • Four years later, another Bank report similarly concluded: • The weight of available evidence points to unsatisfactory income restoration more frequently than to satisfactory outcomes. • <sup>7</sup> For India, another study stated, • the overall record is poor to the extent of being unacceptable. • <sup>8</sup> Indeed, in all its reviews, the Bank was only able to find one Bank-funded dam — the Khao Laem in Thailand — where the • fundamental goal • of the Bank’s policy had been met and • incomes for all households rose after resettlement • .<sup>9</sup> Even here the Bank’s figures have been criticised as misleading and are at odds with the accounts of independent observers.<sup>10</sup> Academic studies by university-based researchers similarly confirm the overall failure of resettlement schemes resulting from dam projects.

Academic Thayer Scudder, for example, states:

• *Well-designed long-term research is urgently needed. In its absence, the arguments will have to rely to a large extent on case studies. What is known from them indicates that, whether short-term or cumulative, adverse social impacts, as with environmental ones, have been seriously underestimated. When combined with adverse health impacts, it is clear that large scale water resource development projects unnecessarily have lowered the living standards of millions of local people.* • <sup>11</sup>

### ***Exposing the Record***

A prime aim of this report is to expose the record of Europe’s premier dam-building companies in impoverishing numerous communities in the South in the pursuit of their own profit and institutional goals. The case for doing so is threefold.

First, the past record of companies provides a good guide — possibly the only guide — to their future performance. With several of the companies covered in this report already involved in promoting private sector hydropower projects — and many of the others likely to become involved in the future — it is hoped that the report will provide local communities, host governments and potential investors with information to help assess the probity, reliability and ethical standards of the companies involved.

Second, with many dam-affected communities now calling for reparations, it is time to hold Europe’s dam building companies accountable for their past. Documenting their record is key to that process. Which dams have they helped build? How reliable were their studies? What information was omitted? And why? How have affected communities fared? Are they better or worse off? Were the companies involved in corrupt practices? Did the companies observe their own environmental and social guidelines? Were internationally agreed standards for development projects honoured? Who ultimately benefited from the dams? Answering questions like these will be vital if communities are to be able to extract from companies the reparations they require to rehabilitate their lives. It is hoped that this report will make a small contribution towards this goal.

Finally, it is also hoped that a knowledge of the record of European dam builders may be of practical help to those concerned European citizens who are demanding that the companies which operate from their countries, often with the backing of their tax-payers’ money, and certainly with their governments’ blessing, are held accountable for their actions abroad. Using the report internally to exert pressure through trade unions or shareholder actions may be one fruitful avenue for exerting pressure for change. More generally, a range of policy changes suggest themselves if the European dam building industry’s power to oppress is to be curtailed. These include:

- Recognition of the principle of prior informed consent by affected communities in all future dam projects;
- A requirement on companies receiving publicly-backed funds for infrastructure development to abide by mandatory development and environment standards;
- Provisions to allow those affected by European-backed infrastructure projects to seek legal redress, with legal aid, in the European courts;
- Internal procedures, including career penalties and rewards, to ensure that inappropriate projects are screened out and that approved projects comply fully with agreed environmental and development standards;
- A requirement on government departments to consider the past human rights, environment and development record of companies applying for publicly-backed funds;
- A requirement on companies receiving publicly-backed support that they agree to meet the same environmental, labour and development standards in other countries as they would be expected to observe in Europe;

- A requirement on government departments to make public all documents relevant to the human rights, environmental and development impacts of publicly-supported infrastructure projects and to make translations available in the languages of project affected people;
- A requirement on government departments to consult with affected communities and interested public interest groups prior to any decision being taken on approval of public funding for infrastructure projects and to demonstrate how account has been taken of the issues raised; and
- A shift away for support aimed at promoting the short-term interests of corporations and their shareholders towards support for projects promoting sustainable livelihoods and greater community control over resources and decision-making.

### ***Into The Future: The Industry's View***

*• It is hoped that future generations will make their own philosophy to build harmonised, attractive, ecologically optimised and yet technically sophisticated and cost-efficient facilities, based on well thought-out and honest planning processes. In our current economic system where unlimited liberalism is preached and the minimisation of costs is the only priority, however, there is no room for works of this kind. Let us hope the time will change. •*

Heinz Brunold,  
Head of Civil Engineering Department,  
Steirische Wasserkraft- und Electricitatz-Aktiengesellschaft,  
Gmunden, Austria, 18 October 1999.

In October 1999, representatives of the dam building industry met in Gmunden, Austria, to peer into the future. • *Hydropower into the Next Century*• featured 98 presentations from 16 European companies and institutions, and others from Turkey, India, New Zealand, the US, China, Japan, Iran, Ethiopia and Canada.<sup>12</sup> These experts discussed problems and case studies from many of the world's major river basins. They talked of hydropower and • development opportunities• , • innovations• , • conflict management• and the • social and ecological aspects• of the environment, and of new turbines, control systems, storage, planning, upgrading, sediment, money, risk and education. The Gmunden gathering was the third in a series and the last of the 1990s.

Hans Haider, chief executive officer of Verbund, Austria's biggest electricity supply company, opened the conference with a story about a • model• dam in • design and environmental friendliness• that had enjoyed • maximum acceptance among the general public• — the Freudenau dam on the Danube, built in the early 1990s. After praising it as such, Haider then declared it was • probably both the climax and the end point of [Austria's] large-scale [hydro] projects . . . The era of large power plant construction is over,• he said. • Nonetheless, hydropower will continue to be our backbone as regards national and global competition. •

The Freudenau is probably Austria's last big dam because, Haider said, • regrettably, a high price has been paid for the effort• to make it a publicly acceptable one. Freudenau's power costs about seven times more to produce than that of a comparable, older dam. Only later, during a presentation by two Verbund engineers, did the conference discover exactly why this was so. The Freudenau would have stagnated and swollen the level of Vienna's ground water, flooding out 4,000 house basements. The • simple answer• , the engineers said, would have been to resettle the people, but, by using • sophisticated technologies and intelligent solutions, it was possible to avoid such drastic measures• . Evicting 4,000 families from the heart of one of Europe's most famous capital cities may have been problematic. To avoid it has cost \$25 million so far, at \$4 million a year.

A similar • success• story from the South was told by Antonio Fonseca dos Santos, head of the Environmental Impact Coordination unit of COPEL, owner of the 1,240 MW Salto Caxias dam in Brazil. The dam was completed in 1999 with European involvement including that of Kvaerner and ABB. Around 1,200 families were resettled, 858 of whom qualified for a package whereby COPEL built schools, medical centres, a church, 500km of road, and paid for social and agricultural assistance for three years. Each qualifying family received 40 acres of land, a brick house and a barn. Salto Caxias cost \$975 million of which \$250 million — nearly a quarter of the price and ten times what has been spent keeping 4,000 Viennese basements dry — dos Santos said, went towards his environmental programmes.



But Salto Caxias too held another story. Local people had learned to fear the Salto Caxias — the last of five dams on the Iguacu River — because thousands of their neighbours had not been consulted and were forcibly evicted to make way for the four earlier dams. COPEL did not agree to an environmental impact assessment until the project was already approved. The EIA was • poor quality• and completed in only 30 days because of • political pressure• from COPEL, which began acquiring land for the reservoir before the study was finished. The people organised themselves into an effective campaign that was • strongly supported• by the media and, after much struggling and stalling, they got what they wanted.<sup>13</sup>

***Public relations: Spin this . . .***

The Freudenau dam in Austria and the Salto Caxias in Brazil are linked by the dam industry's desire for a • model• big dam. Heinz Brunold, the head of civil engineering at Steirische Wasserkraft- und Elektrizitäts- Akiengesellschaft in Austria, lectured the conference about the need for intensive • public relations work focused on people potentially affected by a project• . Dam builders should prepare a communications plan as early as possible and get • critical citizens and opinion leaders• from the area involved in the project. With careful planning and local participation, he said, a project could be made acceptable • without the costs going through the roof• . Brunold showed an example of a dam PR campaign: a cartoon of a smiling drop of water with limbs, one hand holding a flower, the other covering a chimney extinguishing puffs of smoke. It was meant to symbolise how environmentally friendly hydropower is compared with other forms of energy generation. But Brunold closed his presentation with these words:

*• It is hoped that future generations will make their own philosophy to build harmonised, attractive, ecologically optimised and yet technically sophisticated and cost-efficient facilities, based on well thought-out and honest planning processes. In our current economic system where unlimited liberalism is preached and the minimisation of costs is the only priority, however, there is no room for works of this kind. Let us hope the time will change. •*

***• Ecology has not been the main driver•***

The industry is, gauging by these conference presentations, beset by ongoing and worsening problems it optimistically sees as opportunities. Small hydropower projects were touted at the gathering but while • small hydro may [contribute] to electricity production both in developed and developing countries . . . large plants with reservoirs must cover production in the winter . . . or dry season,• said Professor Hermod Brekke of the Norwegian University of Science and Technology. It is • a sad reality• that hydro energy was disappearing from discussions on renewable energies, said Jan Tosnar and Alois Krejci of Hydropol Project and Management AS of the Czech Republic. • It might be . . . because it has been, as a whole, an industry in which enthusiasm for ecology [has not been] the main driver,• they said. Peter Leonard, senior environmental advisor of Canada's Hydro Quebec, said • the growing importance of social issues . . . have pushed to centre stage the social aspects of hydropower development• . Leonard noted that public participation had historically come about only via laws, and from there to • conflict resolution . . . that, of late, is shifting more and more towards participatory processes• .

***• Mistakes, losses and chaos•***

But regardless of intensified public relations and the grudging acceptance of participation, the dam-building industry is finding it costly and difficult to right old wrongs. • It is sometimes quite fantastic what huge tunnels, high dams, sophisticated turbines or giant generators engineers are capable of designing and producing,• said Tosnar and Krejci. • It is also hard to comprehend what mistakes, losses and chaos are taking place when the projects of such fantastic parameters are being implemented. • The two engineers said that the traditional ways of managing a big dam project — either with the client sub-contracting out every discipline, or hiring one general contractor — was • relatively expensive... [and] ineffective• . • Even in such a highly developed country as the US, the main problem has been the general contractor's inability to secure high quality project management. The results are exceeded budgets, delays, low quality and the need for frequent repairs. •

The turbines of Ghana's Akosombo dam have long failed to work properly, said Christian Angerer, who works for Austrian dam-building company VA Tech, Stuart Coulson, from GE Hydro of Canada, and Horst Mielke, from Acres International of Canada. Akosombo, completed in 1966, is one of the most notorious dams in terms of size (the biggest reservoir in the world), disease (more downstream river blindness), under-performance (20 hour per week black-outs during the 1994 drought) and erosion (the coasts of neighbouring Togo and Benin being lost at the rate of 10m a year)<sup>14</sup>. • Finally, •

the three engineers said, tests [in 1988] revealed that the original design would not achieve guaranteed efficiency values. The World Bank and the European Investment Bank paid for a project to refit Akosombo's six turbines. When one was reinstalled in 1993, new tests showed it still operating to substantially less than the original guarantee values. Refit work on the other five units immediately stopped and the contractors, Ansaldo (Italy) and General Electric (Canada), were ordered out. In June 1996, GE Hydro and VA Tech Voest won a tender to do virtually the same specialist refit that was thought necessary in 1988 but had been deleted from plans because the economic benefit appeared to be too marginal. The engineers concluded that their new work would increase Akosombo's maximum power output by 19%. They did not mention how much the repair work was all costing.

Dam reservoirs were silting up faster than new ones were being built, said Dr Tom Jacobsen, from Norwegian engineering firm Groner/Statkraft Engineering, and the problem would not literally reach the surface for another century. Jacobsen said that up to 6,000 square kilometres of the earth's water is now dammed and up to 15 square kilometres is being added each year. However, between 40-120 square kilometres is silting up each year. Sediments imply a significant danger for the environment due to their ability to absorb toxic elements, said Professor Jurgen Kongeter of the Aachen University of Technology. The alternatives to flushing the reservoir, which could pollute downstream water supplies, are often too costly, he said.

However, the industry's future would continue to be important beyond the middle of the 21st century, said Bela Petry, professor of hydraulic engineering at IHE-Deft from The Netherlands, because it was renewable, economically competitive and can be made environmentally compatible, despite being the object of criticism in the social and environmental context. Independent Power Projects, such as build-own-operated plants, are [now] the most common type of private investments because the risk/profit ratio is the most promising and the expected duration for breaking even is the shortest. Money available for green house gas abatement should be invested efficiently, said Lahmeyer International engineer Bert Oud. Assistance in building hydro projects in developing countries would be an attractive option, particularly if construction of new lignite or coal-fired power plants can be avoided, Oud said. Electricity generation from hydropower must be a low cost production to meet competition from fossil fuels, said Hans Lindstrom of VGS Hydro International, a subsidiary of Vattenfall AB. Petry said the industry still needed to cut costs and improve social acceptance.

### ***The future: big and bizarre?***

The [industry] is going to be increasingly influenced by a trend toward concentration and globalisation, said Verbund CEO Hans Haider. Turkey wants 344 new large hydro dams to generate about 21000 MW of power, in addition to the 200-odd dams now under construction, Mine Orhon, deputy head of dams at the Turkey's General Directorate of State Hydraulic Works, told the conference. It's difficult for the government to finance all these hydropower projects, she said, and hence it wants private investors, bilateral agreements and owner-operators. India has one of the largest hydropower potentials in the world . . . 84,000 MW, [requiring] gargantuan investment, said Yogendra Prasad, chief executive of the Indian Government enterprise NHPC, who is in charge of promoting hydropower in central India, Bhutan and Nepal. Prasad presented her government's pitch of mega tax sops, like total customs duty waiver and a 10-year tax holiday for anyone investing in a 500 MW project or greater. Prasad said that State governments will acquire land and address issues related to resettlement so that the project authority should be insulated from these problems. He even offered that [resettlement] costs shall be considered a cost to the project and allowed to be passed through tariff.

The industry revealed at Gmunden that it could not build an ideal big dam in Europe that would be publicly acceptable yet cheap enough to be competitive. It is still wrestling with historical problems of project mismanagement, cost overruns, public distrust and social disruption, engineering failures, increasing competition and scarcity of investment. It saw itself as the provider of beneficial, multi-purpose, non-polluting, renewable energy and, as Lahmeyer International's Bert Oud said, long life [projects] — the majority of which are OK [except for] a few bad projects that spoil [our] reputation. Despite everything, the industry sees for itself a healthy future, given the huge demand from emerging markets especially China, Turkey and India — as long as it can keep its costs down. It also proved it has not lost the capacity for fantastic dreams . . .

Spanish consultant F. Fernandez Damborena told Gmunden of his a vision of a 29.2 kilometre long rock-fill embankment from Spain to Morocco, 340 metres deep, sitting on the Camarinas sill that divides the neck of the Mediterranean Sea from the Atlantic Ocean. The difference in the heights of the tides between the two bodies of water is only about 30 centimetres where he wants to build his \$118 billion fantasy. On the Spanish coast would be the Saladavieja, Fates and Valle reservoirs, on the Moroccan coast, the Meyimel, all of which would feed into two power plants in the middle of the Strait of Gibraltar. One would be 10 kilometres long and 110 metres below sea level, the second nine kilometres long, 165 metres below sea level. There would be special locks and tunnels for • cetacean and big fishes• . • Docks, harbours and navigation locks will be situated on both abutments; highways [and] railroads will be located on the dam crest• from Spain to Morocco, if built. The salinity of the Mediterranean would increase, and so would the sea level and sedimentation, he said. There would also be a build-up of marine bio-mass due to the 60 kilometre long stretch of newly-built artificial seaside; the reservoirs would • create significant visual impacts• ; and the acquifiers below the land-based reservoirs would be contaminated by salt water, and there would be with • catastrophic consequences• if the reservoirs failed. The seismology of the area would be affected too. • But,• he told the conference, • the project appears to be technically as well as economically feasible, without major environmental problems. •

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**A**BB is a company used to plaudits. Since its birth in 1988 — the result of a merger between the European engineering giants Asea of Sweden and Brown Boveri of Switzerland — it has established itself as one of the world's biggest and most dominant engineering and technology companies. Major divisions include power generation; power transmission and distribution; financial services; transportation; and industrial and building systems. In addition to supplying oil, gas, nuclear and petrochemical generating and distribution equipment, the company's energy divisions have been involved in numerous dams around the world, often acting as lead equipment supplier. ABB power plants currently account for about 20% of the world's total installed hydropower capacity.<sup>2</sup>

Through acquisitions, joint ventures and internal expansions, ABB has grown from a mainly European company with orders of \$28 billion and 170,000 employees in 1988 to a global group of 213,000 people generating orders of \$35 billion in 1998.<sup>2</sup> In 1989, ABB purchased 40 companies, including the worldwide power transmission and distribution operations of Westinghouse Electric Co. of the US. A year later, it began an aggressive programme of expansion in Central and Eastern Europe<sup>3</sup> and began to expand into Asia. By 1995, ABB's Asian operation had 30,000 employees and 100 plants, engineering, servicing and marketing centres, sales quadrupling from \$2 billion in 1988 to \$8 billion in 1997, a figure the company hoped to double by the end of the century.<sup>4</sup> Meanwhile, in Europe, the company is preparing to capitalise on the planned expansion of the European Union by integrating its Western European operations with those in Central and Eastern Europe, where the company now has an interest in 70 companies, with almost \$2 billion in sales and some 30,000 employees.<sup>5</sup>

ABB has carved out a global niche for itself that has consistently translated into healthy profits and brought a five-fold increase in its share value since 1988 — with shares rising by an average of 23% a year from 1988-96, well above the stock exchange index in Zurich, its home base.<sup>6</sup>

Widely regarded within the business community as well-managed, thrusting, and at the cutting edge of technology and business thinking, ABB has earned itself an enviable and award-winning reputation, not only in Europe but worldwide. In 1995, it received Ernst and Young's Global Growth Award. The same year, ABB's then chair and chief executive, Percy Barnevik, was awarded the prestigious European CEO of the Year Award.<sup>7</sup> In 1997 — for the fourth year running — top European managers and investment analysts voted ABB Europe's Most Respected Company in a survey conducted by Price Waterhouse and the Financial Times. Among the qualities most admired in ABB were its strong and well thought out business strategy, its robust and human corporate culture and its imaginative approach to the process of innovation.<sup>8</sup>

Even as the Financial Times was announcing the results of its 1997 survey, however, ABB was running into trouble. 1997 saw poor results: the return on equity was half that in 1996, revenues declined by 7% and net income fell to \$572 million.<sup>9</sup> One reason lay in the economic collapse in South-East Asia: although orders overall increased 3% in 1997, they remained flat in Asia. The biggest shadow, however, was cast by one of the smallest sections of ABB — hydropower, accounting for less than 8% of orders in the power division in 1996.<sup>10</sup> As predicted by a number of analysts, its flagship contract — the Bakun dam in Malaysia — fell apart, leaving the company with costs of \$102 million and a severely dented reputation.

Despite the Bakun debacle, however, overall orders have continued to rise, fueled by growth in most emerging economies and in the US and Nordic countries. As a result, 1997 orders received grew 3% to \$34.8 billion.<sup>11</sup> In the first half of 1999, the company earned a net income of \$839 million — up 32% — and revenues stood 10% higher.<sup>12</sup> 1999 also saw Barnevik's successor, Goran Lindahl, win the prestigious Industry Week CEO of the Year award, the first non-US CEO ever to have done so.

### **Looking Abroad For Growth**

ABB has long pursued a three-leg strategy of targeted expansion in Europe (including the former Soviet Union), the Americas and Asia Pacific — the world's most important regional trade zones. Goran Lindahl predicts that future growth is likely to come from emerging markets, in particular Asia, Central and Eastern Europe and Latin America.<sup>13</sup>

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As a result, the company has been undergoing major restructuring. Although core competence centres will remain in Europe and North America, ABB is shifting much of its production abroad, not only to get closer to customers in emerging markets but also to take advantage of cheaper labour abroad.<sup>14</sup> One consequence will be a further loss of jobs in Europe and North America, where ABB has already shed 62,000 jobs between 1990 and 1997. By contrast, the number of employees in Asia and central and Eastern Europe rose by 57,000 — and is expected to rise by a further 30,000 by 2001.<sup>15</sup> ABB tries to act as a local company wherever it operates. As the Norwegian NGO, FIVAS, notes: The corporation buys national companies and tries to gain control over the domestic market . . . The management of these companies is recruited nationally when possible. Thus, the company acts as an 'insider' in almost all countries where it is active.<sup>16</sup>

### **ABB Alstom Power**

In March 1999, ABB and Alstom announced the merger of their power generation businesses on a 50:50 basis, which was approved by European Union competition authorities in October 1999.<sup>17</sup> The new joint company is to be called ABB Alstom Power and will be based in Brussels under president and CEO Claude Darmon, who was previously deputy CEO of Alstom. A management board and a supervisory board, chaired by ABB president Goran Lindahl, control the company.<sup>18</sup>

The new company includes all of ABB's Power Generation segment, except its nuclear activities and its financial services division. Alstom is contributing all its energy sector activities except the General Electric-based heavy-duty gas turbines, which have been divested to GE. The new company will create the world's largest supplier of power generation equipment, employing some 58,000 people in 100 countries. According to ABB, the joint company will be better able to respond to privatisation and the growing market for power generation equipment because of the two companies' complementary product ranges, geographic scope and R&D capabilities.<sup>19</sup>

The merger follows a world trend towards increasing corporate concentration and market consolidation in the engineering equipment sector. With the ABB-Alstom merger, a trio of companies now dominate the world power plant market, supplying 80% of turbines for new projects.<sup>20</sup> According to the consultancy firm Datamonitor, those companies are General Electric (GE), Siemens<sup>21</sup> and ABB Alstom Power.<sup>22</sup>

As of October 1999, the company had 105 turnkey projects under construction, employed 58,000 people in 100 countries and had an estimated annual revenue of \$11 billion. Pursuing ABB's strategy of globalisation (acting locally globally), the company has a Country President in those countries where ABB Alstom is a major industrial presence.<sup>23</sup>

Like ABB, Alstom has been involved in numerous dam projects. Among those for which it has supplied equipment are: Tucuruí, Itaipu — Brazil; La Grande 2, 2A, 3, 4, La Forge 1 (James Bay) — Canada; Three Gorges — China; Pehuenche — Chile; Koyna IV — India; Tarbella — Pakistan.<sup>24</sup>

### **Environmental and Social Policies**

Over the years, ABB has issued numerous statements supporting the need for sustainable development. In 1994, for example, it stated: ABB is committed to sustainable development. Protection of the environment is among our top corporate priorities. We address environmental issues in all our operations and public policy.<sup>25</sup> Or, as company President Goran Lindahl has put it: We should not sell crap anywhere.<sup>26</sup>

The company has played — and continues to play — a leading role in the World Business Council for Sustainable Development, an industry initiative to promote environmental best practice. In 1998, ABB announced its intention fully to integrate its environmental policies into the strategic plans of our business areas.<sup>27</sup> The intention is to make us better environmental neighbours and help us better meet the environmental demands of our customers and society at large.

ABB claims that, in accordance with its environmental protection policy, all the work we are doing meets or exceeds local environmental standards and legislation.<sup>28</sup> In many instances, however, ABB corporate practice has fallen far short of this standard. Far from meeting or exceeding local environmental standards, many ABB projects have involved breaches of local environmental laws. In 1996, for example, ABB bid for the contract for the Bakun Dam in Malaysia [see box and below]

despite a Malaysian High Court ruling that the environmental impact assessment had been conducted illegally.

In China, ABB has supplied equipment for the Three Gorges dam, despite local officials being regularly prosecuted for corruption over resettlement payments, whilst in India the company is involved in the Maheshwar project where local people have been illegally evicted as a result of the dam.

Meanwhile in Lesotho, the company itself has been accused of bribing local officials in charge of the Lesotho Highland Water Project, where ABB was under contract to supply equipment. In other instances, the company has bid for contracts despite clear evidence that those affected by a project are effectively denied recourse to the law in the event of human rights abuses. The company has also been fined for breaking local environmental laws in Poland: at one ABB factory, in Elbag, polluting emissions were found to be two to three times higher than the norm in Poland — and 20 times those from Swedish factories.<sup>29</sup>

The company states that it welcomes debate with environmental groups because • it forces people to sharpen their arguments, so we will find better solutions for processes and projects. •<sup>30</sup> ABB also stresses the need for consultation with those affected by its projects. The company is committed, for example, to • communicating openly with interested parties, in the communities and countries where ABB operates as well as internally about its environmental performance. • Here too, however, the company's record is seemingly at odds with its rhetoric. Requests by affected communities or concerned NGOs to meet with company officials to discuss the Bakun and Three Gorges projects — two of the most controversial dams in which ABB has been involved — have been rebuffed [see below, and boxes on Bakun and Three Gorges].

### **Environmental Degradation As Business Opportunity**

One of the first companies in Europe to realise the business opportunities of environmental degradation, ABB has positioned itself to take advantage of international agreements aimed at reducing impacts on the environment. ABB's 1997 Annual Report, for example, highlights the implications of the Kyoto Agreement on reducing greenhouse gases for ABB's markets and stresses the promises which the Agreement holds for the company: • By pushing industrialised countries to reduce greenhouse gas emissions, and urging developing countries to continue infrastructure development without compromising environmental standards, the agreement promises to increase demand for ecoefficient technologies — one of ABB's strengths. •<sup>31</sup>

The company has also been in the forefront of promoting • carbon-offset trading • . In conjunction with two Norwegian companies — Kvaerner Energy and EEG-Henriksen — ABB Kraft is collaborating with the state-owned power utility in Costa Rica in planning the construction of a small hydropower plant on the Virilla River. The dam is being developed as part of a • carbon-credit scheme • whereby the carbon emissions • saved • by replacing diesel-generated electricity by hydroelectricity will be traded with the Norwegian companies. The companies would be • free to sell them to other Norwegian companies in need of reducing their own carbon dioxide emission quotas or to other buyers on an international emissions trading market •<sup>32</sup>. Commenting on the scheme, ABB's 1998 Environmental Management Report notes: • As electrical partner in the project consortium, ABB is taking a lead role in this entrepreneurial venture, which could serve as a model to the rest of the world as one of the first applications of the new Clean Development Mechanism covered by the Kyoto Protocol. •<sup>33</sup>

Critics of such emissions trading argue that it threatens the gradual privatisation of the atmosphere, as companies buy up the right to pollute, at the expense of poorer groups in the South who must bear the social and environmental brunt of dams and other schemes aimed at reducing carbon emissions. Meanwhile, the North continues its emissions unabated.<sup>34</sup>

### **ABB On Dams**

ABB has supplied some 2,200 generators for hydroelectric dams — generating approximately 150,000 MW, or one-fifth, of the world's installed hydropower capacity.<sup>35</sup> International criticism of ABB's involvement in projects such as Bakun and Three Gorges has made the company defensive of its hydropower division. Since 1996, the company's annual reports and environmental management reports have regularly carried large sections on the issue of dams.

ABB acknowledges that dams have major environmental and social impact, which have not been fully anticipated or appreciated in the past. It also argues that future dam projects should include provision for prompt and permanent improvements in the quality of life for all people affected by the dam.<sup>36</sup> However, it has thus far failed to acknowledge its own role in the environmental and social destruction caused by past dams: on the contrary, when pressed, it has sometimes tended to cast itself as a bit player with little real influence. As an equipment supplier, it argues, the company is drawn into these debates but ABB cannot directly influence decisions on dam-building.<sup>37</sup>

Elsewhere — and somewhat schizophrenically — the company suggests that its ability to influence the outcome of projects — if only through the technologies it manufactures — is a prime reason why it should be involved in those that are most controversial. If a company like ABB refuses to involve itself in a project because of its adverse social or environmental impact, that refusal will probably not result in the cancellation of the project, it states. Indeed, it may result in the project's being carried through using suppliers with less concern for environmental impact than ABB.<sup>38</sup> And again: There are ways to minimize the adverse impacts of large dam projects on people and the environment and the technologies ABB provides are an important component in these.<sup>39</sup>

Discussing the problems of resettlement, for example, Michael Robertson of ABB's Environmental Affairs Department has said: All issues relating to resettlement of people affected [by dams] are clearly a matter for the local authorities and the national governments. However, ABB does what it can to ameliorate resettlement problems on projects where it has a major role. In the case of Bakun, we visited the affected Longhouse people and had discussions with their representatives. For Three Gorges, we will consider siting new factories in areas designated for the resettled people.<sup>40</sup> [For a discussion of the outcome of the resettlement programme at Bakun, see box on the Bakun dam].

ABB insists that it has no commercial interest in promoting hydropower over other sources of energy. It points out that, in terms of ABB added value-per-MW, thermal power plants rank much higher than hydropower. The company believes, however, that hydropower should remain on the menu for our customers, if and when the environmental and social issues can be addressed.<sup>41</sup>

The claim is somewhat disingenuous, however, since it is clear that, whatever its added value per MW, hydropower development frequently provides the company with a way into new markets, with substantial knock-on benefits for the company. In the case of Three Gorges, for example, ABB's hope is that Three Gorges will lead to other large dam contracts in China and elsewhere in the region. Paul Chan, ABB's Senior Vice-President for China, has described the Three Gorges contract as a worldwide entry ticket for the next two decades to large-scale hydropower projects.<sup>42</sup>

### **ABB and The World Commission On Dams**

ABB is an enthusiastic supporter of the World Commission on Dams and has contributed financial support. Goran Lindahl is a commissioner.

Discussing the Commission and ABB's role in it, Michael Roberston of ABB's Environmental Affairs Department, says: Care for the environment is an ABB core policy and we look forward to working towards a consensus on the role of large dams in sustainable development. A positive outcome will include guidelines for environmental issues which can certainly help the industry to improve its image.<sup>43</sup>

In an interview with the Brazilian newspaper *Folha de Sao Paulo*, Lindahl has similarly outlined his hopes for the Commission: The question is how to construct dams in such a way as to cause minimum impacts to the environment and the lives of people. The challenge is to balance the search for income with the preservation of these concerns. In this sense, this Commission is unique. For the first time, representatives of society, companies, governments and multilateral agencies are sitting down at the same table.<sup>44</sup>

ABB is looking to the Commission to break what it views as a political deadlock over dams. What is needed . . . is a set of policy guidelines, agreed upon by all interest groups, to be used as criteria for judging whether future dam projects should go ahead.<sup>45</sup>

ABB itself has proposed that a possible guideline for measuring the environmental efficiency of a large dam is to calculate how many people must be resettled per MW of power.<sup>46</sup> On this basis,

Nepal's Arun III dam (which was cancelled following popular opposition) would be ranked as more acceptable than, say, China's Three Gorges, since it would have displaced two people per MW as against 71 people.

Critics of this • body count• approach to energy planning argue that it is dehumanising and (perhaps intentionally) fails to engage with the social and economic conflicts that underlie opposition to dam projects. ABB argues, however, that • quantifying the environmental effects of large dams is not an easy task — but the effects must be quantified to permit meaningful comparisons with the alternatives. •

### **Shareholder Concerns**

Already, concerns over ABB's involvement in dams has led to it being excluded from the portfolios of almost all ethical investment funds, which is unusual for a company with an ISO 14000 international industrial quality standard. In 1998, only one of 11 ethical funds in Switzerland held ABB shares — and it reduced its holdings following the debacle over Bakun. Although rated positively in a January 1998 Ethical Performance Report by VTZ-Delphi, a Swiss financial institution, ABB's record on dams dragged down its overall rating. The report was particularly critical of ABB's failure to meet with NGO critics of Bakun, charging ABB with showing • an inflexible and patronising• attitude, especially to the dam-affected peoples.<sup>77</sup>

The company's involvement in large dams — and its high public profile — have now made it a prime target for environmental and human rights groups campaigning on dam and development issues. A report by the Berne Declaration, a Swiss NGO, prepared for shareholders, warned: • The danger for the ABB group as a whole is that opposition to its hydro activities will have a spill-over effect on its other business. Investors in the company may also find themselves the targets of secondary boycotts — particularly where they have a household name. •<sup>78</sup>

The report also drew attention to • the increasing amount of senior management time which appears to be taken up with hydro issues• , to the possible detriment of the company's affairs as a whole. • The 4-6 weeks of each year which Lindahl will be expected to put into the WCD [World Commission on Dams] indicates just how much of ABB's senior management time is being taken up with the problems of hydropower, despite it being a relatively small business sector for the group as a whole. Indeed hydropower would seem to be one area where ABB's strategy of decentralisation and local management has been abandoned in favour of a high level of commitment from the CEO . . . There is cause for concern that ABB's senior management is being . . . seduced by dams without concern for the bottom line. •<sup>79</sup>

Finally, argues the report, shareholders might question whether continued involvement in hydropower plays to the company's greatest strength — its proven ability to innovate. Yet, as one Swiss financial institutions points out, the company apparently attaches • low priority to developing renewable energy sources (especially photovoltaics and tidal energy)• . Indeed, the company has stated that it is not currently carrying out active research into photovoltaics.

Such antagonism to photovoltaics — given their potential — sits uneasily with Goran Lindahl's dictum that • innovation must be a core competence• . Indeed, says the report, • shareholders may ask whether ABB's continued commitment to large hydro is not at odds with the President's view that the company's future lies in • [shifting] away from just reacting to the present and [working] harder to shape the future, creating tomorrow's markets, not just competing for today's. •<sup>80</sup>

## **ABB AND DAMS**

### **THREE GORGES, CHINA**

ABB has won two major contracts to supply equipment for the Three Gorges Dam [see box on Three Gorges] and its ancillary infrastructure. In August 1997, the company won an order of \$250 million to supply eight generators for the dam. More recently, in April 1999, a second contract (worth \$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.<sup>47</sup> 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.



The dam has met widespread international opposition. In particular, concerns have been raised over the forced relocation of at least 1.3 million people. ABB acknowledges the concern but argues: • The Chinese government regards resettlement not as a problem but as an opportunity to improve the lives of poor people. • Local farmers, however, have complained of widespread embezzlement of resettlement funds by government officials.

ABB's involvement in Three Gorges has led to a sustained campaign by NGOs in Switzerland and internationally against the company. The company's failure to consult its environmental advisors before bidding for the work; its refusal to meet with prominent dam critics, such as Dai Qing from China; and its failure to answer media enquiries have all contributed to it gaining an increasingly negative image in the Swiss press. In the six months from July 1997 to January 1998, over 25,000 people in Switzerland sent postcards to the company protesting against its involvement in the project. No replies were received.

#### XINGO, BRAZIL

ABB supplied hydromechanical equipment for the 3,000 MW Xingo dam, which took seven years to build at a cost of \$3.2 billion, twice its original budget.<sup>48</sup>

#### ITAIPU, BRAZIL

ABB provided electromechanical equipment for the Itaipu dam on the Parana River between Brazil and Paraguay. Itaipu is the world's most powerful and most expensive dam, mainly due to the staggering level of corruption surrounding the project [see section on Siemens and box on Itaipu dam]. Itaipu drowned a large area of Atlantic forest, the fastest disappearing forest type in Brazil. Many of the 42,000 people displaced by the dam moved to resettlement schemes in Amazonia, with disastrous effects for themselves and for the indigenous peoples and forests of the region. The reservoir has caused the local spread of bilharzia, a debilitating water-borne disease, previously unknown in the area.

#### TUCURUI, BRAZIL

Tucuruí, another dam for which ABB was an equipment supplier, flooded more than 2,000 square kilometres of rainforest, displaced 24,000 people and led to the virtual elimination of several indigenous groups. Rotting vegetation in the reservoir turned its water toxic, creating a serious health hazard both around the reservoir and downstream. The reservoir also provided mosquitoes with an ideal breeding ground, creating a local mosquito plague.

#### SALTO CAXIAS, BRAZIL

ABB is supplying four 310 MW generators and associated equipment for the 1,240 MW Salto Caxias hydro-power plant, completed in 1999. According to the company, the dam exemplifies how the industry in Brazil has learned from past mistakes. • Serious efforts have been made to minimize both the social and environmental impacts of the dam. •<sup>49</sup>

Around 1,200 families were resettled, 858 of whom qualified for a package whereby the dam owner, COPEL, built schools, medical centres, a church, 500km of road, and paid for social and agricultural assistance for three years. Each qualifying family — those with land title — received 40 acres of land, a brick house and a barn. Salto Caxias cost \$975 million of which \$250 million went towards environmental programmes. According to ABB, • special measures [were] taken to conserve one area of 2,200 hectares of high-grade forest. •<sup>50</sup> In addition, • special arrangements were made for tenant farmers. Some 20,000 ha. of high-quality farming land, within 60-80 km of Salto Caxias, were purchased, and those families that wished to continue farming were allocated on average 25 ha (more than twice the size of their previous farms). •

But there is another side to the Salto Caxias story. Local people had learned to fear the Salto Caxias — the last of five dams on the Iguacu River — because thousands of their neighbours had not been consulted but forcibly evicted to make way for the four earlier dams. COPEL did not agree to an environmental impact assessment until the project was already approved. The EIA was • poor quality • and completed in only 30 days because of • political pressure • from COPEL, which began acquiring land for the reservoir before the study was finished. Moreover, the improvements to the resettlement package came only as a result of public pressure. Indeed, the company agreed to the demands of local people only after much stalling.<sup>51</sup>

#### PANGUE, CHILE

ABB supplied hydromechanical equipment for the Pangué dam on the upper Biobío in Chile [see box on Pangué/Biobío River]. The dam has degraded one of the most scenic rivers in Chile and caused major social problems for the Pehuenche, one of the country's most isolated indigenous communities. Commenting on the dam in its 1997 Environmental Management Report, the company notes: • Moral, social or environmental imperatives are not necessarily the strongest forces in the world of international finance. For instance, in 1997, the World Bank received a highly critical report on Chile's 400 MW Pangué hydropower dam, and as a result threatened to foreclose on \$150 million of finance for the project. Chile paid off the World Bank loan and refinanced the project using cheaper money, with fewer environmental conditions, from an alternative source. • <sup>52</sup> The report did not mention that ABB was itself part of the project, nor did it discuss what this involvement revealed about the company's own commitment to • moral, social or environmental imperatives. •

#### ZIMAPAN, MEXICO

Zimapan cost Mexico \$830 million — almost twice as much as the preconstruction estimate. Some 2,500 people were displaced by the dam, the World Bank noting that women, children and the elderly were • severely affected • by the resulting • social disruption and economic impoverishment • . Waste water from Mexico City flows directly into the dam's reservoir and has caused severe pollution problems.

#### GUAVIO, COLOMBIA

It was estimated that 1,000 people would be evicted by this dam: the final figure, however, was 5,500. Most have subsequently suffered economic hardship. Two hundred lives were lost in a landslide during construction of the dam, which cost \$2.5 billion — \$1.2 billion more than estimated — and took six years longer to build than projected. The dam generates nearly one-fifth less electricity than its supposed firm power production. The World Bank has rated the dam as • not economically viable • [See section on Skanska].

#### ATATURK, KARAKAYA and ILISU, TURKEY

ABB supplied equipment for the Ataturk and Karakaya dams, which, between them, displaced 80,000 people, the great majority of them Kurds, living along the Euphrates valley. Compensation was considered inadequate to allow the purchase of replacement lands and those without land titles received no compensation at all. The mass displacements have heightened the grievances of the Kurdish people who are pressing for recognition of their cultural rights. The projects also heightened regional tensions with Syria and Iraq, since the dams enable Turkey to control the flow of water to its downstream neighbours.

More recently, ABB Power Generation has won the contract to supply the generating equipment for the planned Ilisu dam in South-East Turkey [see box on Ilisu]. The contract is backed by an export credit guarantee from the Swiss government. The dam will displace 25,000 people, many of whom have already been forcibly removed from the reservoir area as part of military operations against Kurdish groups fighting for their rights. No consultation has taken place with the affected communities and local officials are unaware that the decision has been taken to build the dam.

#### MAHESHWAR, INDIA

ABB is supplying generating equipment for the Maheshwar dam in India, part of the Narmada Valley Development Project [see section on Siemens]. The dam has provoked mass demonstrations.

Villagers in the area affected by the proposed dam have received almost no information regarding the project. Moreover, the resettlement plan is seriously flawed: the project developer, S. Kumars Power Corporation Limited, claims, for example, that only 13,687 people will be affected when the actual figure is closer to 40,000. In addition, a recent study by the Tata Institute of Social Sciences has revealed that most of the land identified for resettlement will be submerged by the dam's reservoir.

In October 1999, the Ministry of Environment and Forests stated unequivocally that the State government of Madhya Pradesh and the project authorities had failed to demonstrate the availability of cultivable land for resettlement. Citing the example of Jalud, the first village to be submerged by the dam, the Ministry's report contrasts the lands that will be lost with the land on offer at the proposed resettlement site:

• *The lands of Jalud are deep, fertile and black cotton soil, irrigated by pipelines drawn from the Narmada river and follow three crop rotations in a year. It is clear why the naked barren hillock of*

*Samraj Ki Bedi is unacceptable as a rehabilitation site and allotments of land to the displaced people of Jalud village.*•

The report notes that • agriculture is quite impossible• at the new site and that efforts to make it cultivable by importing topsoil are likely to fail. • It is likely that heavy monsoon rains will wash away the soil spread over there and make the soil infertile again. Thus, it doesn't seem a permanent solution to transform a barren land into a cultivable land. • <sup>53</sup>

In several cases, the land earmarked for resettlement sites is already being used by ethnic minority Dalits and indigenous Adivasi groups. Since these groups are not directly affected by the dam's reservoir, they do not count as • project affected people• . In many instances, they have been forcibly evicted, without due process of law. As environmentalist Heffa Schucking reports for those living at Samraj, the resettlement site for Jalud:

• *[Those living there] explained to me that, while they were never well off, their situation has become desperate since April 1998. At this time, representatives of [the dam developers] entered the village with a police force and forcibly annexed and bulldozed the land of 34 families as well as the entire pasture land of the hamlet. Although all of these families have either land titles (which I was shown) or the status of long-term encroachers (and the receipts to back this claim), there was no due process of land acquisition or even written notices served. Instead from one day to the next, their land was bulldozed and taken from them. When some individuals attempted to peacefully intervene and explained that they own title to this land, the police responded by man-handling these people and the representatives of MPEB and threatened to have the entire hamlet thrown into jail.*

• *The consequences of these events for the Harijan/Adivasi community are catastrophic. Since they lost their entire pasture lands they were forced to sell almost all of their cattle and buffaloes — some 400 animals. On the private and encroached lands that were taken, they had been growing subsistence crops such as sorghum. Anokibai, a Bhil adivasi, asks: 'If the land has gone, then we are also gone. If we don't have the land, will we then eat stones or pebbles? How will we live and how will we eat?'*• <sup>54</sup>

#### TARBELA, PAKISTAN

Serious technical problems at Tarbela almost led to the collapse of the dam during the initial filling of its reservoir in the 1970s. Remedial work increased the cost of the dam from a projected \$800 million to \$1.5 billion. Some 96,000 people were displaced by the project and are still fighting in the courts for compensation [See section on Impregilo].

#### BAKUN, MALAYSIA

ABB and the Brazilian company Companhia Brasileira de Projectos e Obras (CBPO) won the contract in 1996 to manage the Bakun dam project and supply all electrical equipment [see box on Bakun]. The contract included a \$3 billion order to supply six 420 MW generators — the biggest order ever received in ABB's history.<sup>55</sup> In 1997, the contract was withdrawn from ABB after an acrimonious row with the project developers, Ekran Bhd. Subsequently, the project was suspended, due to in part to the economic collapse in South-East Asia and in part to investor fears over its high financial risks. Despite the severe environmental impacts of the dam, ABB failed to consult with its environmental panel prior to bidding for the construction contract.

Those directly affected by the dam were provided with minimal information about the project; access to the Environmental Impact Assessment was denied; and when they objected to the proposed resettlement plan, they were denounced as being • anti-development• . Local community leaders had their passports taken away to prevent them traveling overseas to speak out against the project. Communities were also threatened with withdrawal of state benefits if they persisted in their opposition.

The dam created considerable controversy within Malaysia, where a coalition of some 40 groups formed the Coalition of Concerned NGOs. Despite requests for a meeting, ABB refused to meet with a delegation from the Coalition to receive a memorandum setting out the group's concerns. Responding to the rebuff, the delegation stated: • ABB's refusal to even receive the memorandum shows a tremendous lack of concern for the opinions of the general public. This is a blatant contradiction of ABB's policy, which says it is committed to communicating openly with interested parties, communities and countries. Today's incident clearly shows that this is all a farce just like the Bakun Hydroelectric Project. • <sup>56</sup>

The NGOs also questioned ABB's corporate ethics. In particular, they accused the company of

- dumping unacceptable technology in Malaysia.<sup>57</sup> The group went on:
- *Sweden, which is ABB's registered home country, has long abandoned large-scale hydroelectric projects because of the detrimental environmental and social effects of such dams. In the light of this policy, how does the company justify dumping such unacceptable technology onto Malaysia? The Prime Minister has often highlighted this sort of unethical practice of Western multinational companies. It is clearly not in our best interests to accept such discarded technology by the West.*

Unsurprisingly, ABB's involvement in the project led to widespread international protests, including demonstrations outside ABB's London offices. In a series of letters to Percy Barnevik, then chief executive officer of ABB, representatives of the communities affected by the dam, Malaysian NGOs and over 200 international environmental and human rights groups expressed their strongest objection against the involvement [of ABB] in the implementation of Bakun Dam and urged the company to withdraw. The letters variously charged the company with double standards (building a project that would not be permitted in its own home country) and with breaking its own commitments to sustainable development and transparency.

The collapse of the Bakun deal in 1997 severely dented ABB's financial reputation. The immediate impact of the loss of the construction contract was a write-off of \$100 million in the company's third quarter results. In terms of market share, ABB slipped from first to third place in the hydro generator market for the world's largest projects, behind its rivals, General Electric and Siemens.<sup>58</sup>

The withdrawal also raised concerns within the financial community about the health of the large dam industry as a whole. As Frederick Hasslauer, an analyst at Bank Sal. Oppenheimer, told the Wall Street Journal in the immediate aftermath of the Bakun debacle:

- *[Bakun raises] questions about whether ABB is following the right strategy in concentrating on large projects. If it loses one, it makes a noticeable hole in orders, particularly in the light of financing problems for large Asian projects.*<sup>59</sup>

#### BATANG AI, MALAYSIA

ABB supplied equipment for the Batang Ai dam in Sarawak, built in 1975. The Asian Development Bank funded the project. The ADB has described the resettlement of 2,800 Ibans by the dam as an example of a culturally sensitive and economically sound programme because the policies and plans . . . were carefully investigated and prepared.<sup>60</sup> Others, however, are more sanguine. As Marcus Colchester, Director of the UK-based Forest Peoples' Programme, notes in a review paper commissioned by the World Commission on Dams as part of its assessment of the impact of dams on indigenous peoples:

- *The Iban were persuaded to move in exchange for promises of free housing, free water, free electricity and 11 acres of land per family. The reality has proved a bitter experience. Not only were they resettled on a government land scheme, but they were also forced to change their way of life radically. Rice cultivation proved impossible on the terraces prepared for them and they were obliged to set up as small-holders on a plantation scheme. Incomes fell to the point that, according to one study, 60% of households were below the State poverty line, with the majority of respondents reporting that lack of land was their main problem.*<sup>61</sup>

The State-owned Sarawak Land Consolidation and Rehabilitation Authority (SALCRA) ran the plantation on which the Iban were resettled. Women suffered disproportionately from the resettlement procedures. According to a study by Hew Ching Sim:

- *SALCRA's policy of one certificate of ownership per household has meant that Iban women's traditional rights over land have been abrogated and thus a dependency relationship is created. The new system of plantation agriculture has also eroded women's traditional equality with men in the sphere of production.*<sup>62</sup>

Compensation, which should have been paid to both men and women as co-owners of the land, was only paid to male heads of household. As Marcus Colchester recalls:

- *Some women, interviewed by me in 1987, noted that their husbands had abandoned them, taking the money and setting up house with other women, and leaving them virtually destitute. Overall, incomes declined, gathered food became scarcer and firewood hard to find. The women also found it hard to carry on their traditional weaving and basketry, as they lost access to forests from which to collect the*

materials. Summarising the peoples' sense of despair, one old woman told me: 'We are already dead'•<sup>63</sup>

#### BHUMIPHOL, THAILAND

In 1995, a consortium consisting of ABB Power Generation and Kvaerner Energy won the contract to supply and install pumping and generating equipment for an eight-unit at the 535 MW Bhumiphol hydropower facility on Thailand's Ping river.<sup>64</sup> The project was part of a scheme to upgrade and expand the dam, which has been plagued by problems since it was commissioned in 1964 [See sections on VA Tech and Kvaerner].

#### SONG HINH, VIETNAM

ABB Generation was one of five companies which received contracts to supply hydromechanical equipment for the Song Hinh dam in Vietnam. The company teamed up with Kvaerner Turbin to win the \$35 million contract which involved the supply of turbine and generator equipment for the 70 MW dam.<sup>65</sup> ABB also arranged concessional funding from the Nordic Development Fund for the project. The dam caused the forced relocation of 1,732 people: no consultation was undertaken and compensation was inadequate [See sections on Kvaerner and Electrowatt].

#### THEUN HINBOUN, LAOS

In 1995, ABB Generation was awarded a \$30 million contract, involving the supply of two 105 MW generators, for the Theun Hinboun dam in Laos.<sup>66</sup> Under the contract, ABB also undertook installation and commissioning of the equipment and training of power station operators.<sup>67</sup>

Critics of the dam argue that it will completely dry out 40 kilometres of river downstream for most of the year and cut off 70% of the downstream river flow for 140 kilometres. There are fears that the dam will also prevent fish from migrating, breeding and spawning in an area once rich in fish species. A review by Norwegian government agencies of the environmental assessment for Theun Hinboun found it to be severely flawed and biased. The 5,000 people who may lose farming land and fisheries to the project were never informed about the project, still less consulted about its construction [See section on Electrowatt].

#### HOUAY HO, LAOS

In 1996, ABB Power Generation and Sulzer Hydro [see section on VA Tech] won a \$18 million order from the South Korean Daewoo Corporation to supply two generators and electrical equipment to the 170 MW Houay Ho Dam in Laos.<sup>68</sup> ABB's share of the contract was approximately \$11 million.<sup>69</sup> Houay Ho is the centrepiece of a trans-basin water diversion scheme in southern Laos. The dam, developed by Daewoo, was completed in 1998.

The environmental assessment for Houay Ho was not completed until the dam was well under construction. It has yet to be made public. World Bank sources claim that serious financial irregularities surrounded the signing of the contract between the Lao government and Daewoo. The same sources indicate that the contract is extremely unfavourable to the Lao government which will receive a negligible return from the dam.

Conditions among the 800 ethnic minority Nya Heun families displaced by the dam are reported to be appalling, with people suffering from a severe lack of food, a shortage of arable land and insufficient clean water.<sup>70</sup> A researcher who visited the Houay Ho resettlement site in February 1998 found • a sense of anger, frustration and desperation among many of the Nya Heun villagers interviewed. •

The initial feasibility study estimated that each family would need three hectares of non-paddy land for self-sufficiency, but noted that only one-third of that amount was available. While provincial officials claim that there is • plenty of land• , villagers interviewed at the site report that all they had were small plots of land adjacent to their houses. Additional land for growing coffee had been promised but this has been • delayed• . No land for growing a subsistence rice crop was available. Many families have now left the relocation site and have tried to move back to their former villages — but the Lao authorities do not tolerate this.

One elderly woman interviewed in February 1998 said: • We don't know . . . we feel we have been lied to . . . If we were lowland Lao it might be different but they don't care about the Nya Heun people . . . We cannot go on like this or we will die . . . We can't survive at Bat Chat San but we are also not

allowed to return to live here . . . so we don't know what to do . . . It will be the end of the Nya Heun people. • <sup>71</sup> Those resettled also suffer from inadequate water supplies. Most of the wells drilled at the site are either dry or contain water of poor quality. When visited in 1997, 42 families were found to be depending on one shallow well for drinking water. <sup>72</sup> The provincial office of the Attepeu Lao Women's Union has reported that 15 women displaced by the dam have become prostitutes for the workers at the construction site. This is the first time that prostitution has been recorded in the area [See section on Electrowatt].

#### MUELA DAM, LESOTHO

In 1993, ABB was awarded the contract to supply three generators for the Muela dam, part of the Lesotho Highlands Water Project [see box on Lesotho Highlands]. In November 1999, the company was charged paying bribes to the project's chief executive. ABB is working with the Lesotho authorities, • supporting their investigation • . In August 1999, Goran Lindahl, ABB's Chief Executive Officer, told the Brazilian newspaper Folha de Sao Paulo:

• *The company tries to define quite rigorous standards in relationships with governments and, if problems arise with corruption, we try to deal with them as quickly as possible. This type of thing cannot be tolerated. Without getting into details, in the Lesotho scandal we have known about problems involving the company since 1987. We decided on our own to cooperate with the prosecutors in Switzerland and in Lesotho. This resulted in the firing of the official responsible.* •

#### PANGANI, TANZANIA

ABB Energy was one of several Norwegian hydro-power companies to receive contracts for services and equipment to the Pangani Falls Redevelopment Project in Tanzania. The project entailed the rehabilitation of an existing hydropower station and the construction of a modern underground power station, which would increase output by 66 MW. <sup>73</sup> The work was projected to cost \$128 million and was funded by Norwegian, Finnish and Swedish bilateral aid agencies.

Due to the extraction of water for irrigation upstream, there are major doubts that water flow during the dry season will be sufficient to operate the plant at full capacity. The feasibility study, undertaken by IVO-Norplan, failed to examine the issue of water availability, however, leading to severe criticism from the Finnish aid agency, Finnida. An internal memorandum written by Karl Silfverberg, environmental advisor to Finnida, states:

• *How is it possible that a large and experienced consulting company specialised in hydropower rushes head on to prepare an expensive technical power plant plan before the long-term availability of water resources has been ensured with certainty? I am one hundred per cent sure that if this was IVO's own hydropower plant investment, the water resources issue and the water management of the entire catchment basin as well as related risk factors had been studied in detail before any expensive technical planning or extensive rock drilling had been started.* • <sup>74</sup>

In an attempt to resolve the problem, the donor agencies put pressure on the Tanzanian government to introduce water charges for irrigation. By 1996, control over water usage upstream had been made more or less a condition of further development aid from Norway's aid agency, NORAD. Other proposed • solutions • include the building of a further dam upstream to store water.

#### CIECHOCINEK, POLAND

At the beginning of 1999, ABB Zamech (now part of ABB Alstrom Power) and Elektrim — Poland's largest company — formed a consortium to build the Ciechocinek dam on the Vistula river in Poland. The dam is intended to mitigate the severe environmental damage that has already been caused by an earlier dam at Wloclawek. The river bed downstream from Wloclawek has been eroded by three metres and the area immediately behind the dam is heavily polluted with 29 years of untreated city, town and village waste and industrial chemicals. According to Klub Gaja, a Polish environmental group, • This sediment is highly toxic and is in some places 3-5 metres deep. • <sup>75</sup>

Ciechocinek is one of a number of proposals being considered by the Polish authorities, which argue that the new dam is needed to check erosion and prevent Wloclawek from collapsing. Other proposals include the building of a cascade of seven dams along the Lower Vistula. <sup>76</sup> Environmental groups are pressing for the decommissioning of Wloclawek and the ecologically-sensitive development of the Vistula Valley. The Vistula river, known in Poland as the • Queen of Polish Rivers • , is one of Europe's largest rivers and is renowned for its unique and rare habitats. Ecologically, the river forms an important corridor, linking the Dniestre Basin and the Danube.

- 1 ABB, 1999b.
- 2 ABB,1998a.
- 3 ABB, 1998a.
- 4 Financial Times 1997a.
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- 7 Evans, J., 1995: 57.
- 8 Financial Times, 1997 b
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- 11 Lindahl, G., 1998:3
- 12 ABB, www.
- 13 Lindahl, G., 1998: 7.
- 14 Financial Times, 1997c.
- 15 ABB, 1998b: 4.
- 16 FIVAS, 1996: 94.
- 17 Financial Times, 1999a.
- 18 International Water Power and Dam Construction, 1999a: 2.
- 19 International Water Power and Dam Construction, 1999a: 2.
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- 21 Financial Times, 1999a.
- 22 ABB Alstom Power, 1999.
- 23 ABB Alstom Power, 1999.
- 24 Alstom, 1999; McCully, P., 1996: 248.
- 25 ABB, 1994.
- 26 Financial Times, 1997d.
- 27 Lindahl, G., 1998: 5.
- 28 ABB, 1999a: 33.
- 29 Greer, J. and Bruno, K, 1996.
- 30 Financial Times, 1997d.
- 31 Lindahl, G., 1998: 5.
- 32 ABB 1999a: 45.
- 33 ABB 1999a: 45.
- 34 Lohmann, L., 1999.
- 35 ABB, 199b.
- 36 ABB, 1998d: 31.
- 37 ABB, 1998d: 28.
- 38 ABB, 1998d: 32-33.
- 39 ABB, 1998d: 28.
- 40 International Water Power and Dam Construction, 1998b: 35.
- 41 ABB, 1998d: 33
- 42 Financial Times, 1997e.
- 43 International Water Power and Dam Construction, 1999b; 35.
- 44 Folha de Sao Paulo,1999.
- 45 ABB, 1998d; 28.
- 46 ABB 1998d: 31.
- 47 Swedish Society for Conservation of Nature/Berne Declaration 1999.
- 48 Water Power and Dam Construction, 1995: 3.
- 49 ABB, 1998d: 35.
- 50 ABB 1998d: 35.
- 51 Nascimento Brito, E. and Verocai, I., 1999.
- 52 ABB, 1998d: 32.
- 53 Narmada Bachao Andolan, 1999.
- 54 Schucking, 1999: Schucking also notes: "The actions of the authorities in Samraj are clearly illegal. According to India's Land Acquisition Act, written notice must be given, as well as a time period allowed for landowners to put forward objections before they can be expropriated. If the objection is overruled, they receive compensation for payments based on prices for similar land in the same area. Because the affected people in this case belong to the scheduled castes and scheduled tribes, there are additional legal provisions to protect their rights."
- 55 ABB 1997: 16.
- 56 Concerned NGOs on Bakun, 1996a.
- 57 Concerned NGOs on Bakun, 1996b.
- 58 O'Neill, P., 1997.
- 59 Wall Street Journal, 1997.
- 60 Asia Development Bank quoted in Colchester, M., 1999.
- 61 Colchester, M., 1999: 54.
- 62 Quoted in Colchester, M., 1999.
- 63 Colchester, M., 1999: 29.
- 64 Independent Energy, 1995.
- 65 International Water Power and Dam Construction, 1996a: 4.
- 66 International Water Power and Dam Construction, 1996b: 40.
- 67 Power Asia, 1995.
- 68 International Water Power and Dam Construction, 1996c: 8.
- 69 European Power News, 1996.

70 IRN 1999: 37.  
71 IRN 1999.  
72 Dennis 1997;14-15.  
73 FIVAS,1996: 103-106.  
74 FIVAS, 1996: 106.  
75 Klub Gaja, 1999a  
76 Klub Gaja, 1999b.  
77 VTZ-Delphi, 1998.  
78 Berne Declaration, 1998.  
79 Berne Declaration, 1998: 18-19.  
80 ABB, 1997: 8

## **ABB: DAMS AT A GLANCE**

### **BANGLADESH**

Karnafuli dam. ABB and Voest-Alpine manufactured and supplied the original electromechanical equipment for the Karnafuli dam in South-Eastern Bangladesh. In 1998, ABB SAE Sadelmi (Milan) won the contract, in partnership with Voest-Alpine, to refurbish the dam.

### **BRAZIL**

Ita dam: ABB part of CONITA, the consortium which won the contract to build and operate the Ita Dam, currently nearing completion on the Uruguay River [see section on Coyne et Bellier]. Itaipú, Salto Caxias, Tucuruí and Xingó dams [see main text for all].

### **CHILE**

Pangué dam [see main text]. Aconcagua dam: contract awarded in 1991 by HASA for supply of one generator. Curillinque dam: contract awarded in 1992 by Pehuenche SA for supply of one generator. El Toro dam.

### **CHINA**

Yele dam: in October 1999, ABB Alstom Power signed a contract worth around 35 million Euros with the China National Machinery Import and Export Corporation to supply equipment to the Yele hydroelectric power plant. Also involved in the Guandong, Pan Jia Kou and Shi Lou Ti dams.

### **COLOMBIA**

Guavio dam. [See main text].

### **COSTA RICA**

Virilla dam.

### **ECUADOR**

Papallacta and Chimbo dams.

### **ETHIOPIA**

Finchaa dam, commissioned by EELPA in 1969.

### **INDIA**

Uri dam: contract in 1990 by National Hydroelectric Power Corporation (NHPC) to supply four generators for Uri Dam. Maheshwar dam [see main text and section on Siemens]. Naptha Jhakri [see box on Naptha Jhakri]. Rajhat dam: contract awarded in 1992 by Madhya Pradesh Electricity Board for supply of three generators. Rangit: contract awarded in 1991 by National Hydroelectric Power Corporation for supply of three generators. Sharavathy: contract awarded in 1992 by Karnataka Power Corporation Ltd for supply of two generators. Kalinadi Stg. 1 (Nagjhari): 1992 contract for one generator.

### **LAOS**

Theun-Hinboun and Houay Ho dams [see main text].

### **LESOTHO**

Muela dam [see main text]. Also involved in the Mantsonyane, Orange/Senque and Semonkong dams.



## MALAYSIA

The Pan Jia Kou, Batang Ai, Batangui and Perak dams.

## MEXICO

Zimapan dam: contract awarded in 1991 by Commission Federal de Electricidad for two generators.

## MOZAMBIQUE

Cuamba and Lichinga dams.

## NEPAL

The Khimti Kola dam [see section on Kvaerner], and the Jhimruk dam.

## NORWAY

Hekni: contract awarded in 1992 by Aust-Agder Kraftwerk for supply of two generators. Bortveit: contract awarded in 1992 by Sunnhordland Kraftlag for one generator. Hogstad: contract awarded in 1992 by Vestfold Kraftselskap for supply of one generator. Kopa: contract awarded in 1992 by Volda Komm. Elverk for supply of one generator. Nomeland: contract awarded in 1992 by Kristiansand Elverk for supply of one generator. Skjaerlivatn: contract awarded in 1992 by Sor-Trondelag Elverk for one generator.

## PAKISTAN

Tarbela dam [see section on Impregilo].

## PAPUA NEW GUINEA

Warangoi dam.

## PERU

Carhuaquero dam: ABB was the lead contractor for the electromechanical equipment for the 75 MW first stage of the 125 MW Cahuaquero project on the Chancay river. The dam was commissioned in 1991. Skanska was the lead contractor for civil works and Kvaerner Brug A/S of Norway supplied the turbines.

## PHILIPPINES

The Janopol and Magat dams.

## PORTUGAL

Alqueva dam: ABB SGPS SA of Portugal won a \$58 million in 1997 from EDIA Empresa - Desenvolvimento e Infraestructuras do Alqueva SA to supply electrical and mechanical equipment for the Alqueva dam on the Guadiana River in southern Portugal.

## SPAIN

Agavanzal: awarded contract in 1992 by Iberdola for three generators. Asma: awarded contracts by Navarro in 1992 for generators. Cordinanes: awarded contract by Navarro in 1992 for two generators. Mandeo-Zarzo: awarded contract by Navarro in 1992 for two generators. Pontelinares: awarded contract by Enorsa in 1992 for two generators. Soutelo: awarded contract by Iberdola in 1991. Talave: awarded 1991 contract from Idea for two generators.

## SWEDEN

Alfta dam: awarded contract by Voxnans Kraft AB in 1993 for two generators. Gideabacka dam: awarded contract by Gidekraft AB in 1994 for generator. Klippen dam: awarded contract by Vattenfall in 1991 for generator.

## SWITZERLAND

Augst Unit 7 dam: awarded contract by KW Augst in 1992 for generator. Brugg dam: awarded contract by BKW in 1992 for two generators. Engeweiher dam: awarded contract by EW Schaffhausen in 1991 for generator. Platz dam: awarded contract by EW Murg in 1992 for generator

## TANZANIA

Pangani dam [See main text].

## THAILAND

Bhumiphol dam [see main text], and the Mae Tian and Mae Chai dams.

## TURKEY

Ataturk dam [see main text]. Ilisu dam: ABB Power generation has won the contract to supply the generating equipment for the planned Ilisu dam in South-East Turkey [see box on Ilisu]. Karakaya dam.

## UGANDA

Owen Falls dam: Contract awarded in 1994 by Uganda Electricity Board for supply of two generators.

## VENEZUELA

Macagua II and Santo Domingo dams.

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**B**alfour Beatty was founded 75 years ago as a power construction and engineering company. In 1969, it was acquired by BICC (then known by its full name, British Insulated Callender's Cables), which remains Balfour Beatty's parent company today. Balfour Beatty's interests now include civil, railway and power engineering, building and building services and maintenance, and asset management. Power engineering accounts for 9% of Balfour Beatty's activities while civil engineering, which includes hydropower work, makes up 24%.<sup>3</sup>

In the energy sector, Balfour Beatty specialises in power transmission and distribution systems, design and construction of overhead transmission lines, power stations, tunnels, dams and reservoirs, which, according to the 1998 Annual Report, include • some of the largest schemes in the world• .

Only one-third of Balfour Beatty's turnover is gained overseas (£543 million overseas compared to £1,596 million in the UK). Of this, Asia provides £137 million, the Middle East £79.5 million and Africa £6.4 million. The US and Caribbean accounts for the rest.<sup>2</sup>

Balfour Beatty's annual turnover has remained fairly stable in the past couple of years: £2,140 million in 1998 compared to £2,202 million in 1997. However, profits have rocketed. In 1997, Balfour Beatty

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achieved record pre-tax profits of £51 million, only to see this rise in 1998 to £75.4 million — a 48% increase. And things look set only to improve, as Balfour Beatty's order book stood last year at a record £2.7 billion.

However, the BICC Group as a whole has fared less well, Balfour Beatty being the only company within the group to report substantial profits. In 1998, BICC reported debts of £129 million, as against profits of £70 million (profits in 1997 had been £110 million). In the last decade, BICC's share value has plummeted dramatically — from 422 pence in 1990<sup>3</sup> to 6.6 pence in 1998. In its Annual Accounts, Balfour Beatty has opted to take exemption from the requirement to disclose transactions between itself and its parent company, BICC.<sup>4</sup> In early 1999, BICC sold its entire cable business to American rivals, leaving it with only Balfour Beatty.<sup>5</sup>

In 1998, Balfour Beatty drew together most of its joint ventures and other businesses operating internationally under one wing: Balfour Beatty Major Projects. According to the 1998 Annual Report, Balfour Beatty Major Projects was created as • a centre of excellence for the management and execution of complex infrastructure projects worldwide• .<sup>6</sup> It combines the companies Dutco Balfour Beatty, Balfour Beatty Abu Dhabi, PT Balfour Beatty Sakti Indonesia, First Philippine Balfour Beatty Inc., Zubair Kilpatrick, and Balfour Beatty Hong Kong. The only other Balfour Beatty group business operating internationally is Heery International, which carries out project and construction management.

#### **Private Power**

• We have achieved considerable success under the UK Government's private finance initiative in roads, power and healthcare. •  
Balfour Beatty.<sup>7</sup>

Many of the projects in which Balfour Beatty has participated recently in the UK, including the Heathrow Link and the Channel Tunnel [see below], have been joint public-private ventures. The company has been one of the main beneficiaries of recent government policies that seek to involve the private sector in provision of public infrastructure — particularly roads and rail, healthcare and power. In addition to its extensive involvement in rail projects following the privatisation of Britain's railways in the early 1990s, Balfour Beatty received, along with Tarmac (another major donor to the then-ruling Conservative Party), 49% of all road construction contracts. Four of these have been constructed under public-private initiatives, known as Design-Build-Finance-Operate. Lately the company has expanded into the privatised power sector. In 1997, Balfour Beatty's subsidiary, Balfour Kilpatrick, completed its first turnkey cable installation contract for the privatised utility Yorkshire Electric.<sup>8</sup>

With the global trend toward private provision and financing of public infrastructure, Balfour Beatty, like many UK companies, is capitalising on experiences gained in privatised Britain. In 1997, Balfour Beatty formed an international joint venture business, First Philippine Balfour Beatty, to target the growing private infrastructure market in that country.<sup>9</sup> This followed the pattern already established by Balfour Beatty in Indonesia where it set up a joint venture, Balfour Beatty Sakti Indonesia.

Balfour Beatty Sakti Indonesia carries out power construction, mechanical and electrical engineering, industrial construction and power transmission installation. It participated in one of Indonesia's first private power producer projects, the 135 MW gas turbine combined cycle Sengkang power station.<sup>10</sup> In the Philippines, First Philippine Balfour Beatty again concentrates on infrastructure: from pipelines, power stations and transmission lines to roads and urban infrastructure.

#### **Balfour Beatty's Environmental Policy**

BICC, Balfour Beatty's parent company, has a fairly comprehensive environment policy, and claims that • each of BICC's businesses has conducted a formal analysis of its environmental and safety performance, in some cases with the assistance of external experts• .<sup>11</sup> However, for reasons unexplained, each of BICC's businesses follows their own and not the parent company's guidelines. Hence, • Balfour Beatty continues to develop its systems for environmental monitoring and reporting. Where practical, they have been linked with existing safety and quality management arrangements. •<sup>12</sup>

#### **BALFOUR BEATTY DAMS**

Balfour Beatty has been the engineering consultant or construction company for a number of highly controversial projects including Kainji (Nigeria), Muela (Lesotho), Pergau (Malaysia), Samanalawewa (Sri Lanka), Victoria (Sri Lanka), and is currently bidding for the Ilisu dam in Turkey [See boxes on Ilisu and the Lesotho Highlands Water Project].

#### PERGAU, MALAYSIA

The Pergau dam, built on the Malaysian-Thai border with £234 million of British overseas aid, has become a byword for patronage politics and the illegal use of aid money. The contracts for the dam were awarded jointly to Balfour Beatty — a company with close links to the British Conservative Party — and Cementation International, a company which employed Prime Minister Margaret Thatcher's son as an advisor.<sup>13</sup> Balfour Beatty, a major donor to the then-ruling Conservative Party, won civil works contracts for the dam — without competitive bidding. The works included a 75-metre high zoned earthfill dam, power tunnels and shafts, an underground power cavern and a 24 km water transfer tunnel, together with a pumping station.<sup>14</sup>

Britain's aid agency, the Overseas Development Administration (ODA), opposed the funding of Pergau. However, Thatcher made an oral offer to fund the dam during a visit to Malaysia in 1989, conditional on a full economic appraisal. In 1990, an ODA review of Malaysia's power sector identified a number of alternative projects and concluded that Pergau would not be an economic proposition until the year 2005 at the earliest.<sup>15</sup> Nonetheless, the government agreed to fund the project in February 1991. At the time, Alan Clark, the UK Defence Procurement Minister, argued that withdrawal of support for Pergau • would have an adverse impact on UK relations with Malaysia in general and defence sales in particular. •<sup>16</sup>

Documentary evidence subsequently revealed that the aid package was linked in writing to a reciprocal arms deal whereby the Malaysian government agreed to buy over £1,000 million worth of British military equipment in return for the UK funding Pergau. A judicial review brought by a British NGO, the World Development Movement, against the Foreign Office led to a High Court ruling that aid for Pergau was in violation of the 1966 Overseas Aid Act, which forbids British aid money being used for the purchase of arms. Conservative ministers in parliament had consistently denied the link between aid for the dam and arms.

Subsequently, the • revolving door • between Whitehall and the City, which has long ensured a place for ex-Ministers and top civil servants in the boardrooms of corporate Britain, saw Sir Charles Powell, Thatcher's foreign affairs advisor until 1990, become a director of Trafalgar House, which owns Cementation. Both Lord Prior, a former minister under Thatcher, and Lord King, ennobled by Thatcher, have also been linked to the affair.<sup>17</sup>

#### SAMANALAWEWA and VICTORIA, SRI LANKA

Balfour Beatty also figures prominently in two other British aid-linked dam debacles: those of the Samanalawewa and Victoria dams in Sri Lanka, both part of the multi-dam Accelerated Mahaweli Development Programme. As with Pergau, ministers focused on the dams' commercial advantages to British firms rather than on the benefits to local people.

In this case, British firms were appointed to design and help build the projects, Alexander Gibb winning the design work and Balfour Beatty the contracts to lay roads, drive a tunnel and build the power station.<sup>18</sup> Yet two years after the Samanalawewa project was completed, its reservoir still could not be filled because its bed was leaking badly. Although remedial action has been planned, one Sri Lankan geologist has warned that the leak cannot be plugged: • Samanalawewa is a write off. It will become an archaeological site. •<sup>19</sup>

NEDECO, the Dutch consultants which did the main feasibility study (1979) for the five-dam Mahaweli Scheme, stated that: • On the basis of the scenario adopted by the consultants about 50,000 families, or 250,000 people, have to be settled between 1980 and 1985. It is hard to find examples elsewhere in the world of successful settlement of such a large number of people in such a short time. •<sup>20</sup> The experience of those resettled from Kinchigune village is typical of those who were evicted as a result of the project. As Ar Karunawathie of the NGO Samanalagama Samagi Kantha Samithya told a regional consultation of the World Commission on Dams:

• *The villagers were relocated . . . on a tea estate in a highly degraded condition . . . The Ceylon Electricity Board has put a plaque near the temple stating that they provided houses, water roads and*

*electricity free of charge to the settlers. The truth is that the people of Kinchigune actually lived under the trees until they put up huts and then built their own houses through their own efforts. Although the farmers were provided compensation for their houses and crops, this was peanuts compared to what they had. Nothing was provided free of charge, and even the electricity connections had to be paid for.*<sup>21</sup>

Meanwhile, just 80 kilometres north of Samanalawewa, another ODA-funded dam — the Victoria dam, also built by Balfour Beatty with Gibb acting as design consultant — has also run into difficulty, failing to produce the electricity expected. An assessment carried out by the UK National Audit Office estimated that the firm capacity of the dam was likely to be 40 per cent below the original estimate.<sup>22</sup>

As with Samanalawewa, those resettled have suffered economic and social hardship. The project displaced some 30,000 people, flooding 28 square kilometres of the productive and densely populated Dumbara Valley. Many of those made homeless were resettled under an agricultural scheme part-financed by the World Bank. The scheme was subsequently criticised by the Bank's own Operations Evaluations Department for having neglected the project's environmental impacts. In particular, the OED noted that the project resulted in the loss of some 30,000 hectares of forest due to clearance for paddy fields and encroachment on remaining forest areas for shifting cultivation or for fuelwood.<sup>23</sup> Low water flow downstream of the dam created stagnant pools — a habitat for mosquitoes. In 1986-7, outbreaks of malaria occurred for the first time ever in the Mahaweli area.

The dam is the centrepiece of the Accelerated Mahaweli Development Programme, a five-dam mega-scheme . . . to expand irrigation in previously forested areas which has submerged and turned into agricultural land the habitat of at least seven endangered and two threatened animal species, according to Patrick McCully, author of *Silenced Rivers*. For both Balfour Beatty and Alexander Gibb, the Victoria and Samanalawewa dams brought prestige. For Sri Lankans, however, they have saddled the country with a debt that the country is having grave difficulties in servicing. Indeed, according to the World Bank, the long-term macroeconomic impacts of the Mahaweli scheme have proved almost entirely negative. Not only did the scheme crowd out other priority public investments but the influx of foreign funding supported an overvalued exchange rate and put extraordinary pressure on real wages and prices.<sup>24</sup> Today, the country is facing renewed balance of payments and debt problems, one consequence of which is increased pressure on its natural resources as it seeks to export its way out of its financial difficulties.

The Mahaweli Project has also exacerbated civil conflict in Sri Lanka. Officials within the Mahaweli Authority have admitted that, in league with militant Buddhist priests, they used the resettlement programme to drive a wedge between minority communities of Tamil-speaking Hindus and Muslims by settling poverty-stricken households from the Singala-speaking Buddhist majority within and around minority communities.<sup>25</sup> As Thayer Scudder of the California Institute of Technology notes: • Though contrary to project goals, which stipulated that ethnic and religiously distinct populations were not to be mixed and that minorities were to receive plots according to their proportionate representation within the national population, these actions were ignored by such donors as the United States Agency for International Development and the World Bank. Subsequently, massacres on both sides occurred, in some instances in the very communities where they had been predicted.<sup>26</sup>

#### LESOTHO HIGHLANDS WATER DEVELOPMENT PROJECT, LESOTHO

Balfour Beatty was part of the international Lesotho Highlands Project Contractors consortium which won a £230 million contract to construct Phase 1 of the Lesotho Highlands Water Project [LHWP], a massive water-transfer scheme, intended to pipe water from Lesotho to Johannesburg. The contract to Balfour Beatty was worth £43 million and included the construction of over 65 kilometres of tunnels and associated shafts.<sup>27</sup> British involvement in the project was supported by export credits from Britain's Export Credit Guarantees Department. Other companies in the international consortium included Spie Batignolles, LTA and Züblin. Balfour Beatty holds a 16-25% share in the LHWP.<sup>28</sup> The project has been fraught with social problems from the beginning. The project's CEO, Masupha Sole, is currently on trial for corruption. Balfour Beatty was one of 12 companies named in the charge sheet as having paid money to Sole. In a recent development, the Lesotho government proceeded to prosecute the 12 companies for corruption, including Balfour Beatty, in a court case beginning on 29 November 1999<sup>29</sup> [See box on LHWP].

## KAINJI, NIGERIA

The Kainji dam was completed in 1968 and caused the displacement of 44,000 people. Many more people who had used the seasonal floodplains, which were permanently inundated by the dam, were adversely affected. Yam production in the floodplain area fell by 100,000 tonnes after the dam's completion, while downstream fish stocks fell by 60-70%. • Incredibly• , remarks author Patrick McCully, • one of the original aims of the Kainji dam was 'control of the river Niger to lessen . . . seasonal inundation . . . and to allow thereby the expansion of agriculture'• <sup>30</sup> [See section on Impregilo].

## BALFOUR BEATTY AT HOME

No review of Balfour Beatty's history would be complete without some description of the company's activities at home in the UK — activities which, after all, account for over two-thirds of its business.

### Budget, Safety, Service

Balfour Beatty states in its 1998 • Overview• that its highest priority is • customer service• and that it is committed to delivering projects • on programme and to budget• . In addition, Balfour Beatty states that • the health and safety of our employees, our clients, members of the public and anyone who might be affected by our operations, is of paramount importance• . Yet a review of some of the most recent projects Balfour Beatty has completed in the UK reveals that the company has fallen short of its own goals.

### Record fine

In February 1999, Balfour Beatty was fined a record £1.2 million for breaches in health and safety during its construction of a new rail link to Heathrow airport. The fine was the highest ever meted out by the Health and Safety Executive (HSE) for incidents involving no loss of life. The judge called the incident • one of the worst civil engineering disasters in the United Kingdom in the last quarter of a century . . . It is a matter of chance whether death or any serious injury resulted from these very serious breaches. • <sup>31</sup> Balfour Beatty was one of two companies contracted to construct tunnels for the £550 million rail link. One of the tunnels collapsed in October 1994, leaving a crater which dragged down car parks and shook buildings, and crushed the Piccadilly Line of London's underground train system. The cancellation of flights alone caused by the accident cost British Airways some £50 million. <sup>32</sup> In March 1999, Balfour Beatty was again fined by the HSE — this time £500,000 for health and safety breaches leading to the derailment of a train between Witham and Kelvedon in 1997. The judge in this case said, • a very substantial risk to the public was caused. • He said that he would have imposed a larger fine, but for, among other considerations, the company's good record. <sup>33</sup>

### Dead workers

In fact, in the previous eight years, Balfour Beatty had been repeatedly fined in cases involving the death of several workers. In 1993, the company was fined £17,500 by the HSE for breaching safety rules at its Derbyshire foundry, where a worker was crushed to death. <sup>34</sup> But by far the most serious incidents occurred during the construction of the Channel Tunnel, linking England and France. Balfour Beatty was one of five UK companies contracted to build the tunnel. All five were found guilty of failing to ensure the safety of seven workers who were killed during the construction period. Each of the contractors was fined between £40,000 and £125,000. In one case, the prosecutor claimed that the breaches were a continuing danger that the contractors had done nothing to prevent. Commenting on the circumstances surrounding the death of a 26-year old worker, the judge said, • The failure in this case is one of the worst this court has heard about in the past years. This accident happened because the safety procedures in place were not properly supervised and carried out. • <sup>35</sup>

### Cost overruns

Balfour Beatty's involvement in the Channel Tunnel project was also marked by serious time and cost overruns. The company was one of ten who refused to carry our further work on the tunnel until an extra £1.2 billion was provided to cover increased costs. <sup>36</sup> In a more recent example of cost and time overruns, Balfour Beatty was one of five UK companies involved in the construction of the Jubilee Line — a new rail extension for the London Underground. On its completion at the end of 1999, the project was 60% over budget, costing £3 billion instead of the original estimate of £1.8 billion, and 19 months behind schedule. The Chair of London Transport, Peter Ford, blamed contractors for putting in rock bottom tenders: • Many contractors succumbed to the temptation to bid low and work on the claims• . By 1999, contractors' claims had amounted to £500,000. Ironically, another factor in the time

and cost overruns was the disaster at the Heathrow link — another Balfour Beatty project. Because the Jubilee Line was using the same tunnelling methods employed by the latter project, work on the line was halted for six months.<sup>37</sup>

### **Environmental damage**

The latest project completed by Balfour Beatty in the UK is the Cardiff Bay Barrage — a 1.1km dam replacing tidal mudflats with a 500-acre freshwater lake. The project had been criticised by local citizens, campaign groups such as Friends of the Earth, and the European Commission for its impact on the environment. The project inundated important habitats for birds, including the threatened redshank and dunlin.<sup>38</sup>

1 Balfour Beatty, 1998a.

2 Balfour Beatty, 1998b.

3 Financial Times, 1990a.

4 Balfour Beatty, 1998b.

5 Financial Times, 1999c.

6 Balfour Beatty, 1999a.

7 Ibid.

8 Ibid.

9 Ibid.

10 Ibid.

11 BICC www.

12 Ibid.

13 Durham, M. et al, 1994.

14 Balfour Beatty, 1998a.

15 World Development Movement, 1994.

16 Ibid.

17 Durham, M. et al, 1994.

18 Pearce, F., 1994.

19 Pearce, F., 1994.

20 NEDECO, 1979.

21 Karunawathie, A.R., 1999.

22 Pearce, F., 1994.

23 OED Precis, 1995.

24 Frederiksen, H. D. et al, 1993.

25 Gunaratna 1994: 13

26 Scudder 1990, 1994

27 Financial Times, 1990b.

28 Balfour Beatty, 1998a.

29 Business Day, 1999.

30 McCully, 1996: 69.

31 Mr. Justice Cresswell, quoted in the Financial Times, 1999d.

32 Financial Times, 1998, 1999d, 1999e, 1993a.

33 Financial Times, 1999f.

34 Financial Times, 1993b.

35 Financial Times, 1990c, 1991a, 1992a, 1993c.

36 Financial Times, 1991b.

37 Financial Times, 1999g.

38 Financial Times, 1994a, 1994b, 1994c.

## **BALFOUR BEATTY: DAMS AT A GLANCE**

### **MALAYSIA**

Sungai Ahning dam: a 74m-high, 280m-long water-supply dam close to the Thai border in Kedah State. Balfour Beatty arranged finance for the project and, in joint venture, was responsible for its construction.

### **INDONESIA**

Mrica (Soerdirman) hydroelectric dam: the 180 MW dam was inaugurated by then-President Suharto in 1989. Company promotional materials state that • the importance of the Mrica project to Indonesia was signified by President Suharto officially changing its name after the great General Sudirman, a famous Indonesian hero• . Balfour Beatty worked in consortium with Skanska and ASEA of Sweden to build the 110m-high earthfill dam; the company also assisted in arranging financing for the turnkey project.

### **KENYA**

Kamburu hydroelectric dam: EPD consultants, a member of the Balfour Beatty Group, provided feasibility studies, designs, contract documents and supervision of construction of the 95 MW Kamburu dam on the Tana river. The 53 m-high dam flooded an area of 150 has. Gitaru hydroelectric dam: the Gitaru is the largest dam of the Seven Forks development in Kenya, which comprises Kamburu (above), Masinga and Kindaruma. Gitaru harnesses the fall in the Tana river between Kamburu and Kindaruma. Again, EPD consultants (see above) were involved, carrying out first the pre-feasibility report, then detailed site investigation, designs, tender assessments, procurement, supervision of construction and commissioning services. The 30m-high 214 MW dam flooded an area of 310 ha [See section on Knight Piesold].

### **NIGERIA**

Balanga dam: Balfour Beatty designed the Balanga dam and irrigation scheme in Bauchi State, Northern Nigeria. The 42 metre-high dam impounds a reservoir of 73 million cubic metres, which irrigates 4,100 hectares. The contract for the scheme was undertaken on a turnkey basis. The UK government Export Credit Guarantee Department supported a sterling loan for the project.

### **UNITED KINGDOM**

Kielder dam: Balfour Beatty worked in consortium with Fairclough Civil Engineering (AMEC) to construct the Kielder dam in Northumbria, which was completed in 1982. The Kielder reservoir, over 11 kms-long and supplying water to north-east England, is the largest artificial lake in Europe. Queen Elizabeth II officially opened the dam. In her speech, she commented, • I have heard the present scheme criticised as being one which provides rather too much water . . . there has been inevitably the loss of some agricultural land and some homes, with families uprooted. It is sad when a larger good requires a personal sacrifice. •

Mini hydropower dams. Balfour Beatty state that their experience of designing and engineering large hydroelectric schemes around the world • is invaluable in developing the more recent concept of mini hydroelectric power stations which bring power to small communities and raise the standard of living• . In recent years, the company has built mini hydro dams in the Philippines, Thailand, Peru and Scotland.

### **SOURCES**

Balfour Beatty: 1999. This section all taken from company promotional materials.



- **COYNE ET BELLIER**

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The dam design and consulting company Coyne et Bellier was founded as Andre Coyne et Jean Bellier (or ACJB) in 1947<sup>4</sup> by the French dam designer Andre Coyne (1891-1960).<sup>2</sup> Coyne established the company after his retirement from the civil service where he had already gained a worldwide reputation as a dam designer. Jean Bellier was Coyne's son-in-law. ACJB was established specifically to design dams, initially for Electricite de France but gradually expanded to other countries and clients.<sup>3</sup> Andre Coyne designed 70 dams in 14 countries after World War Two. The company name was changed to Coyne et Bellier in 1962.<sup>4</sup> Today it employs 180 people and has an annual turnover of \$25 million. Hydropower represents 60-70% of this amount.<sup>5</sup>

Since 1976, Coyne et Bellier has been a wholly-owned subsidiary of the Brussels-based Tractebel, Belgium's biggest electricity producer with 1996 revenues of \$11.2 billion. Tractebel built and operated tram systems all over the world between 1860-1900.<sup>6</sup> It is now ranked 16th in international design firms in the world's energy sector by Engineering News-Record.<sup>7</sup> Tractebel's controlling shareholder is the giant French conglomerate Suez Lyonnaise des Eaux.

The name Andre Coyne is still revered in French engineering circles. He was president of the International Commission on Large Dams (ICOLD) from 1946 to 1952 and, in 1953, he won the prestigious • Prix du Cercle d'Etudes Architecturales • .<sup>8</sup> Around the world, however, the company has been involved with dam projects which have led to serious social and environmental problems.

### **COYNE ET BELLIER AND DAMS**

#### **MALPASSET, FRANCE**

The 60m-high Malpasset dam designed in 1954 • made Coyne a star among engineers because of his breathtaking vision and the dam's daring technology • .<sup>9</sup> The dam collapsed in 1959 almost as soon as the reservoir was filled, leaving Coyne • deeply harrowed • according to Coyne et Bellier's publicity material.<sup>10</sup> Shortly after the Malpasset dam was completed, cracks appeared near the base on the downstream side of the dam. At 9.13pm, 2 December 1959, the dam swung open, releasing a 50m-high tidal wave of reservoir water<sup>11</sup> which severely damaged the town of Frejus and killed around 500 people. The dam itself broke loose and travelled downstream with the flood water. The cause of the failure was eventually determined as a combination of pressure build-up under the dam, the state of the rock below the dam (which had numerous small faults 300mm thick filled with clay, not found during the site investigation prior to dam construction),<sup>12</sup> and a tectonic fault downstream that was not taken into account in design or construction because of its distance from the dam.<sup>13</sup>

#### **DANIEL JOHNSON, CANADA**

Andre Coyne's other dam designs include the 214 metre-high Daniel Johnson dam on the Manicougan river in Quebec, which has been plagued by numerous cracks since its completion in 1968.<sup>14</sup>

#### **ITA, BRAZIL**

Coyne et Bellier is providing consulting services on the 1,450 MW Itá dam, currently nearing completion on the Uruguay River. Construction began in the late 1980s, but opposition from affected people and funding problems caused it to be delayed and then suspended in 1990. It was restarted in 1996 when the state-owned electricity utility for southern Brazil, ELETROSUL, awarded a heavily

subsidized concession to build and operate Ita to CONITA, a consortium of private Brazilian investors which includes CBPO, ABB Ltd and Voith SA Máquinas e Equipamentos. ELETROSUL has since been broken up and privatized and its role in Ita has now been replaced by GERASUL, whose majority shareholder is Coyne et Bellier's parent company Tractebel.

The dam will create a reservoir of 14,000 hectares, flooding 3,200 small rural properties and causing the forced displacement of around 12,700 people. Funders of the \$1 billion dam, include the Inter-American Development Bank, Brazil's National Development Bank and foreign credit agencies.

Before privatisation, the movement of farmers affected by Ita and other dams in the upper Uruguay Basin forced ELETROSUL to make significant concessions on resettlement. All displaced farmers would be offered land of equivalent quality and value and displaced landless farmers would be eligible for land at resettlement sites. Communities awaiting resettlement also negotiated control over how resettlement funds would be spent. Such community-managed resettlement has enabled a number of communities to build comfortable houses and acquire good quality land, although they still face numerous outstanding issues such as poor infrastructure at the sites and disputes over compensation payments. A major ongoing problem is inadequate compensation for farmers owning land around the edges of the reservoir. In October 1999, 700 people occupied the construction site to protest about these problems. The occupation ended after protesters won concessions from GERASUL.

#### BUI, GHANA

Coyne et Bellier produced hydrological, irrigation and up-date feasibility studies and a preliminary environmental impact assessment for the 400 MW Bui dam on the Black Volta river in central Ghana.<sup>15</sup> In 1997, CMS Generation (US) formed a joint venture with Ghana's Volta River Authority to develop and manage energy projects in Ghana, including the Bui dam.<sup>16</sup> In 1999, Ghana's government signed a memorandum with a UK consortium led by Brown and Roots, a subsidiary of the US company Hallyburton. Other members of the consortium include Hyundai (South Korea), Alstrom (UK) and Grupo Deagados (Spain).<sup>17</sup>

The Bui dam project would require the forced relocation of over 2,500 people. The Black Volta river flows through some of the last areas of old-growth forest the Brong Ahafo region of Ghana, including the Bui national park, home to around 150 hippopotami and many globally endangered amphibians, butterflies, birds and various primates. A large area of the Bui national park would be flooded by the reservoir behind the dam.<sup>18</sup>

- Contrary to widely held beliefs by the dam proponents that the hippos and the other endangered species in the park will be relocated when construction of the dam begins, • argues an anonymous submission to the World Commission on Dams (WCD), • conservationists interviewed contend that the hippos in particular cannot survive anywhere outside the Bui national park due to its unique nature. Moreover the country's game and wildlife department is even too broke to afford the cost involved in rescuing the animals at Bui and sending them to the supposed 'safe havens'. •<sup>19</sup>

The dam will also set in motion other serious environmental impacts, such as changing the flow regime of the river which will harm downstream habitats. A recent survey by the University of Aberdeen has revealed that the Black Volta river abounds with 46 species of fish from 17 families, all of economic importance. These native fish communities could be severely impacted by changes to water temperature, pollution and barriers that will block their migration along the Black Volta. Forests that serve as fish spawning grounds would also be destroyed. Waterborne disease could also occur should the dam proceed, say critics. Schistosomiasis in particular could become established in the reservoir, with severe health risks for local people.

#### KEDUNG OMBO, INDONESIA

According to the World Bank's 1985 technical data sheet on the Kedung Ombo hydropower and irrigation dam, Coyne et Bellier carried out studies during the pre-appraisal and appraisal stages. However, Jean Billore, vice president of business development at Coyne et Bellier, said that the company • has not been involved at all in Kedung Ombo in Indonesia. •<sup>20</sup>

Kedung Ombo dam was completed in 1989. It was funded with a \$156 million World Bank loan, \$21.3 million in export credits and \$105.8 million from the Indonesian government.<sup>21</sup> The 6,700 hectare reservoir flooded the homes and lands of 30,000 people from 20 villages. The World Bank's project

completion report states that the Bank's resettlement plan for the dam was • highly defective• and • built on very shaky foundations•.<sup>22</sup> Seventy-two per cent of families evicted by the dam were worse off than before the project began.<sup>23</sup> A majority of the families refused to join the government relocation programme. The World Bank notes, • Compensation offered . . . was substantially less than the cost of replacing their lost assets, and most refused to accept it. •<sup>24</sup>

In spite of local opposition, the dam's reservoir was filled. Villagers clung to the rooftops of their houses as the waters rose. In an internal memo on Kedung Ombo prepared for its 1990 Annual Meeting, the Bank noted that, • Recent surveys of reservoir people show an average decline of 40% in incomes since relocation, and 50% of households are smaller than before. •<sup>25</sup> In the six months after the dam was closed, six people drowned.<sup>26</sup>

Four years after the dam was complete, Indonesia's Supreme Court ordered that compensation be paid to the displaced villagers, but in late 1994 President Suharto's government appealed and the Court revoked the compensation order.<sup>27</sup>

#### LESOTHO HIGHLANDS WATER DEVELOPMENT PROJECT (LHWP)

Coyne et Bellier is involved in one of the largest and most controversial projects in Africa — the Lesotho Highlands Water Development Project (LHWP). Coyne et Bellier was part of the SCBG-Europe consortium responsible for design and construction supervision of the Katse dam, along with Sogreah and Sir Alexander Gibb<sup>28</sup> [See box on Lesotho Highlands Water Development Project].

When Jean Billore of Coyne et Bellier was asked about the problems and criticisms of the LHWP, he replied that environmental problems were the responsibility of the Lesotho Highlands Development Authority and the South African government. • We heard about a minor earthquake induced by the reservoir filling but this is rather common and nothing really serious happened,• he said. In fact, those who lost homes to the earthquakes were forced to live in temporary storage-shed-type housing for months, including over a very harsh winter.

#### MANANTALI, MALI

Coyne et Bellier was the lead partner with Tecsalt (Canada) and Fichtner (Germany) for the feasibility study, detailed design and construction supervision of the 200 MW Manantali dam on the Senegal river.<sup>29</sup> In 1972 Electrowatt worked on a feasibility on the same river, including the Manantali dam.

In addition to causing environmental damage that harmed local livelihoods, the project led to conflict in the Senegal Valley which has taken an • ethnic• character, with ethnic majorities being encouraged by local politicians and economic elites to scapegoat local minorities. The completion of the Manantali dam and its associated Diama dam encouraged the political and economic elite of the • Moors• in Mauritania — a segment of Moor society known as • bidans• (literally • whites• ) because of their lighter skin<sup>30</sup> — who had never previously shown an interest in agriculture, to appropriate river basin land in anticipation of profiting from the development of medium- and large-scale irrigation schemes.<sup>31</sup> Backed by security forces, the Moors began to take over lands from the black inhabitants of the Valley, forcibly expelling thousands of black Mauritanian nationals as • foreigners• and expropriating their land. Senegal, meanwhile, retaliated by expelling thousands of its minority Moorish population. At least 60,000 Senegalese and black Mauritians were deported or fled from Mauritania and twice that number of Moors left Senegal.<sup>32</sup>

#### RUZIZI II, RWANDA and ZAIRE

Coyne et Bellier was responsible for the feasibility study, economic and financial analysis, detailed design, specifications, call for tender and contract award and supervision of works for the 51 MW Ruzizi II dam.<sup>33</sup>

Officials predicted that the dam, funded jointly by the World Bank and the European Development Fund, would affect just 200 people. In the event, over 60 times that number had to be resettled, with nearly 13,000 people losing their homes and livelihoods. As Bruce Rich of the Environmental Defense Fund in the US said: • It is stupefying that even though the Bank has had an operational requirement to deal with forced resettlement since 1980, it managed to completely ignore 12,600 people. •<sup>34</sup>

Obligations central to the loan agreement were not met and the massive claims for compensation were never paid due to lack of funds.

## KARIBA, ZAMBIA

Coyne et Bellier designed the 128 metre-high, 600 MW Kariba dam on the Zambesi river.<sup>35</sup> Coyne et Bellier was responsible for the civil works and produced a feasibility study, detailed design, tender documents, and supervised construction of the dam<sup>36</sup> which was built by the Impregilo Group and completed in 1959.

The project, which displaced 57,000 Tonga people, led to major social friction and loss of livelihoods, not least because of the shortage of land for resettlement. • The problem of land shortage presented by relocation was obvious from the start to all government officials concerned • , according to Professor Thayer Scudder, an authority on resettlement.<sup>37</sup> • After resettlement it was known that approximately one-third of the population would find themselves in serious straits within ten years. • Women in particular lost out, since the authorities only recognised male • heads of households • , and few were therefore compensated for the loss of their lands<sup>38</sup> [See section on Impregilo for further information on Kariba].

## BIRECIK, TURKEY

Coyne et Bellier is acting as consultant to the government and investors in the 672 MW Birecik dam on the Euphrates river. The dam, which according to Coyne et Bellier<sup>39</sup> is the biggest build-operate-transfer (BOT) hydroelectric project in the world, is being built by a consortium headed by Germany's Philipp Holzmann with a local partner, Gama Endustri. The dam is anticipated to be completed in 2001.<sup>40</sup> Coyne et Bellier produced a design review, and is responsible for site supervision, technical assistance, commissioning and quality control of the construction works.<sup>41</sup> Lahmeyer International [see section on Lahmeyer] is also involved in the Birecik dam. The dam is part of Turkey's massive GAP project [see box on Ilisu].

The flooding of the reservoir was slated to begin in December 1999. As of the end of October 1999, however, the villages in the reservoir were still • full of people • , according to Justin Huggler, a journalist who visited the area.<sup>42</sup> The villages reported that they had nowhere else to go. • This house will be a tomb for me, • said one 60-year old woman. • You don't know how much I don't want to leave. • In one of the planned resettlement villages, only the road had been built at the time of Huggler's visit. Although the government promised compensation, only one-third of the agreed money had been paid to villagers — the rest would not be disbursed until three months after the reservoir was scheduled to begin filling. • By then • , comments Justin Huggler of the London Independent, • the waters will be lapping round their knees. • The Regional Director of GAP has admitted that there are problems with resettlement but maintains • we are doing much better than we did with the earlier dams • .<sup>43</sup>

## BAN MAI, VIETNAM

Coyne et Bellier is the main consultant for Electricity of Vietnam on the 338 MW Ban Mai dam on the Ca river in northern Vietnam. The company produced a feasibility study and environmental impact assessment study.<sup>44</sup> Knight Piesold carried out the pre-feasibility study in 1994<sup>45</sup> [see section on Knight Piesold]. In 1994 the consultants Norconsult estimated that almost 15,000 people would have to be evicted to make way for the dam's 194 square kilometre reservoir.<sup>46</sup>

### **Coyne et Bellier and the World Commission on Dams**

Coyne et Bellier as a company appears to dismiss the controversies raised by large-scale dams and their impact on people and the environment. In 1991, to commemorate the centenary of Andre Coyne's birth, Coyne et Bellier published a glossy publicity brochure celebrating Coyne's dam designs. Illustrated by photographs of dams, Coyne's drawings and literary quotations such as, • Je tiens le flot de la riviere comme un violon • [I hold the flow of the river in my hands like a violin — Paul Eluard], the material makes no mention of the thousands of people who have lost their lives, lands, homes or livelihoods to Coyne's dams.

Coyne et Bellier is • not really involved • in the World Commission on Dams. In the words of Jean Billore, vice-president of business development at Coyne et Bellier, • we have contributed, although modestly, to its financial needs • , but the final report of the WCD will be • only guidelines that each country will be free to follow or not. •<sup>47</sup>

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2 simscience, www 1.

- 3 Billore, 1999.
- 4 Billore, 1999.
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- 29 Coyne et Bellier, 1998.
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- 35 Coyne et Bellier, 1991.
- 36 Coyne et Bellier, 1998.
- 37 Scudder, T., 1973: 232.
- 38 Mehta, L. and Srinivasan, B., 1999.
- 39 Coyne et Bellier, 1997.
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- 41 Coyne et Bellier, 1998.
- 42 Huggler, J., 1999.
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- 44 Coyne et Bellier, 1998.
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- 46 Norconsult, 1994: 2-64.
- 47 Billore, 1999.

## **COYNE ET BELLIER: DAMS AT A GLANCE**

### **ARGENTINA**

Potrerrillos: Coyne et Bellier designed the 105 MW Potrerrillos dam in Mendoza province.

### **BOLIVIA**

San Jacinto: Coyne et Bellier produced the feasibility study, design and tender documents, and supervised construction of the 8 MW San Jacinto dam. The project was financed with a loan from Argentina. Siemens supplied electrical equipment and Voith the turbines. Electrowatt also worked on the dam, which was completed in 1989.

### **BRAZIL**

Coyne et Bellier is acting as consultant on the 450 MW Cana Brava dam, the 1,450 MW Ita dam (see main text) and the 1,140 MW Machadinho dam, all currently under construction.

### **CAMEROON**

Coyne et Bellier produced a feasibility study for the 56 MW Lom Pangar dam.

### **CANADA**

Daniel Johnson dam [see main text].

### **CHILE**

The company produced the feasibility study, detailed design, tender documents and supervised the construction of the 450 MW Rapel dam on the Rapel river.

#### CHINA

Coyne et Bellier formed a joint venture with EDF to design the 1,200 MW Xiao Wan dam, on the Lacang river. At 292m-high, the Xiao Wan is the world's highest arch dam.

#### ECUADOR

Coyne et Bellier was the main consultant with local associates for the 175 MW Agoyan dam in the Andes mountains. The company produced a review of the final design, construction drawings and assisted in supervision of the construction works. It also produced the feasibility for phase 1 of the 492 MW Coca Codo Sinclair dam and worked with Electroconsult on the hydrological study, the geological investigation and study, and the feasibility study of the 167m-high, 1,200 MW Zamora dam.

#### ETHIOPIA

Coyne et Bellier was leader of a consortium that produced the feasibility study, detailed design and tender documents for the 140 MW Gojeb dam on the Gojeb river. Lahmeyer International is also involved in the project. Coyne et Bellier also produced the feasibility studies, designs and tender documents for two other Ethiopian dams, the Tekeze – where it led the a consortium for the 180m-high, 295 MW dam – and the 73 MW Tis Abay II on the Tis Issat waterfall 32kms downstream of Lake Tana [see section on Knight Piesold].

#### FRANCE

Coyne et Bellier has been involved in six French dams. It designed L'Aigle dam on the Dordogne river, the Malpasset (see main text), the 155m-high Monteynard completed in 1962, the 150m-high Roselend completed in 1962, the Serre-Poncon and the 182m-high Tignes which was, when completed in 1952, the highest in Europe.

#### GHANA

Bui dam [see main text].

#### GUATEMALA

Coyne et Bellier acted as technical advisor for design and construction to Renace S.A., the private company developing the 60 MW Cahabon dam.

#### GUINEA

Coyne et Bellier formed a consortium with Electricite de France to design and build the 75 MW Garafiri dam on the Konkoure river, completed in December 1994. Coyne et Bellier completed the environmental impact assessment, tender documents, tender evaluation, construction drawings, site supervision, technical assistance, commissioning and instrumentation monitoring. The company has been involved in three other dams in Guinea. It was the main consultant for the feasibility study, detailed design, tender documents and construction supervision for the 28 MW Grandes Chutes dam on the Samou river. With Electricite de France it produced the feasibility study and detailed design for the 105 MW Kaleta dam, and it also prepared the feasibility study for the 40 MW N'zebela dam on the Dani river.

#### INDIA

Coyne et Bellier produced a review of design, detailed design and specifications (for civil and electromechanical works), construction drawings and construction management for the 390 Dul Hasti dam on the Chenab river. It also acted as main consultant for the redesign of the 300 MW, 204m-high Lakhwar dam on the Yamuna river.

#### INDONESIA

Coyne et Bellier produced the prefeasibility study, feasibility study and environmental impact assessment for the 352 MW Cimandiri dam on Java. It also designed the 105m-high, 186 MW Jatiluhur dam built in 1956 on the Tarum river on Java. The company was also main consultant for the rehabilitation of the plant, responsible for the feasibility study, detailed design, tender documents and construction supervision.

Kedung Ombo dam [see main text]. Coyne et Bellier produced the feasibility study reviews, detailed designs and tender documents for the 166m-high, 360 MW Maung dam and the 14.8 MW Tulis dams, both on Java island. It also prepared the prefeasibility and feasibility studies, and the environmental impact assessment for the 80 MW Palu dam which increases the size of the existing Lindu Lake on Sulawesi island. With Sogreah and Electricite de France (EDF), the company also produced the detailed design and tender documents for the 28 MW Peusangan IV dam on Sumatra island.

#### LESOTHO

Katse dam [see main text].

#### MADAGASCAR

Coyne et Bellier was the main consultant, and produced feasibility study, tender design and tender documents for the 40 MW Ambodiroka dam. It also carried out the • environmental reconnaissance• for the World Bank funded Energy II project, which involves the rehabilitation of the electricity system and possible dam construction.

#### MALAYSIA

Along with Electricite de France (EDF), Coyne et Bellier produced the prefeasibility study for the 120 MW Maran dam in Pahang state.

#### MALI

Manantali dam [see main text].

#### MOROCCO

Coyne et Bellier entered a joint venture with the local company Ingema to produce a feasibility study review, design and tender documents, construction drawings and technical assistance during construction of the 247.5 MW Al Wahda dam on the Ouergha river. The dam is Africa's second highest earth dam. Impregilo was part of the building consortium. Coyne et Bellier also worked with Ingema on a feasibility study for the 19.5 MW Asfalou dam.

#### NEPAL

Coyne et Bellier, in association with EDF and BCEOM, produced the feasibility study for the 60 MW Kankai dam.

#### NICARAGUA

Coyne et Bellier produced a feasibility study, detailed design and tender documents for the 40 MW Larreynaga dam.

#### PAKISTAN

Coyne et Bellier produced the feasibility studies for three dams in Pakistan: the 500 MW Abassian and 450 MW Kohala dams on the Jhelum river; and the 135m-high, 130 MW Gomal Zam dam.

#### PHILIPPINES

Coyne et Bellier, in association with Sogelerg, produced the feasibility studies, detailed designs, tender documents and supervised the building of the 180 MW Agus II and the 255 MW Maramag dams on Mindanao Island. It also produced the feasibility study of the 68 MW Tagoloan dam on Mindanao Island with Sogreah and EDF.

#### RWANDA AND TANZANIA

Coyne et Bellier produced the preliminary study, feasibility study, detailed design and tender documents for the 80 MW Rusumo Falls dam on the Kagera river.

#### RWANDA AND ZAIRE

Ruzizi II dam [see main text].

#### SUDAN

Coyne et Bellier worked on the feasibility study, detailed design, tender documents and supervised construction of the 245 MW Roseires dam on the Blue Nile river. Impregilo built the dam.

#### THAILAND

The company produced the final design for the 82 MW Nam Khek dam and prepared the tender design documents for the 90m-high Tha Dam.

#### TOGO-BENIN

Coyne et Bellier (with Electricite de France) produced the prefeasibility and feasibility studies, detailed design, tender documents and the environmental impact assessment for the 108 MW Adjarala dam.

#### TURKEY

Birecik dam [see main text]. In 1991 Coyne et Bellier prepared the environmental impact assessment for the 201m-high, 510 MW Berke dam for the World Bank. The company also produced a feasibility study, basic design, detailed design, tender documents and supervised construction work. The company also worked on the 185m high, 540 MW Oymapinar dam from prefeasibility study through to project completion and assisted in monitoring the completed dam during the guarantee period. Bilfinger and Berger (Germany) built the Oymapinar between 1997 and 1983. Coyne et Bellier was the main consultant for the review and modification of the design, design drawings and specification, and supervision of construction on the 120m high, 285 MW Sir dam on the Ceyhan river.

#### VIETNAM

Ban Mai dam [see main text].

#### ZAIRE

Coyne et Bellier was responsible for the feasibility study, detailed design and specifications, the call for tender and contract award, works supervision and training at the 28 MW Mobaye dam on the Ubangui river.

#### ZAMBIA

Kariba dam [see main text].

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Electrowatt Engineering (EWE) is a firm of consulting engineers working in the fields of energy, transport, industrial plants and commercial buildings. The company has subsidiaries and branch offices in Europe, the Middle East, Latin America and Asia<sup>5</sup> and employs 1,200 staff worldwide.<sup>2</sup>

The original parent company, Elektrowatt Ltd, was founded in 1895,<sup>3</sup> and developed into a large corporation with business in power, industry and construction.<sup>4</sup>

The present-day company, Electrowatt Engineering, was established in 1964, developed from the technical department of the parent company, Elektrowatt Ltd. Initially, the company concentrated on the planning and design of hydroelectric power schemes in Switzerland.<sup>5</sup> In 1996, Electrowatt Engineering was struggling; Oskar Ronner, CEO of the parent company, described the 1996 revenues as • very unsatisfactory • . The company laid off about 150 people in Switzerland and Germany.<sup>6</sup>

Electrowatt Ltd. was restructured in 1997 into two groups: an engineering division and an industrial division.<sup>7</sup> Siemens AG bought Electrowatt's industrial division consisting of 300 companies with business in 50 countries including Landis and Staefa, one of the world's largest building controls supply companies.<sup>8</sup> In October 1998, the company was renamed as Siemens Building Technology. Its projects include the Petronas Towers in Malaysia, the tallest building in the world, and the Sydney Olympic Stadium.<sup>9</sup>

Meanwhile, Jaakko Poyry Oy (the Finnish engineering and forestry consulting firm – see box on Jaakko Poyry Group) gradually increased its share in Electrowatt Engineering Ltd until April 1999, when Jaakko Poyry assumed 100% ownership of the company.<sup>10</sup> Between 1997 and 1998, Electrowatt Engineering laid off another 200 employees.<sup>11</sup>

Electrowatt Engineering includes an energy division, which is divided into five business areas: Hydropower and Water Management, Thermal Power, Nuclear Technology, Waste Management and Power Economics & Consulting.<sup>12</sup> The energy division employs 890 people and in 1998 had net sales of \$110 million. Twenty per cent of the energy division is in hydropower.<sup>13</sup>

The company is the consultant to the Atomic Energy for Peace for Thailand's proposed 10 MW experimental nuclear reactor. In December 1997, the Thai prime minister Chuan Leekpai ordered that the project be put on hold pending a review as to why no safety licence had been granted to it.<sup>14</sup> EWE has refused to give public interviews in Thailand about its role in promoting nuclear power in the country.

Also in Thailand, Electrowatt Engineering acted as consultant to the Electricity Generating Authority of Thailand for the 2,625 MW Mae Moh lignite power plant.<sup>15</sup> Since the plant opened in the late 1960s, the mining operations and the pollution from the plant's smokestacks have caused severe health and environmental problems in 32 villages of Mae Moh subdistrict. In August 1998, 1,000 villagers fell sick after the plant released 150 tons per hour of sulphur dioxide for two days. Some 42,000 people in the area suffer a variety of respiratory and skin disorders caused by the Mae Moh power plant.<sup>16</sup>

## ELECTROWATT ENGINEERING AND DAMS

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### RALCO and PANGUE, CHILE

In 1979, Electrowatt Engineering did a feasibility study for the two-stage development of the Ralco and Pangue dams.<sup>17</sup> The 570 MW Ralco dam is the second (after the Pangue dam) of a series of dams proposed for the Biobio river in Chile.<sup>18</sup> Electrowatt Engineering's Chilean subsidiary, Electrowatt Ingenieros Consultores, carried out the environmental impact assessment for the \$540 million Ralco dam. Conama, the Chilean National Commission on Environment, subsequently requested a series of • clarifications, corrections, and additional information• on the study. Conama also demanded that project developers, Endesa, Chile's largest electricity utility, halt work on the site until the additional information was provided.<sup>19</sup> However, Conama subsequently decided that the project was • environmentally viable• after all<sup>20</sup> [See box on Biobio dams].

### ATATURK, TURKEY

Electrowatt Engineering was responsible for detailed design, tender documents, final design and construction supervision of the 179 metre-high, 2,400 MW Ataturk dam, completed in 1998 [See section on ABB].

### AWASH III, ETHIOPIA

In 1969, Electrowatt Engineering provided consulting services during the design of the 1,200 metre-long pressure tunnel at the 40 MW Awash III dam. Lahmeyer International was also involved in Awash III. The World Bank-funded Awash valley programme destroyed much of the forest and grazing lands on which 150,000 Afar pastoralists depended. The subsequent conversion of most of the irrigable land to cotton and sugar cane plantations led to the displacement of 20,000 people who became dependent on food relief. The Afar came to view the development project as • punishment from God• .<sup>21</sup>

### MANANTALI, GLOUGO and GOURBASSI, SENEGAL<sup>22</sup>

In 1972, Electrowatt Engineering did a feasibility study in conjunction with other firms of the Manantali (152 MW), Glougo (285 MW) and Gourbassi (21 MW) dams on the Senegal river.

All three dams form part of the Senegal river project. Funding for the Manantali dam came from a variety of sources, including bilateral aid agencies such as Canada's CIDA, the Islamic and African Development Banks and the European Union. The Swiss government's Export Risk Guarantee (ERG) provided guarantees of SF155 million for civil works contracts. Germany's KfW funded 18% of the total: the loan was covered by an investment guarantee from Hermes, the German export credit agency. By the time the Manantali dam was finished in 1988, all the funding for the project had already been spent: consequently there was no money to build the power station for the dam.

The Senegal river project as a whole, and Manantali in particular, has been widely criticised for its adverse social and environmental impacts [see also Coyne et Bellier]. The project has had severe negative impacts on agricultural production, public health, fisheries and the ecology of the region. It has also exacerbated conflict both within and between Senegal and Mauritania.

The Manantali dam alone destroyed 120 square kilometres of forest and caused the involuntary resettlement of 12,000 people. The Manantali reservoir, along with that of the Diama dam, have infested the Bafing and Senegal valleys with waterborne diseases, bilharzia being the most prevalent. The Norwegian government has refused to support the completion of the power plant for Manantali because of further unresolved public health impacts.

The Berne Declaration, a Swiss NGO, notes in *Race to the Bottom*, a report on export credit agencies and their support for destructive infrastructure projects:

• *At \$25,000-\$40,000 per hectare, construction costs of irrigation networks from the Manatali dam greatly exceeded estimates: by 1999, only 100,000 hectares had been irrigated, as opposed to the planned 375,000 hectares. Much traditional agricultural production of sorghum, relatively sustainable economically and environmentally, has been replaced by rice production.*• <sup>23</sup>

Local rice has, however, turned out to be totally uncompetitive with imported rice. The result, says Thierno Oumar Sow, a local farmer, is • poverty, famine and indebtedness• .

Manantali has also reduced the annual flood on the Senegal river to an artificial two-week flood. The result has been that less food is available for local consumption. A study financed by USAID in 1994, for example, documents that villagers • clearly state that their health has deteriorated in the past few

years because of the deterioration in their diet. They are convinced that before the construction of the dams, when they produced traditional food recession crops . . . their diet was more varied and hence more healthy.<sup>24</sup>

That view is confirmed by the African Development Bank, which notes that in a report on the project:

- The absence of the low flood level induced by the retention of the Bafin waters by the dam (nearly 60% of the river flow) seriously disturbed the basin's ecosystem and disorganised its traditional economic activities, as a result of which the region became the poorest in all three countries. The appearance and increase of social disparities and malnutrition led to a massive exodus of the labour force from the basin.<sup>25</sup>

#### NATHPA JHAKRI, INDIA

In India, Electrowatt Engineering won the contract for assistance and advice to the project authorities and consultants during the detailed design, preparation of tender documents and construction supervision for the 1,500 MW Nathpa Jhakri dam.<sup>26</sup> As a result of height miscalculations, the dam will only be able to generate its peak output for half the time anticipated. The miscalculations led to the World Bank withdrawing its funding of the project. The dam is running four years behind schedule, and the cost has risen from \$1 billion in 1988 to \$1.7 billion<sup>27</sup> [See box on Nathpa Jhakri].

#### SAMANALAWEWA, SRI LANKA

Electrowatt Engineering acted as the dam-owner's engineer during the construction of the 124 MW Samanalawewa dam, completed in 1991.<sup>28</sup> Balfour Beatty built the dam. The dam has had severe social impacts for those who were forcibly evicted from its reservoir area [See section on Balfour Beatty].

#### BAKUN, MALAYSIA

Electrowatt Engineering provided advisory and consulting services to Impregilo for the preparation of their tender bid to construct the Bakun dam. International opposition to the dam, coupled with investor fears as to its high financial risks, led to the dam being cancelled [See box on Bakun].

#### HOUAY HO, LAOS

The company was responsible for the design, environmental impact assessment and construction supervision of the 150 MW Houay Ho dam in Laos, built between 1993 and 1998.<sup>29</sup> The dam was built on a 30-year Build Operate Transfer (BOT) basis and is 60% owned by Daewoo (Korea), 20% by Electricite du Laos (EdL) and 20% by Loxley (Thailand). Daewoo's creditors are currently restructuring the company after rescuing it from bankruptcy in July 1999. Daewoo is looking to sell off assets outside its car related businesses, but there appear to be no buyers for the financially struggling Houay Ho hydropower project.

Electrowatt Engineering's environmental impact assessment was not completed until after project construction was well underway.<sup>30</sup> The dam is located in the homelands of the ethnic Nya Heun people, who have a population of 1,200 families in 30 villages. More than 70% of all Nya Heun communities would be evicted by the Houay Ho and the Xe Pian-Xe Nam Noi dams [see below].<sup>31</sup> Yet Electrowatt Engineering's EIA does not deal with the impact of the project on the Nya Heun people.<sup>32</sup>

A villager, interviewed in February 1998 at the resettlement village, Ban Chat San Unit 8, said:

- *We were told that if we moved to the resettlement site, we would be given enough land to grow crops and also receive rice for three years. But we have not received that rice and the land is not enough so we have to leave to find work or look for food elsewhere. It seems like we will not be able to survive here.*<sup>33</sup>

A consultant working for an Asian Development Bank-funded project visited the area in September 1997 and described the resettlement site as • a disastrous combination of too many people on too little land with too little external support<sup>34</sup> and as • a human rights emergency<sup>35</sup>.

The company's construction supervision has also been criticised. Extensive logging took place in and around the reservoir area. Thai newspapers reported that 100,000 cubic metres of timber was brought into Thailand from Houay Ho. Electrowatt Engineering allowed an unusually wide 50 metre-corridor for the transmission lines, giving a bonus to the Thai logging companies responsible for clearing the forest. Work on a road from the dam site was started without conducting a survey of the proposed route. After

clearing several kilometres of dense forest for the road, the contractors came to a 200 metre-high cliff, and were forced to cut an entirely new route closer to the river.<sup>36</sup>

#### THEUN HINBOUN, LAOS

In 1997, Electrowatt Engineering was responsible for advisory services, technical review and construction supervision of the 210 MW Theun Hinboun dam on the Theun river in Laos.<sup>37</sup>

The \$260 million project, completed in 1998, includes a 25 metre-high dam, a 24 kilometre-long reservoir, water diversion from the Theun river via the power station and a four kilometre-long canal into the Hai river, a tributary of the Hinboun river which is, in turn, a tributary of the Mekong river. Theun Hinboun is owned by Electricite du Laos (60%), GMS Power (formerly MDX of Thailand) (20%) and Nordic Hydropower (a consortium of Statkraft and Vattenfall, the Norwegian and Swedish state utilities respectively) (20%).

The project was funded by the Asian Development Bank with a \$60 million interest-free loan, the Norwegian export credit agency with a government-guaranteed loan of \$21 million, the Nordic Development Fund with a governmental-guaranteed loan of \$7.5 million, the Nordic Investment Bank (\$15 million), NORAD (\$7 million), the Swedish export credit agency (\$30 million), the Thai Export-Import Bank (\$10.7 million for the transmission lines) and a consortium of Thai banks (\$63 million).<sup>38</sup> The project has had a severe impact on thousands of villagers. The Theun Hinboun dam blocks fish migrations and has resulted in reduced fish catches; it has destroyed dry season water sources. The reservoir has destroyed riverbank vegetable gardens, and led to transportation difficulties for villagers. The water diversion means that water flow in the Hai and Hinboun rivers has vastly increased, water has become muddy and fishing is difficult. Mitigation and compensation measures proved hopelessly inadequate to deal with the problems caused. Only \$50,000 was allocated for resettlement and compensation costs of the \$1 million set aside for mitigation. Most of it was spent on buying land for the transmission line towers.<sup>39</sup>

In March 1999, just before the dam was officially opened, fishermen trying to fish in the reservoir said,

- The project has many bad effects. Now it is very difficult for fishing. We can only get about half as many fish as before the dam was closed. We don't know where all the fish went. We have to buy expensive new nets to try to fish deeper in the river now . . . We have not been told about receiving any help or compensation for these problems. •<sup>40</sup>

#### XE PIAN-XE NAM NOI, LAOS

Electrowatt Engineering carried out the feasibility study and environmental impact assessment for the 438 MW, \$1 billion Xe Pian-Xe Nam Noi dams in 1995. The company hired a US NGO, the Wildlife Conservation Society (WCS), to conduct fishery and wildlife surveys of the project area. None of the follow-up studies that WCS recommended were carried out. In writing the final report, Electrowatt Engineering removed the WCS recommendations and findings that would have cost the developers money. For example, the WCS study recommended the Xe Pian dam not be built because of damage to fisheries. This recommendation was excluded from the final report. WCS consultants were not allowed to see the final EIA and they were not consulted or informed about the changes made by Electrowatt Engineering to their reports.<sup>41</sup>

The project, although stalled because the Korean developers, Dong Ah, have failed to agree a power purchase agreement with the Electricity Generating Authority of Thailand (EGAT), has been used as an excuse to evict the Nya Heun ethnic group from the project area to Ban Chat San, the same resettlement village used for villagers from the Houay Ho project (see above), thus exacerbating problems there.<sup>42</sup>

#### KHAO LAEM, THAILAND

Electrowatt Engineering provided technical assistance and construction management for the Italian-Thai private joint venture company, Ital-Thai, during construction of the 300 MW Khao Laem dam on the Khwae Noi river.<sup>43</sup> Funded in 1980 with two World Bank loans to the Electricity Generating Authority of Thailand (EGAT) totaling \$99 million, the dam was completed in 1985.<sup>44</sup>

Of the 1,949 families that were forced to move to the resettlement site, 20% had moved again by 1989. As many as one in five of the ethnic minority Karen villagers living in the 388 square kilometre reservoir area before the dam was built had no legal residence papers and were therefore ineligible for

houses at the resettlement site. The World Bank thus ignored them.<sup>45</sup> According to a study produced by the World Bank's Operations Evaluations Department in 1993, 80% of people evicted by the dam • were . . . dissatisfied with the resettlement outcome • , considering themselves • to be worse off than before resettlement • .<sup>46</sup> The area between the nearby town of Kanchanburi and the dam was forested before access roads to the dam were built. Since the dam was completed, forest has been cleared for golf courses, tourist resorts, commercial agriculture, plantations, transmission lines and more roads.<sup>47</sup>

Panya Kwanprasertwaree, a Karen elder who was forced to move because of the dam, told Watershed magazine:

• *We had to spend all of our compensation for living, and it wasn't enough, actually. The water supply that they talked about never happened . . . The condition of the land here and my previous land is very different . . . I miss the fertile resources. Everything was fertile. I could find things for a meal. The thing that I miss most is rice. Rice is my soul. Our ancestors did rice farming for ages. But now I cannot grow rice and have to buy it, which is also very expensive . . . If I could ask the officials for one thing, I would like to ask, 'Please can I return to where I was?'* •<sup>48</sup>

### YALI FALLS, VIETNAM

In 1992, Electrowatt Engineering produced the environmental and financing studies for the 720 MW Yali Falls dam on the Se San river that runs over Vietnam's border into Cambodia. The first 180 MW turbine came on line in October 1999, six years after construction began. The 65 square kilometre reservoir has flooded the farmlands, forests and villages of over 3,000 people from the Jarai and Bahnar ethnic groups. The World Bank reportedly refused to fund the project on the grounds that the resettlement programme did not comply with Bank guidelines.<sup>49</sup>

According to Electrowatt Engineering's EIA, electricity will not supply local villagers: • It is not envisaged that minority villagers will take immediate advantage of home electricity because the cost in relation to current income may prove prohibitive. •<sup>50</sup>

The Mekong Committee (the dam-promoting agency funded both bilaterally and through the UN, now called the Mekong River Commission based in Phnom Penh) commissioned the EIA. The Swiss government almost entirely funded the study to the tune of \$1.19 million. Electrowatt Engineering's international • experts • and consultants took up \$780,000 of this.<sup>51</sup>

The EIA takes little account of the traditions and culture of the Jarai and Bahnar villagers to be evicted by the project and adopts a patronizing attitude toward their way of life. For example, the EIA consultants state: • It is understood that an effective support is required since the affected populations belong mainly to the mountain (minority) tribes. Their knowledge regarding modern agricultural production systems is limited as well as their thinking regarding economic terms. •<sup>52</sup>

The EIA ignores the full impacts of the project downstream of the Se San river into Cambodia. Electrowatt Engineering's consultants simply state: • For the purpose of this study, the downstream area has been defined as an area of eight kilometres long and one kilometre wide below the dam. •<sup>53</sup>

### THE JAAKKO POYRY GROUP

The Jaakko Poyry Group, established in 1958 by Dr Jaakko Poyry, owns 100% of Electrowatt Engineering. Today, Poyry is the world's largest forestry and engineering consulting firm, with 4,500 employees and a turnover of around \$400 million in 1998. Poyry's headquarters are in Vantaa, Finland and the company has over 60 offices in 25 countries around the world. The company was founded as a forestry consulting firm and since 1958 has played a key role in promoting pulp mill operations, logging and fast-growing tree plantations throughout the world. Poyry has benefited from Finnish and Swedish aid-funded consultancies in Indonesia, Vietnam, Laos, Thailand, the Philippines, Sri Lanka, Tanzania, Nepal, Zambia, Kenya, and Mozambique. Poyry has worked in more than 100 countries on projects including 300 • major pulp and paper mill projects • .

In 1993, the company expanded into the areas of energy, infrastructure and environment. The company first acquired the Ekono Group, a Finnish energy company, which engineered more than two-thirds of all combined heat and power plants in Finland, and subsequently Electrowatt Engineering. The engineering trade magazine Engineering News-Record ranks the Jaakko Poyry Group as the fourth largest international design firm in the energy sector.

In 1985, Dr. Jaakko Poyry sold half the company to Henrik Ehrnrooth, who became President and CEO. Ehrnrooth is now vice chairman, and the current president and CEO since January 1999 is Erkki Pehu-Lehtonen. In 1995, Finvest plc, a Finnish development and investment company, bought the Jaakko Poyry Group. The company was publicly listed on the Helsinki and Stockholm stock exchanges in 1997. The major shareholders in Jaakko Poyry are Corbis SA (16.0%), Geveles AB (7.3%) and Porcurator Oy (4.1%). Poyry predicts that investment in the power sector will increase in Finland and the rest of Europe in 1999, and sees a shift towards combined heat and power generation, biofuels and hydropower.

Poyry's role as a consultant on hydropower projects is illustrated by its involvement in the Song Hinh dam in Vietnam. In 1995, the Swedish International Development Agency (SIDA) and the Nordic Development Fund (NDF) commissioned Jaakko Poyry to conduct an environmental review of the 70 MW Song Hinh dam. The study was conducted after work had started on site. When filled in 1998, the 45 square kilometre reservoir flooded the forests, farmlands and grazing areas of approximately 1,800 people, including people of the highland ethnic groups Ede and Bahnar. Yet Poyry's consultant states in the Environmental Review, "[T]he resettlement of people is planned by Project Management in cooperation with the local authorities . . . No direct consultation with the people is required, but in principle, the preferences of the villagers, including tribal customs, are considered by the designers." SIDA and NDF based their decision to fund the project on Poyry's study. Contracts for the design and supply of machinery to the dam went to a range of Nordic companies, including ABB Generation AB, Kvaerner Turbin AB, Norconsult International, VBB Anlaggnig AB, SwedPower and Skanska. ABB was involved in organising the concessional loan funding from NDF for the dam.

- 1 Electrowatt, www 1 .
- 2 Electrowatt, www 4 .
- 3 Electrowatt, www 4.
- 4 Electrowatt, www 1.
- 5 Electrowatt, www 1.
- 6 PiA, 1996a.
- 7 H&D, 1997c.
- 8 SCMP, 1998.
- 9 SBT, 1999.
- 10 Electrowatt, www 4.
- 11 Poyry, 1999b.
- 12 Electrowatt, www 2.
- 13 Electrowatt, www 2.
- 14 Watershed, 1998d.
- 15 Kositchotethana, 1996.
- 16 Watershed, 1998e.
- 17 EWE, 1999.
- 18 El Mercurio, 1999.
- 19 El Mercurio, 1999.
- 20 El Mercurio, 1999.
- 21 Adams, P., 1986.
- 22 This section is drawn from • Manantali Project• in Berne Declaration et al., 1999.
- 23 Berne Declaration et al, 1999.
- 24 Cited in Berne Declaration et al, 1999.
- 25 Cited in Berne Declaration et al, 1999.
- 26 EWE, 1999.
- 27 Cornerhouse, 1999: 13.
- 28 Electrowatt, www 3.
- 29 Electrowatt, www 3.
- 30 IRN, 1999d: 41.
- 31 Watershed, 1998a: 52.
- 32 IRN, 1999d: 41.
- 33 Watershed, 1998a: 52.
- 34 IRN, 1999d: 44.
- 35 Watershed, 1998a: 52.
- 36 IRN, 1999d: 47.
- 37 EWE, 1999.
- 38 Ryder, 1999.
- 39 IRN, 1999d: 15-21.
- 40 IRN, 1999d: 20.
- 41 IRN, 1999d: 50.
- 42 IRN, 1999d: 51.
- 43 EWE, 1999.
- 44 Watershed, 1998h: 48.
- 45 McCully, 1996: 85.
- 46 Watershed, 1998h: 48.
- 47 Watershed, 1998g: 44.

48 Watershed, 1998h: 49-50.  
49 Watershed, 1995b: 43.  
50 Watershed, 1995b: 43.  
51 Mekong Secretariat, 1990: annex 1.  
52 Electrowatt, 1993: II.5-38.  
53 Electrowatt, 1993: II.6-13.

## ELECTROWATT: DAMS AT A GLANCE

### AFGHANISTAN

In 1976, Electrowatt did the feasibility study and site investigations for the 45 MW Kama dam. It also did the feasibility study, detailed design and tender documents for the 8 MW Kamal Khna dam, and a prefeasibility study and masterplan for the 368 MW Konar dam.

### ARGENTINA

Electrowatt did the preliminary design, final design and construction supervision for the 1,000 MW Alicura dam, in conjunction with another firm. It also did preliminary design work and prepared specifications in 1971 for the 440 MW Futaleufu dam with Argentinian firms, and in 1987 provided assistance and services for the final design of the 1,800 MW Piedra del Aguila dam that was built by the Impregilo Group.

### BENIN

Electrowatt Engineering formed a consortium with Sogreah to provide consulting services for the Nagbeto dam. The World Bank funded \$30 million of the \$140 million project cost.

### BOLIVIA

The company reviewed the feasibility study, detailed design and tender documents for the 120 MW Misicuni dam. It consulted in the final design and supervised the building of stage one of the 8 MW San Jacinto dam. Siemens supplied electrical equipment and Voith supplied turbines for the dam, completed in June 1989. Coyne et Bellier also worked on the dam.

### BRAZIL

Electrowatt did the feasibility study, detailed design, tender documents, final design and construction supervision for the 441 MW Cachoeira dam in conjunction with another firm. It provided consultancy services for the final design of the 60 MW Contigo dam, and designed and supervised construction of the 40 MW Curua-Una dam. In the 1960s, Electrowatt did the feasibility study of the 580 MW Pelotas dam and provided consultancy services for the 560 MW Sao Felix dam.

### CAMBODIA

In 1971, Electrowatt reviewed existing designs for the 24 MW Battambang dam.

### CANADA

In 1959, Electrowatt designed the 198m high, 528 MW Homathko dam in conjunction with another firm.

### CHILE

Ralco dam [See main text]. Electrowatt has been involved in eight other Chilean dams. It did the feasibility studies for the 173 MW Alfalfal, the Cortaderal and the 119 MW Chacrita dams in 1986, as it did for the 60 MW extension of the Coya dam. It revised the feasibility study, provided consulting services during the tender stage and organised construction management of the 400 MW Colbun dam and the 90 MW Machicura dam. In 1971, it provided consultancy services on the 300 MW Antuco dam and produced a study of reservoir leakage at the 400 MW El Toro dam. In 1963, it did the preliminary design of the 25 MW Rio Blanco dam.

### CHINA

In October 1996, Pacific Consult, a consortium led by Electrowatt Engineering, won a contract as advisor to the Chinese government on legal and regulatory frameworks to attract overseas funding for energy projects. The company did the feasibility study and provided assistance in design and implementation of the 125 MW Yang-Zhou-Yong dam, in conjunction with other firms. In 1973, it carried out a review of the feasibility, detailed design and prepared tender documents for the two-stage 250 MW Liwuchi dam.

## ECUADOR

The company did the feasibility study for the two-stage 342 MW Guayllabamba dam in conjunction with another Swiss firm. It also did the feasibility studies, detailed designs and tender documents for the 180 MW Paute Mazar dam and the 300 MW Toachi-Pilaton dam, both in conjunction with other firms.

## EGYPT

Electrowatt Engineering won the rehabilitation contract for the Aswan dam, with responsibility for the site investigation, rehabilitation proposal, detailed design, review of suppliers' proposals and commissioning. The work was completed in 1997.

## ETHIOPIA

Awash III dam [See main text].

## GERMANY

The company produced the prefeasibility and feasibility studies, detailed design, tender documents and supervised construction of the upgrading to 39 MW capacity of the Wyhlen dam.

## GREECE

Electrowatt Engineering did the feasibility study, site investigations, detailed design and tender documents for the three stages of the 850 MW Arakthos dams and completed the review of feasibility study, detailed design, tender documents, final design and construction supervision of the 105m-high, 360 MW Polyphyton dam.

## GUATEMALA

The company has been involved in four Guatemalan dams. In 1971, it did the feasibility and preliminary design for the two-stage 430 MW Atitlan power station. In the same year, it completed the detailed design, tender documents and construction supervision of the 60 MW Jurun-Marinala dam. It did the feasibility study, detailed design and construction supervision of the 90 MW Maria Linda and the 68 MW Santa Maria II dams.

## ICELAND

In 1963, Electrowatt Engineering provided consulting services on the 210 MW Burfell dam. It also did the feasibility study, detailed design, tender documents and construction supervision of the 150 MW Sigalda dam in conjunction with another firm.

## INDIA

Nathpa Jhakri dam [See main text]. In February 1999, Electrowatt won a \$9 million contract for the engineering and supervision of the 70 MW Tuirial hydropower project in the state of Mizoram. Electrowatt Engineering's contract involves a review of the feasibility study, tender design and documents and assistance during construction. The project is partly financed with a loan from Japan's OECF and is due to be finished in 2006.

## INDONESIA

In 1979, the company provided consulting services and construction supervision to the Indonesian government for the 600 MW Asahan and the 68 MW Maninjau dams, in conjunction with another Swiss firm. It also revised the feasibility study, detailed design, tender documents, final design and construction supervision of the 17 MW Tanggari I dam.

## IRAQ

Electrowatt Engineering did the feasibility study for the 26 MW Middle Tigris dam and reviewed the feasibility study, the detailed design, tender documents, construction supervision, management quality control and commissioning of the 750 MW Mosul dam, finished in 1987.

## LAOS

Xe Pian-Xe Nam Noi, Theun Hinboun and the Houay Ho dams [See main text]. Electrowatt Engineering also produced the feasibility study and initial environmental examination for the 615 MW Nam Ngum 2 dam, upstream of the existing Nam Ngum dam. Siemens and Voith are part of the



consortium developing the project. It did the same work on the Nam Theun 1 dam. In addition, the company was consultant for a study of the overall water utilisation in the Theun river basin.

#### MALAYSIA

Bakun dam [See main text]. The company also produced the feasibility study for the 900 MW Murum dam.

#### MONGOLIA

In 1995, Electrowatt Engineering completed the detailed design study for the 220 MW Egiin river dam in association with Electroconsult of Italy. It also did the feasibility study and preparation of tender documents. The Asian Development Bank (ADB) funded the study, and subsequently funded \$100 million of the total \$300 million project cost.

#### MOROCCO

Electrowatt Engineering did a review of feasibility study, detailed design, tender documents and construction supervision of the 12 MW Lalla Takerkoust and the 36 MW Ques el Makhazine dams.

#### NEPAL

Electrowatt Engineering did the feasibility study for the 3,600 MW Chisapani dam, in conjunction with another firm, for the United Nations Development Programme (UNDP). It also completed a similar study and did the detailed design for the 69 MW Mulghat dam funded by the Asian Development Bank.

#### PERU

Electrowatt Engineering did the feasibility study for the 140 MW El Platanal dam; carried out a survey of earthquake damages at the 100 MW Hualanca dam on behalf on UNDP in 1970; and completed the final design for powerhouse extension and construction supervision of the 798 MW Mantaro dam. In 1969, it helped study the extension of the Machu-Picchu dam by increasing its capacity to 115 MW. It also did the detailed design, tender documents, final design and construction supervision of the 217 MW Restitucion dam, and designed and supervised construction of the extension (to 105 MW capacity) of the Yaupi dam on the Paucartambo river. In 1967, it did the feasibility study and preliminary design of the 111 MW Yuncan dam.

#### PERU/ECUADOR

In 1991, the company produced the feasibility study for the 160 MW Puyango-Tumbes dam. The dam is designed to irrigate 49,000 hectares in Ecuador and 25,000 hectares in Peru.

#### REPUBLIC OF GEORGIA

Electrowatt Engineering won the contract for the design and feasibility study review for the rehabilitation of the 1,300 MW Inguri dam. Electrowatt Engineering will also prepare technical specifications, and assist with the procurement arrangements. The project is scheduled for completion in 2002.

#### PORTUGAL

In 1969, Electrowatt Engineering did a feasibility study of the two-stage 265 MW Alto Lindoso dam.

#### SENEGAL

Electrowatt completed the feasibility study, detailed design, tender documents and implementation of the multi-purpose 5.5 MW Anambe dam. Electrowatt Engineering was also responsible for managing the pilot farm. In 1972, it did a feasibility study in conjunction with other firms of the Manantali (152 MW), Glougo (285 MW) and Goubassi (21 MW) dams.

#### SOMALIA

Electrowatt Engineering produced a review of the basic design, operation and maintenance studies, dam and power station design, quantity and cost estimates, power market study and economic project evaluation of the 105 MW Baardheere dam.

#### SOUTH AFRICA

Electrowatt finished the feasibility study, detailed design, tender documents, construction supervision and commissioning of the 400 MW Palmiet dam.

## SPAIN

In 1951, Electrowatt Engineering designed and supervised construction of the 17.6 MW Pintado dam, and in 1967 designed and prepared the specifications and tender documents for the 60 MW Salas dam.

## SRI LANKA

The company is part of the consortium (with Lahmeyer International and a Japanese company) planning the 78 MW Kukule Ganga dam. Its role includes updating the tender documents, assisting the Ceylon Electricity Board in tendering and awarding contracts, detailing design, managing the project and supervising the site. It completed the feasibility study, detailed design, tender documents, final design and construction supervision of the 130 MW Randenigala and the 51 MW Rantembe dams in conjunction with other firms. It also acted as the dam-owner's engineer during the construction of the 124 MW Samanalawewa dam, built in 1991 by Balfour Beatty.

## SURINAME

Electrowatt Engineering did the feasibility study, detailed design and tender documents for the two-stage 800 MW Kabalebo dams funded by the World Bank.

## SWITZERLAND

Electrowatt Engineering has been involved in at least 25 Swiss dams. In 1969, it designed and supervised reconstruction and refurbishment of the 13 MW Arniberg dam. It produced the prefeasibility and feasibility studies, detailed design, tender documents and supervised construction of the rehabilitation of the two Augst-Wyhlen dams on the Rhine river in 1994. It did the design and construction supervision of the 14 MW Burglen and the 235 MW, 120m high Mattmark dams and, in 1951, the 20 MW Calancasca dam. In 1952, it designed and supervised construction of the 30 MW Chatelot dam on the French border. It did the prefeasibility and feasibility studies for the extension of the Curciosa dam in 1975; the prefeasibility study for the 400 MW pumped storage Emmetten dam; and in 1979 a similar study for the eight-stage, 136 MW Ems-Flasch dams. It did the feasibility study, detailed design, tender documents, final design and construction supervision on the extension of the existing Filisur-Tiefencastel dam. In 1962, it did detailed design, tender documents and construction supervision of the 155m high, two-stage 192.5 MW Goschenen dam. In 1992, it produced the feasibility study, detailed design, tender documents, final design and supervised construction for upgrading the Laufenburg dam. In 1963, it designed and supervised the building of the 40 MW Lizerne dam. It produced feasibility studies for the 550 MW Mauvoisin II dam; the 1,100 MW Seeboden dam in 1970; the 1,020 MW pump storage Zugersee dam in 1971; the 448 MW Nant de Drance dam in 1972; the 1,000 MW, pump storage Totensee dam; the 1,000 MW Gletsch dam and the 140 MW Amsteg II dam. In 1963, it designed, prepared the tender documents and supervised the building of the three-stage, 380 MW Misox dams. In 1991, it completed the prefeasibility and feasibility studies, detailed design, tender documents and construction supervision of the extension of the existing 80 MW Pradella-Martina dam. It designed and supervised construction of the three-stage, 393 MW Punt dal Gall dam, in conjunction with other Swiss firms and in 1951 did the same work on the 48 MW Wassen dam. It worked on the feasibility study, the preparation of tender documents and the final design for the replacement of the Rheinfelden dam built in 1898.

## THAILAND

Khao Laem dam [See main text]. Electrowatt Engineering produced the detailed design, tender documents and supervised construction of the 4.5 MW Huai Pa Thao dam for the Mekong Committee and the Swiss government. In 1969, it provided consulting services on concrete penstocks and dam construction on the 24 MW Nam Pong dam.

## TOGO/BENIN

The company did the feasibility study, detailed design, tender documents, bid evaluation and construction supervision of the 66 MW Nangbeto dam with other firms.

## TURKEY

Electrowatt Engineering was responsible for detailed design, tender documents, final design and construction supervision of the 179m-high 2,400 MW Ataturk dam, completed in 1998. It did the detailed and final designs, tender documents for equipment, and advised the main contractor during construction of the 12 MW Darlik dam. In 1978, it did the feasibility study for the 150 MW Gezende dam in conjunction with a Turkish firm. Electrowatt Engineering also did the detailed design, tender documents and construction supervision for the 1,800 MW Karakaya dam, in conjunction with other

firms. The project cost \$1,160 million and involved the eviction of 17,000 people. The World Bank loaned \$120 million toward the project's cost.

#### UKRAINE

The company produced the feasibility study for the completion of the interrupted construction of the 2,541 MW Dniester dam.

#### USA

Electrowatt Engineering acted as the turnkey contractor's engineer for the 200 MW North Fork Stanislaus River dam, completed in 1990, and in 1967 it produced a preliminary design of the 30 MW Terror Lake dam in conjunction with other firms.

#### VENEZUELA

Electrowatt Engineering did the feasibility study and preliminary design of the 30 MW Agua Viva dam, and did the feasibility study, detailed design, tender documents, final design and construction supervision for the 240 MW Santo Domingo dam.

#### VIETNAM

Yali Falls [See main text]. In 1997, Electrowatt Engineering produced a pre-feasibility study and environmental impact assessment for the 150 MW Rao Quan hydropower, irrigation and flood control dam in Hue province.

#### ZAMBIA/ZIMBABWE

Electrowatt produced the feasibility study, economic and financial studies for the 1,600 MW Batoka dam.

#### SOURCES:

EWE: 1999

Electrowatt: www 3

IRN: www 2

IRN: 1999d: 50

IWP&DC: 1995f

IWP&DC: 1996

Poyry: 1999a

World Bank: 1980

World Bank: 1984a

Watershed: 1998h: 48

- **IMPREGILO**

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**B**ased in the Northern Italian city of Milan, Impregilo<sup>6</sup> has been involved in constructing more than 160 hydroelectric projects around the world. The majority of the company's orders are for infrastructure, hydroelectric dams and large-scale civil engineering works.<sup>2</sup> Impregilo's web-site describes the company as a • world leader• in construction of dams and hydroelectric schemes.<sup>3</sup> Through a series of mergers, Impregilo is today the construction unit of Fiat, the Italian car-maker.

In 1981, Cogefar, an Italian construction company founded by Bastogi in 1975, created the original Impregilo shareholder company named Impregilo S.p.A.; in 1990, the Fiat Group, through Fiatimpresit, acquired Cogefar, creating Cogefar-Impresit and consequently Impregilo.

The present structure of Impregilo is the result of a one-year merger in which Impresit-Cogefar Girola Lodigiani teamed up to become the Impregilo Group S.p.A., Italy's largest construction group.<sup>4</sup> Subsequently, Impregilo acquired the Italian civil engineering company, Castelli. The major shareholders in Impregilo are Fiat Group (5%), Gemina (16%, partially controlled by the Fiat Group), Girola (2%) and the private commercial bank Banca di Roma (3%). The remaining 74% of Impregilo's shares is floating capital controlled by minority shareholders.

Fiat was founded in Turin in 1899, and quickly became Italy's most important car manufacturer. The company diversified so that the Fiat Group is one of the world's biggest industrial holdings with 888 companies operating in 62 countries employing 242,000 people.<sup>5</sup> In the 1980s, Fiat was accused of illegally selling arms to Iran.<sup>6</sup>

As a result of a downturn in the Italian construction industry, Impregilo started to lose money in 1992 and only returned to profit in the second half of 1995.<sup>7</sup> In 1996, Impregilo's chair, Franco Carraro, told the Financial Times: • All our rivals have big domestic markets, but the market is still very depressed within Italy so we try to be competitive abroad. •<sup>8</sup> In 1998, 61.7% of the company's sales were in countries outside Italy, an increase of 10.4% over the previous year. European sales fell 40.5% in the same year.<sup>9</sup> The Impregilo Group operates in 50 countries and has over 600 subsidiaries and associated companies. The company employs 31,109 people.<sup>10</sup> In 1998, Impregilo's sales were \$1.15 billion, an increase of only 0.1% over 1997 and approximately equal to sales in 1993.

In 1996, Impregilo won the biggest overseas building contract ever obtained by an Italian company, a mosque in Abu Dhabi. When built, the \$417 million mosque will cover an area equivalent to 10 football pitches and will include a chandelier the height of a seven-storey building.<sup>11</sup> Also in 1996, Brazilian officials announced that Impregilo was to build a \$55 million road between Sao Paulo in Brazil and Buenos Aires, the capital of Argentina.<sup>12</sup>

One of Impregilo's board members is C. Lotti, the head of the engineering consulting firm C. Lotti and Associati, Italy's biggest water engineering consulting firm, which recently did the preliminary studies for the Dai Ninh dam in Vietnam.

Impregilo has never answered questions from the Italian NGO, Campagna per la Riforma della Banca Mondiale, as to whether the company has any environmental policy. Yet Impregilo has been involved

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in many environmentally destructive hydropower projects world-wide. It is one of the companies currently bidding for a slice of the lucrative Ilisu dam contract in Turkey [See box on Ilisu].

## IMPREGILO AND DAMS

### YACYRETA, ARGENTINA/PARAGUAY

Impregilo is the main contractor, with a 20.75% share, in the Eriday consortium for the 2,700 MW Yacyreta dam [See box on Yacyreta]. The project, originally scheduled to be completed in 1989, is still not finished, and the most recent estimated completion date is 2001. Eriday filed 844 claims with the implementing agency, Entidad Binacional Yacyreta (EBY), seeking between \$800 million and \$1 billion in additional expenses that the contractors claim was incurred as a result of delays completing the project. In early 1999, EBY rejected 80% of these claims, and said it would discuss the remaining 20%.<sup>13</sup>

### ERTAN, CHINA

In October 1991, as lead company of the Ertan Joint Venture, Impregilo won a \$776 million contract to build the 3,300 MW Ertan hydropower dam on the Yalong river, a tributary of the Yangtze river in Sichuan province. The Ertan Joint Venture includes Torno (Italy), Dumez (France), GTM (France), Holzmann (Germany), Hochtief (Germany) and Changian Gezhouba Engineering Bureau 8B (China).<sup>14</sup> The implementing agency is the Ertan Hydroelectric Development Corporation (EHDC).

The five million cubic metre dam is the largest concrete arch dam currently being built in the world, and 35,000 people were evicted when the reservoir was flooded. The World Bank funded the project with a \$380 million IBRD loan in 1992 and, in 1995, a second IBRD loan for \$400 million and a \$150 million guarantee for private commercial funding of the dam. The loans amount to the largest sum the World Bank has ever granted a single project.<sup>15</sup> Other funding has come from the Chinese government (\$795.4 million), Sichuan province (\$795.4 million) and \$30 million from the US export credit agency, the ExIm Bank. The total project budget is \$2.5 billion.

The dam started to generate electricity in 1998, but by September that year, the Xinhua News Agency reported that Liu Junfeng, the general manager of Ertan Hydropower Development Corporation, has become increasingly anxious because he could sell only 60% of the dam's output. Sichuan province has an electricity glut after a steady slowdown in economic growth from 12.6% in 1994 to just 7% in 1999.<sup>16</sup> A second, but potentially more serious problem, is that the electricity generated at Ertan is significantly more expensive than that produced by smaller power stations that have sprung up since Ertan's inception in 1991.

In October 1999, the project was running at half capacity and was expected to lose more than Rmb1bn (\$72.2 million) over the year. Losses are expected to spiral even higher in 2000 after the last two of six turbines are installed for a total generating capacity of 3,300 MW.<sup>17</sup> Describing the situation as bleak, the *Financial Times* said: Ertan's difficulties may . . . complicate efforts to bridge an Rmb25bn funding shortfall for the second phase of the Three Gorges, possibly via foreign lenders.

### XIAOLANGDI, CHINA

Impregilo is lead partner in the Yellow River Contractors (YRC) joint venture. The YRC, which also includes Hochtief (Germany), Zublin (Germany) and Construction Bureau Nos. 7 and 14 (China),<sup>18</sup> has been contracted by the Yellow River Water and Hydroelectric Power Development (YRWHDC) to construct the 154 metre-high, 1,670 metre long, 1,800 MW Xiaolangdi dam in Henan province. Impregilo's share in the contract is worth \$313 million.

In 1994, the World Bank agreed a \$570 million loan package for the Xiaolangdi project (\$460 million IBRD loan for dam construction and \$110 million IDA loan for resettlement). The Bank subsequently agreed a new loan of \$160 million, for conservation of the Loess Plateau and another \$60 million in retroactive financing. The US ExIm Bank provided \$55 million in export credits to the project. The total project cost is \$4.5 billion.

Construction is planned to be completed in 2002. To make way for the reservoir, 180,000 people will be evicted from their homes and about 300,000 people will be affected by the project. The reservoir will also flood 100 archaeological sites where 10,000 year-old relics, and objects from the Song Dynasty (900-1279 AD), have been found. The World Bank-funded resettlement project includes the

construction of housing, roads, mines, factories and electricity lines. Some 11,000 hectares is to be allocated for farming, which is to create 37,000 jobs, a tiny proportion of the almost half a million people who will be affected by the project.<sup>19</sup> In 1997, Nicholas Hope, director of the China and Mongolia department of the World Bank, told the Financial Times that the Xiaolangdi project is • a model •.<sup>20</sup>

The waters of the Yellow river are the most silt-laden in the world, and other dams on the Yellow river have run into serious sedimentation problems. For example, the Sanmexia dam 130 kilometres downstream of Xiaolangdi was completed in the early 1960s.<sup>21</sup> Within three years of the reservoir filling, the river had dumped more than 50 billion tonnes of sediment into the upper end of the reservoir. Originally planned as a 1,200 MW storage dam, Sanmexia finally started to generate electricity in 1973 as a 250 MW dam.<sup>22</sup> The reservoir flooded 66,000 hectares of some of the most fertile farmland in the world and involved the eviction of 410,000 people.<sup>23</sup>

#### AKOSOMBO, GHANA

The Impregilo Group was involved with building the 912 MW Akosombo dam on the Volta river. The dam was built to supply electricity to the 100% foreign-owned Valco aluminium smelter. The World Bank provided funding for both the dam and the smelter.<sup>24</sup> About 80,000 farmers were forced to move to make way for the 8,500 square kilometre Volta reservoir — the largest in the world.<sup>25</sup> The 740 flooded villages were replaced by only 52 new ones. The reservoir rose faster than anticipated and many people were forced to flee, leaving behind their belongings for which they were never compensated. The resettled farmers did not have enough land to farm, and in 1966 the World Food Programme and USAID sent over 6,000 tonnes of emergency food aid in an attempt to prevent the resettled villagers from starving.<sup>26</sup>

After a serious drought in 1982-83, electricity supplies in Ghana were rationed for three years. Akosombo was re-designed to have a minimum operating reservoir level several metres lower than the original design, but in 1994 the reservoir level fell below the new operating minimum, resulting in electricity blackouts of up to 20 hours a week.<sup>27</sup> Water-borne diseases such as schistosomiasis, ochocerciasis and malaria have increased dramatically since the filling of the reservoir.<sup>28</sup> The trapping of silt behind the dam has also led to severe coastal erosion downstream, with beaches and sections of the highway along the West African coast from Ghana to Nigeria being washed away.

#### CHIXOY, GUATEMALA

Impregilo was the contractor for the \$12.7 million El Jute gallery, which adjusts the water level at the Chixoy dam. The El Jute gallery project was funded with Italian bilateral aid and funding from the Guatemalan government. The Chixoy dam was built during the military dictatorship in Guatemala, from 1977 to 1985, in the midst of a violent civil war. The project is notorious for the massacre of nearly 400 Maya Achi indigenous people who lived in the area of the proposed reservoir [See box on Chixoy].

#### NATHPA JHAKRI, INDIA

Impregilo won a \$234 million contract with Jindustan Construction (India) to construct the headrace tunnel and surge shaft of the 1,500 MW Nathpa Jhakri hydro-power project on the Satluj river. The World Bank withdrew its funding from the project after miscalculations in the height of the dam were revealed [See box on Nathpa Jhakri].

#### LESOTHO HIGHLANDS WATER DEVELOPMENT PROJECT

Impregilo is one of the main contractors of the Lesotho Highlands Water Project (LHWP), involved in the Katse and Mohale dams and the construction of water tunnels [See box on the Lesotho Highlands Water Project]. Impregilo has a 30% share in the Highlands Water Venture joint venture which won the contract to build the Katse dam on the Malibatso river. The Highlands Water Venture also includes Kier International, Hochtief, Bouygues, Stirling International, Group 5 and Concor.<sup>29</sup>

Impregilo also won a \$77 million contract as lead company in the Highlands Water Venture joint venture to build the 145 metre-high rockfill Mohale dam on the Senqunyane river — the main works of phase 1B of the Lesotho Highlands Water Development Project. The total cost of phase 1B is \$1.13 billion, funded in part with a \$45 million World Bank (IBRD) loan. The European Investment Bank and several European export credit agencies are also involved in financing phase 1B. Impregilo, as part

of the Mohale Tunnel Contractors joint venture (with Hochtief and Concor), also won a contract to construct the 32 kilometre long tunnel from the Mohale dam to the Katse reservoir.<sup>30</sup>

In November 1999, Impregilo was one of 12 multinational companies charged by the Lesotho authorities with having • wrongfully, unlawfully and corruptly make payments/transfers• to Masupha Sole, the former director of the Lesotho Highlands Development Authority.<sup>31</sup> Impregilo is accused of having paid \$250,000 to Sole, an accusation that Impregilo denies. Romano Allione of Impregilo told the Washington Post: • No payment for whatever sum at whatever time has been made by Impregilo• to Sole.<sup>32</sup>

#### BAKOLORI, NIGERIA

Cogefar (now part of Impregilo) constructed the Bakolori dam on the Sokoto river, a tributary of the Niger. (Fiat Impresit of the Fiat Group started the works in 1975; construction was completed in 1983; in 1989, Fiat Impresit acquired Cogefar and Impregilo S.p.A. from Bastogi-General Costruzioni and therefore created Cogefar-Impresit which existed until the establishment of the Impregilo Group in 1995.) The project resulted in the eviction of 13,000 people who received no compensation for 12,000 hectares of farmland and the trees that they lost. The contractors applied for compensation for delays caused by farmers' protests. In February 1980, the protests culminated in a blockade of the dam site and the shooting of at least 126 people — and possibly as many as 386. The dam reduced the area of rice grown downstream by 7,000 hectares and that of dry season crops by 5,000 hectares. A survey in the 1980s revealed that three-quarters of the dry season irrigators in affected villages had given up farming. Only the richer farmers could continue farming.<sup>33</sup>

#### KAINJI, NIGERIA

In the 1960s, the Impregilo Group was involved in building the 760 MW Kainji dam on the Niger river, a project that forced out 44,000 people to make way for the reservoir. Hundreds of thousands more people were adversely affected as their grazing and agricultural lands are no longer irrigated by the river's annual flood<sup>34</sup> [See also Balfour Beatty]. The project included a huge lock served by a 6 kilometre-long canal capable of holding four 5,000 tonne barges at a time. According to a 1994 report, no barge had ever used the lock in almost three decades since it was installed.<sup>35</sup> In 1999, at least 39 people were killed and thousands were left homeless after floodgates were opened to release rising floodwaters at the Kainji, Jebba and Shiroro dams. More than 210 villages were flooded or washed away.<sup>36</sup>

#### EL CAJON, HONDURAS

Impregilo was the contractor of the 300 MW El Cajon dam on the Humuya river. The project was partly funded by the World Bank and the dam was completed in 1995. However, the level of water in the reservoir fell after it was filled in 1991, and on completion the dam was able to generate only 80-152 MW, around half its installed capacity. From July 1994, electricity in Honduras was rationed to 10 hours a day, and half of all public lighting was turned off.<sup>37</sup> Some 4,700 people lost their homes to the dam.<sup>38</sup>

#### GHAZI BAROTHA, PAKISTAN

Impregilo won a \$512 million contract as lead company of a consortium to build the 1,450 MW Ghazi Barotha dam, along with Ed Zublin (Germany), Campenon Bernard (France), Saadullah Khan (Pakistan) and Nazir (Pakistan). The consortium's bid was \$300 million lower than the originally projected project cost.<sup>39</sup> The construction works include a barrage on the Indus river at Ghazi, seven kilometres south of the Tarbela dam, and diversion of water into a 95 metre-wide, 52 kilometre-long concrete channel to Barotha, where the power station is being built. The channel will support a 1,600 cubic metre-per-second flow, the largest in the world. Works were originally scheduled to be completed by March 2000, but delays have occurred because of technical, social and financial problems.

The anticipated total cost of the project is \$2.24 billion. The World Bank loaned \$275 million through IBRD for the construction of the water diversion channel. The Asian Development Bank lent \$200 million for the barrage. Other lenders include Japan's OECF (\$137 million), the European Investment Bank (\$50 million) and Germany aid agency Kreditanstalt für Wiederaufbau (KfW). By 1997, the project was at least two years behind schedule because the government had not contributed its share of the funding, as stipulated by the donor agencies.

Around 20,000 people will lose some or all of their land because of the project. The land compensation is also delayed because the implementing agency, Pakistan's Water and Power Development Authority (WAPDA), has acquired less than half of the required new land.

Impregilo is accused by local and international trade unions of not respecting a joint agreement on wage and working conditions. In 1998, the Brussels-based International Confederation of Free Trade Unions reported that Impregilo, with the help of local police, locked out 5,000 workers. In addition, management and security forces physically abused the workers, large numbers of whom were arrested, and union leaders' relatives were detained and some even tortured. On 22 December 1998, at Impregilo's request, the Pakistani president implemented a Presidential Ordinance that deprived WAPDA workers of their rights to freedom of association and collective bargaining. The suspension of trade union rights of WAPDA's 130,000 employees puts the company under the direct control of the armed forces.<sup>40</sup>

#### TARBELA, PAKISTAN

Impregilo was the lead contractor in a consortium of French and Italian firms that built the World Bank-funded Tarbela dam on the Indus river. The dam is three kilometres long, 143 metres high and has the largest volume of any dam in the world: 106 million cubic metres.<sup>41</sup>

The dam has been plagued with problems ever since 1974 when the reservoir impoundment began. Two of the four tunnels being used to control the rate of filling were damaged and forced to close. A week later one of the two remaining active tunnels collapsed, bringing down nearly half a million cubic metres of concrete and rock. The reservoir had to be emptied immediately to avoid a disaster. Engineers then discovered around 70 • sinkholes • in the reservoir bed, which they tried covering between 1975 and 1978 by dumping thousands of tonnes of earth by the barge load. One sinkhole that appeared in 1984 was still there in 1991 and could affect the permeability of the dam.<sup>42</sup> Downstream of the dam, a huge 50 metre-deep, 300 metre-wide plunge pool formed in 1976 when the main spillway began operating. During the following year's floods, the rocks at the base of the spillway eroded, threatening the safety of the huge concrete spillway. The auxiliary spillway had similar problems and the contractors had to undertake a three-year • rock stabilisation programme • .<sup>43</sup>

The rescue works on the Tarbela dam boosted the cost from an estimated \$800 million in 1968 to \$1.5 billion by 1986.<sup>44</sup> Only continual monitoring, remedial work and maintenance have stopped the dam from releasing a tidal wave into the densely populated Peshawar Valley below.<sup>45</sup> In 1999 Gohar Ayub, Pakistan's Minister for Water and Power, reported that the Tarbela reservoir • is silting up and it has silted 32% • . In response to a question about who was responsible for wrongly estimating the sedimentation during the design stage, Ayub answered, • Let us not start digging graves. Let us look at the future. •<sup>46</sup>

#### DEZ, IRAN

The Impregilo Group was involved with building the Dez dam, Iran's highest. The water from the reservoir went to irrigate 16,000 hectares, only one-fifth of the area that the dam's designers claimed would be irrigated. The irrigated land was largely for the benefit of foreign agribusiness corporations, including Mitsui, Chase Manhattan, Bank of America, Shell, John Deere and Transworld Agricultural Development Corporation. About 17,000 farmers lost their land to make way for the dam and agribusinesses. Years later, many were still landless and jobless. Until the overthrow of the Shah in 1979, the agribusiness firms that managed the new plantations in the area included Shell, John Deere, Dow Chemical, Chase Manhattan, Bank of America, Diamond A. Cattle, and Hawaiian Agronomics. As one executive put it: • They develop the water first and we come and farm it • .<sup>47</sup>

#### CARUACHI, VENEZUELA

In 1994 (as part of a consortium), Impregilo won a \$60 million contract for the preliminary works of a rockfill dam on the Caroni river, part of the 2,076 MW Caruachi hydropower dam. The implementing agency, Electrificación del Caroni (Edelca), hopes to complete the project by 2001. Impregilo won in 1997 a further \$50 million contract for the construction of the spillway channel of the Caruachi project. The works include the digging of three million cubic metres of rock and are scheduled for completion in 2002. Among the other lenders are Corporación Andina de Fomento, and Norwegian, Swedish, Finnish, Austrian and Canadian export credit agencies [See section on Kvaerner].

#### ITEZHITZHI, ZAMBIA



The Impregilo Group was involved in building the Itezihitezi dam on the Kafue river, a main tributary of the Zambesi. The dam was partly funded by the World Bank. The floodplain of the Kafue river was once one of the richest wildlife habitats in the world. The Itezihitezi dam was built upstream of the Batoka Gorge dam and prevented the remaining seasonal floods of the Kafue river, thus effectively wiping out the habitat.

#### LOWER KIHANSI, TANZANIA

Impregilo won a \$55 million contract to construct the Lower Kihansi gravity dam and the associated 300 MW power station. The \$257 million project was due for completion by the end of 1999. The project area includes two of Tanzania's protected areas: a regional forest reserve and a national park. The World Bank funded the project with an IDA loan of \$123 million. Among the other lenders are NORAD (Norway, \$57 million), SIDA (Sweden, \$29 million), KfW (Germany, \$16 million), and the European Investment Bank (\$32 million).

#### KARIBA, ZAMBIA

The Impregilo Group was the contractor for the Kariba dam on the Zambesi river. The dam was partly funded by the World Bank and was designed by Coyne et Bellier. About 57,000 people were forced to move to make way for the reservoir. In 1958, police of the then British colony of northern Rhodesia shot dead eight villagers and wounded over 30 more during the evictions.<sup>48</sup> In addition, more than 100 workers were killed during the construction of the dam.<sup>49</sup> The arid resettlement lands are far away from the reservoir. The government decided that the area around the reservoir would be best used for tourists. Villagers have dug bore holes and built small dams but, according to a 1997 article on the Tonga ethnic people resettled by the dam project, the water supply is neither reliable nor safe. Ironically, the name Tonga means • the people of the great river• . Today, Tonga families and their relatives are separated by the reservoir.<sup>50</sup> The reservoir behind the dam covers more than 1,000 square kilometres. At one point, one-fifth of the water surface was clogged with aquatic plants.<sup>51</sup>

1 This section draws on Tricarico, A., 1999, part of a report by the NGO Campagna to be published in 2000.

2 Simkins, 1996.

3 Impregilo, www 1.

4 Simkins, 1996.

5 Fiat, www 1.

6 ECN, 1987.

7 Simkins, 1996.

8 Simkins, 1996.

9 Wright, www 2.

10 Wright, www 1.

11 Simkins, 1996.

12 Ambito Financiero, 1996.

13 EIA, 1999.

14 H&D, 1996e.

15 BJ Review, 1997.

16 Financial Times, 1999b.

17 Probe International, 1999; Kyngge, J., 1999.

18 H&D, 1996e.

19 IWP&DC, 1995k.

20 Walker, 1997.

21 IWP&DC, 1995k.

22 McCully, 1996: 108.

23 McCully, 1996: 66.

24 Gitlitz, 1993: 39.

25 McCully, 1996: 7.

26 Gitlitz, 1993: 39.

27 McCully, 1996: 136.

28 Gitlitz, 1993: 40.

29 IWP&DC, 1995i.

30 World Tunnelling, 1999.

31 Greybe, D., 1999.

32 Blustein, 1999.

33 McCully, 1996: 69.

34 McCully, 1996: 68.

35 McCully, 1996: 152.

36 Coulson, 1999.

37 McCully, 1996: 136.

38 McCully, 1996: 324-325.

39 Financial Times, 1995.

40 ICFTU, 1999.

41 McCully, 1996: 12.

42 McCully, 1996: 123.  
43 McCully, 1996: 124.  
44 McCully, 1996: 124.  
45 McCully, 1996: 123.  
46 Khan and Hussian, 1999.  
47 Moore Lappe, F. and Collins, J., 1977: 217.  
48 McCully, 1996: 73.  
49 McCully, 1996: 97.  
50 Tulloch, 1997.  
51 McCully, 1996: 39.

## **IMPREGILO: DAMS AT A GLANCE**

(• Impregilo Group• refers to the involvement of Impregilo, Cogefar, Impresit, Girola or Lodigiani in a project.)

### **ARGENTINA**

The Impregilo Group was involved with building the Piedra del Aguila dam. Electrowatt was involved with the final design of the dam.

### **ARGENTINA AND PARAGUAY**

Yacyreta dam [See main text].

### **BRAZIL**

Impregilo is involved in the 176 MW Ponte de Pedra hydropower dam. If built, the reservoir would flood 14.5 square kms and the project includes 130 kms of power lines. The project is currently in the final planning stage and due for completion in 2003.

### **CHINA**

Ertan and Xiaolangdi dams [See main text]. In 1997, Impregilo was part of the Wan Long Joint Venture that won a \$193 million contract to build the Shanxi Yellow River Diversion Project to supply irrigation and industrial water from the Yellow River to the cities of Taiyuan and Datong. The contract includes the construction of a 43 km-long tunnel — the longest of its type in the world. The World Bank is contributing \$400 million towards the total anticipated project cost of \$1.35 billion. The other members of the Wan Long Joint Venture are Cooperativa Muratori E Cementisti (Italy), the China Water Conservancy and the Hydropower Engineering Bureau (China).

### **COLOMBIA**

The Impregilo Group was involved with building the Chivor dam which was partly funded by the World Bank. It also built the S. Rafael project, which aims to guarantee fresh water to Bogota. The project was funded in two tranches, the first \$35 million by the World Bank (IBRD) and the Colombian government, the second by Japan's OECF. Impregilo was the contractor for both tranches.

### **ECUADOR**

Impregilo won a \$100 million contract for the civil works and a \$125 million contract for electro-mechanical equipment at the 210 MW Daule Peripa dam. Work began in 1995 and the project is due to be finished in 1999. It was funded with \$55 million from the Italian government, \$140 million from the Corporation Andina de Fomento (Ecuador) and \$30 million from the government of Ecuador. Impregilo also built Phase C of the Paute dam, Ecuador's largest hydropower dam, partly funded by the World Bank. The Inter-American Development Bank has provided \$289 million to the project since 1974, and in 1992 funded \$14.2 million towards a project to improve watershed management and reduce siltation in the reservoir.

### **EGYPT**

Impregilo was part of the Italian consortium that constructed the 84 MW New Esna dam, commissioned in 1995.

### **GHANA**

Akosombo dam [see main text and introduction]. The Impregilo Group also helped build the Kpong dam on the Volta river, partly funded by the World Bank.

### **GUATEMALA**

Chixoy dam [See main text].

#### HONDURAS

El Cajon dam [See main text].

#### INDIA

Nathpa Jhakri dam [See main text].

#### INDONESIA

Impregilo is part of the joint venture building the \$141 million Singkarak hydropower dam project. Italian government bilateral aid is involved in the project financing.

#### IRAN

Dez dam [See main text].

#### IVORY COAST

The Impregilo Group was involved with building the Kossou dam.

#### LESOTHO

Katse dam [See main text]. Impregilo also won a \$77 million contract as lead company in the Highlands Water Venture joint venture to build the 145m-high rockfill Mohale dam on the Senqunyane river. It was also part of the Mohale Tunnel Contractors joint venture (with Hochtief and Concor) which won a contract to construct the 32km-long tunnel from the Mohale dam to the Katse reservoir. Lahmeyer is part of the joint venture responsible for the design and supervision of the tunnel. The company also won a \$35 million contract to build the 5.7 km-long Matsoku Diversion Tunnel to the Katse reservoir.

#### MALAWI

Impregilo won a \$75 million contract in Phase I (the first two units of 32 MW each) of the Kapichira dam. The World Bank is backing the project as part of the Power V project. Impregilo is a 50% participant in a joint venture with another Italian company, Salini. The company was also involved in the 46 MW Tedzani III hydropower dam on the Shire river.

#### MEXICO

Impregilo had a 41.5% share in the consortium that built the 292 MW Zimapan dam on the Moctezuma river. Other members of the consortium included Dumez (France), Cogefar Fernal (Italy) and Condux S.A. de CV (Mexico). The \$417 million project was partly funded by the World Bank and construction began in 1989. ABB and Kvaerner supplied equipment.

#### MOROCCO

Impregilo was part of the consortium that built the 1,600m-long, 90m-high Al Wadha landfill dam on the Ouerrha river, near the city of Fes. The total contract value was \$360 million. Coyne et Bellier was one of the consultants for the project. Impregilo is involved in the construction of the 110m-high, 150m-long Asfalou arch dam.

#### NEPAL

In 1997, Impregilo won a \$129 million contract to construct the 144 MW Kali Gandaki A dam. It will construct the main civil works, including the 43m high dam, the diversion tunnels and the powerhouse by July 2000. The Nepal government is paying for the project through a \$160 million loan from the Asian Development Bank and other foreign assistance. The Kali Gandaki A is the largest of the six projects being built in Nepal as an alternative to the 1,000 MW Arun III, which was shelved when the World Bank withdrew because of strong local and international opposition.

#### NIGERIA

Bakolori and Kainji dams [see main text]. Impregilo also won a \$13 million contract to build the Funtua earthfill dam and had a 70% share in the CIBAS consortium which built the \$42 million Suleja dam to supply water to the city of the same name. Impregilo Bakolori built the Watari irrigation project, which was partly funded by the World Bank.

## PAKISTAN

Ghazi Barotha and Tarbela dams [See main text].

## SUDAN

The Impregilo Group helped build the Roseires dam on the Blue Nile. Coyne et Bellier was design consultant, and VA Tech Voest MCE won the contract to rehabilitate three turbines.

## TANZANIA

Lower Kihansi dam [See main text].

## TURKEY

Ilisu dam [See box on Ilisu].

## UGANDA

In 1997, Impregilo won a \$65 million contract to build a new 200 MW hydropower station on the White Nile called the Owen Falls dam, which will be near the existing dam of the same name built in the 1960s.

## VENEZUELA

Impregilo won a \$60 million contract for the preliminary works of a rockfill dam on the Caroni river, part of the 2,076 MW Caruachi hydropower dam. Impregilo won a further \$50 million contract to build the spillway channel of the Caruachi project [See section on Kvaerner]. Impregilo also helped build the \$49 million Taguaza earthfill dam that was finished at the end of 1998.

## ZAIRE AND RWANDA

Impregilo was the contractor for the World Bank-funded Ruzizi II dam on the Rwanda-Zaire border. The Bank estimated in its 1984 pre-project appraisal that only 115 people would be affected. In fact, 15,000 lost their lands and homes to the project [See section on Coyne et Bellier].

## ZAMBIA

Itezihitezhi and Kariba dams [See main text].

## ZIMBABWE

Impregilo won a \$35 million contract for the construction of the 2.5 million cubic metre Mukorsi dam, and in 1994 Cogefar-Impresit started building the Zhove irrigation dam.

## SOURCES:

Gitlitz: 1993: 39  
H&D: 1996e  
H&D: 1997e  
IWP&DC: December 1994  
IWP&DC: 1995i  
IWP&DC: 1995j  
IWP&DC: 1997e  
McCully: 1996: 49  
McCully:1996: 83  
McCully: 1996: 173  
McCully: 1996: 136  
McCully 1996: 324-325  
World Tunnelling: 1999

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**K**night Piesold is unlike any other dam builder featured in this report. It is an umbrella or a federation of consultancy groups, the largest of which are based in South Africa (where it began in 1921), the UK, Australia, Canada and the US. It now has smaller offices in 17 other countries: Argentina, Belgium, Botswana, Brazil, Chile, Ghana, Greece, Kenya, Malawi, Paraguay, Peru, Philippines, Saudi Arabia, Singapore, Swaziland, Zambia and Zimbabwe.<sup>7</sup>

Knight Piesold is not a publicly listed company, has no consolidated accounts and no headquarters as such. Each office is independent and owned by the local principals. The British office, for instance, only incorporated itself as a company in 1996 from what was until then a private partnership, with senior partners putting in £201,000 capital. Company officials describe the group's working process as interchangeable and inter-related . . . We swap staff and information [between countries and offices]. If Chile gets a hydro job, they might contact Ashford [in the UK] and our people will go out there.<sup>2</sup>

Knight Piesold used to be called Watermeyer Piesold Legge Uhlmann. It has undergone many changes and its history is difficult to pin down. It built its first hydroelectric scheme in 1926 and now boasts of 200 or more dams in over 50 countries. It has around 800 employees worldwide in varied specialities, most notably in hydropower (public and private), water resource use and river basin planning, mining, IT, transport, engineering and environmental and financial analysis.<sup>3</sup>

Knight Piesold established itself in Britain from what was then Rhodesia as a base to develop international business. Ninety per cent of UK turnover is generated outside of Europe. Hydropower makes up 40% of UK turnover and 15% of the group's turnover. This report has learned, however, that the Knight Piesold group will probably become a single entity in 2000. Rather than owning their local practices, local partners will own shares in a global holding company. The head office will be in Denver, US, but the biggest practice will remain in Ashford, UK.<sup>4</sup>

In 1998, Knight Piesold won a World Bank commission to study the modalities of how private hydropower schemes can be built in developing countries. The study, led by Ashford-based consultant and UK partner Chris Head, is almost done. It will look into laws and regulations, financing and concession arrangements, power purchasing agreements, security packages and risk management.<sup>5</sup> Knight Piesold won the World Bank commission despite the Bank having criticised the company in 1992 for charging five times the normal cost for an exorbitant consultancy it did on the Ewaso Ngiro hydro scheme in Kenya [see below].

## **KNIGHT PIESOLD AND DAMS**

### **THREE GORGES, CHINA**

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.<sup>6</sup> The project will cost \$43 billion and displace 1.3 million people — though some estimates have put the cost as high as \$75 billion and up to 1.9 million people displaced [See box on Three Gorges].

### **LESOTHO HIGHLANDS WATER DEVELOPMENT PROJECT**

Knight Piesold is part of the joint venture that provided the investigation, design and supervision services for the 185 metre-high, 710 metre-long Katse dam on the Malibatso river, part of the \$8 billion, five-dam Lesotho Highlands Water Project (LHWP).<sup>7</sup> There have been severe social, economic and environmental impacts from this project, although only two of the five dams so far completed. The

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project has been riven by allegations of serious corruption, with 12 companies and two consortia named and charged with paying bribes to local officials. Knight Piesold is not among those charged [See box on Lesotho Highlands Water Project].

#### PERGAU, MALAYSIA

Knight Piesold was involved in the preparation work for the \$700 million, 600 MW Pergau dam in Malaysia. Between 1991-97, the company provided the tender, detailed design and site liaison and supervision for Malaysia's National Electricity Board. The funding source — according to company documents — was the UK government's aid division, the Overseas Development Administration (ODA), and commercial loans. The ODA originally opposed funding for Pergau, but Prime Minister Margaret Thatcher nevertheless offered financial support during a visit to Malaysia in 1989. It was subsequently revealed that the aid money was linked to a reciprocal deal for British arms worth over £1,000 million — a deal that broke British law. The ODA recommended alternative sites in 1990 and concluded that Pergau would not be an economic proposition until 2005 at the earliest. British companies Balfour Beatty and Kvaerner Boving were also involved in building the Pergau dam [See section on Balfour Beatty].

#### NAM THEUN 2, LAOS

Knight Piesold has been involved in the controversial 680 MW Nam Theun 2 hydropower dam in Laos since 1995. The company is acting as the lenders' engineer, advising six commercial banks and the World Bank's International Finance Corporation on \$750 million worth of loans for private power projects. The banks include Societe Generale Asia, Barclays Bank and Deutsche Bank.<sup>8</sup> The dam is proposed on the Theun river, the fourth largest tributary of the Mekong river. The reservoir would flood 450 square kilometres of the Nakai Plateau and result in the eviction of 4,500 people. Despite the fact that the dam may never be built, the Lao military-run logging company, BPKP, has clear-cut about half of the proposed reservoir area. The cost price of the dam is over \$1 billion, and the economic rationale of building the dam is dependent on neighbouring Thailand buying the power [See section on Lahmeyer].

#### TURKWELL, KENYA

Between 1986 and 1993, Knight Piesold was the overview consultant for detailed design and construction for the 155 metre-high concrete Turkwell hydropower dam in Kenya — a \$300 million project.<sup>9</sup> Other companies involved in Turkwell include GE Alstom, Norconsult, Sogreah and Spie Batignolles. The project was mired in sleaze, a stinking scandal and the whitest of white elephants, according to the Kenyan press. Kenyan president Daniel Arap Moi and other officials were believed to have received personal advantages of millions of dollars. The European Commission said the dam cost more than twice what it should have. Knight Piesold documents obtained by this report say that the funding source for its involvement in Turkwell came via export credits from the UK's Export Credit Guarantee Department (ECGD), which was not publicly reported at the time [See section on Sogreah].

#### EWASO NGIRO, KENYA

Since 1989, Knight Piesold has continued to be involved in a project run by the state-owned Kenya Electricity Generating Co. called the Ewaso Ngiro project — three dams, 180MW and costing in total \$350 million by its due completion date of 2007.<sup>10</sup> In 1992, a World Bank study team criticised a £38.1 million contract for feasibility studies and environmental impact assessments that the company won in 1990 as being five times what such services would normally cost.<sup>11</sup>

The World Bank's report was obtained by the Financial Times, which reported that the UK government's ECGD had backed 85% of Knight Piesold's fee. The reputation of the client, then called Kenya Power and Lighting Corp, was already tainted by allegations of corruption and more against Energy Minister Nicholas Biwott — including one that he had murdered former Foreign Minister Robert Ouko (for which he was arrested, then released for lack of evidence). The World Bank documents stated that at least £15.3 million had been paid up front to Knight Piesold, even though the project was not due to come on-stream for another 10 years. The exorbitant cost of this contract together with the high level of upfront payments . . . even before the feasibility study has been completed, raises fundamental questions about procurement practices and financial management, the World Bank report said.<sup>12</sup> Knight Piesold said at the time that the fee was entirely in line with the norm for work of this nature. Since this scandal, Knight Piesold won contracts for full tender

design and documentation and is still working today on Ewaso Ngiro. According to company documents, the ECGD is backing their involvement.<sup>13</sup>

The three-dam project includes linking the Ewaso Ngiro and Amara rivers with a 3.5 kilometre-long tunnel, reversing the Amara's flow which will consequently suck water from Masarua Swamp, giving Kenya the ability to tap water from the rainy West to the arid Rift Valley.<sup>14</sup> The Masarua Swamp is a key water resource within the famous Serengeti National Park.

The project is causing massive controversy between Kenya and Tanzania, according to a March 1999 report from Mishael Ondieki at *The Nation* newspaper in Kenya. Tanzanians are convinced that the formation of dams in Kenya will drain water from Tanzania, leading to migration of animals from their country. Oneiki quoted one source saying. It is predicted that the project, if commissioned, could jeopardise the East African Cooperation regional alliance. Other sources told Ondieki that Tanzania, teaming up with Uganda, wanted to stop Kenya generating power so as not to threaten Tanzanian power finding a market.

The Nation said that Knight Piesold had recently prepared a report claiming that the project was viable and would have little impact on the environment. However, the report went on to state that it was unable to give conclusive results because of insufficient data on the levels of the Ewaso Ngiro river and Lake Natron into which the river drains. 'It is increasingly difficult to carry out Kenyan research on Lake Natron since it is on the Tanzanian border', the newspaper quoted the Knight Piesold report.

Knight Piesold also spoke to Tanzanian fears about fragile flamingo nesting and breeding sites being destroyed: It will definitely affect the flamingo nesting areas but will not at any point hinder them from their breeding grounds since the lagoon there they breed will not be affected. Tanzania has twice vetoed the project, fearing the Masarua Swamp in the Serengeti will be drained, driving wild animals permanently to Kenya.

The Kenyan government is pushing the project; its permanent secretary in the Ministry of Energy, Crispus Mutitu, accused the media of giving the project bad publicity, adding that the country's electricity supply would worsen if the project was not undertaken. The government will have to pay 30% of the total cost of the project under World Bank arrangements — conditions that it has failed to meet on several past projects, which have consequently stalled.<sup>15</sup>

#### TANA RIVER DEVELOPMENT, KENYA

Knight Piesold investigated, designed and supervised the 55 metre-high, 2,150 metre-long earth-filled Masinga dam, a multi-purpose irrigation/hydropower dam that was to regulate the waters of Kenya's longest river, the Tana.<sup>16</sup> The Masinga dam regulates water for the \$98 million Bura Irrigation Project, which the World Bank funded in the 1980s to irrigate 35,000 acres of land to grow cotton and maize.

The Bank concedes now that it has irrigated only 6,000 acres and that it has cost \$10 million more than planned — even after all the social and environmental components had been cancelled.<sup>17</sup> Korinna Horta of the US Environmental Defense Fund, who visited the Bura Project site in 1994, called it an unmitigated disaster . . . of remarkably poor planning, while anthropologist Thayer Scudder described it as a classically idiotic project. The project owners spent \$55,000 for every settler on the project site — in a country where the per capita income is only \$350 — and yet today these settlers and their families suffer abject poverty and drought and famine are a daily reality . . . Food must be supplied by the United Nations World Food Program. Malnutrition and disease are rampant, especially among children. The Bura Project initially planned to build 20 village health units and various health centers, but these were cancelled, Horta says. Half of Kenya's rural development funds were wasted on the Bura project, Scudder said. Horta noted about the Bura Project in 1994:

*The World Bank's 1990 Project Performance Audit Report, a leaked confidential document, indicates that project managers should have been aware of problems and halted the project early on. Technical studies on the lack of suitable soils for irrigation in the area existed but were not taken seriously. Project managers, rushing to get the ill-prepared project approved by the [World] Bank's Board of Directors, downplayed the risks and vastly underestimated its costs.*

According to company documents, Knight Piesold has continued to carry out additional working at the Masinga site since 1996 for its client, the Kenya Power Company Ltd, under funding from the Kenyan government. Knight Piesold is providing a feasibility study for raising another dam for a 40 MW

station. The same client and paymaster has contracted Knight Piesold to design a • third unit• for the 180 MW underground power station at the Gitaru site. Knight Piesold also worked from 1996-97 studying the redevelopment of the original 1930s Tana power station — including • financial and environmental• studies.<sup>18</sup>

Meanwhile, the furthest upstream development on the Tana is the 112 metre-high, 840 metre-crested, 142 MW Kiambere dam that was begun in 1985. Knight Piesold provided full investigation, design and supervision of the dam project.<sup>19</sup> The World Bank, which funded the dam, noted in an internal 1989 memorandum that the number of people displaced by the Kiambere dam was 6,000 — six times the original estimate.<sup>20</sup> • There was no resettlement plan, no timetables and no evaluation of the adequacy of compensation,• said Horta. • ‘There is nothing that could explain why this happened’,• Horta quoted Robert Tillman, an official with the Bank’s Africa Region Environment Division. • ‘Someone just dropped the ball’ •

#### CORPUS CHRISTI, PARAGUAY/ARGENTINA

Knight Piesold began work on the proposed \$3 billion, 2,880 MW Corpus Christi dam on the Argentine-Paraguay border in 1992, doing the project preparation for private sector financing. The company was funded, according to internal documents, by the British government. The Corpus Christi would be built between two huge dams on the Parana River — Yacyreta and the world’s largest dam, Itaipu — and all the generated power is earmarked for export. Knight Piesold is still working on the Corpus project, and has been carrying out a feasibility study for alternative sites since 1996 [See box on Parana River].

#### OMAI TAILINGS, GUYANA

Knight Piesold’s Canadian branch built the first stage of the Omai waste dam for Canadian gold mining company Cambior in Guyana.<sup>21</sup>

In 1995, the dam cracked and released 3.4 million cubic metres of water laced with cyanide into nearby rivers for five days. Cambior said it was an industrial accident, not an environmental disaster.<sup>22</sup> An environmental report by Technitrol Eco-research said that only 400 fish had died as a result of the dam failure on the Omai river, an important source of food and water for local people. At the time of the dam burst, however, the Guyana Geology and Mines Commission said it was • the worst industrial disaster to hit the country• . The UNDP office said at the time that aquatic life in the Omai and other rivers had been • seriously impacted• .<sup>23</sup> Roger Moody, the mining advisor to the Amerindian People’s Association of Guyana, said the mine had been • hastily built, ill planned and [is] an example of greed masquerading as the hope of a poor country. • A witness gave this account:

*• I saw the waters flowing past my town turn filthy brown. The cyanide waste came like a great brown slick covering the water from the mine 80 miles upstream. It was dreadful to see. The river was so rich, four miles wide and full of fine fish. It had in it giant otters, dolphins, porpoises. It flowed down between the mountains through the forest. Jaguars, deer, monkeys, boa constrictors, all came to it to drink and swim as did I myself and all my family. •*<sup>24</sup>

Cambior said it had enough money to cope with the • setback• that the dam failure had caused its business.<sup>25</sup> In 1997, a Canadian Superior Court dismissed a \$69 million action against Cambior. Knight Piesold said at the time that it had only built the first 15 metres of the 45 metre wall, and that the cracking had appeared higher up in a section • designed . . . by others• . However, a minority partner in the dam said that the Knight Piesold design had been followed throughout the construction work. This report has learned that a • representative action• was filed in Guyana against Cambior in August 1999 for \$100 million — the claim representing some 23,000 local people.<sup>26</sup>

1 Knight Piesold, www.

2 Knight Piesold, 1999a.

3 Knight Piesold www.

4 Knight Piesold, 1999a.

5 Knight Piesold, 1999b.

6 Knight Piesold, 1999b.

7 Knight Piesold, 1999b.

8 Knight Piesold, 1999b.

9 Knight Piesold, 1999b.

10 Knight Piesold, 1999b.

11 Financial Times, 1992b.

12 Financial Times, 1992b.



- 13 Knight Piesold, 1999b.
- 14 Ondieki, M., 1999.
- 15 Ondieki, M., 1999.
- 16 Knight Piesold, 1999b.
- 17 Horta, 1994.
- 18 Knight Piesold, 1999b.
- 19 Knight Piesold, 1999b.
- 20 Horta, 1994.
- 21 Knight Piesold, 1999b.
- 22 Gooding, K., 1995.
- 23 Knight Piesold, www.
- 24 Omai, www.
- 25 Gooding, K., 1995.
- 26 Cambior, www.

## **KNIGHT PIESOLD: DAMS AT A GLANCE**

### **EAST AFRICA**

In Ethiopia, more than \$1 billion is being spent on the Chemoga Yeda hydropower scheme. Lead consultant for most the feasibility studies — including the economic and financial analysis, as well as the environmental impact assessments — is Knight Piesold. The funding is coming from the African Development Bank. There are three dams involved: Beles, Chemoga Yeda and Halele Werabesa. Knight Piesold completed the feasibility study for the \$250 million, 105 MW Arror dam for the Kerio Valley Development Authority, its involvement funded by the UK's government's Department of Trade and Industry. East Africa is also home to two other dams that Knight Piesold was involved in investigating and designing: the multi-purpose Oldorko and 140m-high Oletukat dams.

### **CENTRAL AFRICA**

Knight Piesold has been involved in 99 Central African dams — 35 for irrigation, 23 for hydropower, 22 for mine tailings, 9 for flood control, 9 for water supply and the company's single • pollution control• dam, the Chingola PCD, next to the tailings dam, Chingola TD4. Their largest dam in the region is the proposed 1600 MW, 182m-high, \$1.5 billion Batoka hydropower dam in Zambia/Zimbabwe. The company worked on the Batoka feasibility study for the Zambezi River Authority which was paid for by the African Development Bank. It reviewed all the tender designs and feasibility studies for the \$22 million Mubuku III. One of the most expensive dams, for which it is the • promoter's engineer• , is the \$400 million Bujugali dam in Uganda. The other 95 dams are: Baluba, Bwana Mkubwa 1, Bwana Mkubwa 2, Cambridge, Chambishi, Chibila, Chimpempe, Chimwemwe, Chiwindama, Chonga, Dundwe, Duntyte, Fitula, Freda Rebecca, French Hoek, Gladwick, Guernsey, Hwange, Horsley, Inyankui, Ipumbu, Itezhi-Tezhi, Kabwe, Kabwelume, Kafue Gorge, Kafue Hook, Kalengile, Kamana TD3, Kampelanje, Kamuzu Barrage, Kansanshi, Kapichira, Kasama B, Kasungula, Kazinze, Kazinze No.2, Kembe, Kenyauna, Lion's Lodge, Luano, Luanshya Dam, Luanshya Old Dam, Lubengele, Lubungu, Lumwana, Lunkwakwa, Lusiwasi Lake, Makoma, Mambilima, Mangwendi, Mansa B, Mazamba, Mindola Central, Mindola East, Mindola West, Mita Hills, Mofia, Monora, Mount Arthur, Msase, Msinje, Mufulira TD8, Mufulira Valley, Mufulira Magazine, Mufulira Caving Area, Mukonchi, Mulungushi, Muntimpa, Musi, Mutondo, Muzuma, Mwembeshi, Namuseba, Nangoma Lower, Nangoma Upper, Nangweshi, Nanenga, Ncema Lower, Ncema Upper, Nchanga Railway, Nchanga Stadium, Nkula, Nyanga, Rakodsi, Red Acres, Redwing, Richlands North, Riseholm, Rokana Oxide, Sipolilo, Tedzani, Turgwe, Umzingwani and Worsely.

### **SOUTHERN and WEST AFRICA**

Knight Piesold is working on two dams in Mozambique — the Mepanda Uncua and Cahora Bassa, \$1.7 billion and \$550 million respectively. The UK government is paying for the studies, at least on the latter project. The company has built two hydropower dams in South Africa, the Cambewe Foz and the Lupohlo. The Grootdraai, Katse, Mahalapye, Morgenstond and Phalaborwa Barrage are water supply dams. There are also four irrigation dams (Halstead, Mkombane, Mnjoli and Mpisi), three multi-purpose dams (Orange River Saddle, Van Der Kloof and Gariep), and four tailings dams (ERGO, Foskor Main, Foskor Phase III and Marco Fluorspar). The nine West African dams are the Batabana, the Nukula B and Kapichira (both of which the company is designing and building in Malawi for \$100 million and \$174 million respectively), the Katik, Marampa Valley A, Marampa Valley B and Somima dams, and the Ejigbo and Marampa Triangle water supply dams.

### **SOUTH AMERICA**

In addition to the Corpus Christi dam [see main text], Knight Piesold has also been involved in the earth-fill Betania dam, a 100m-high hydro project. In 1998, the company studied the feasibility of the 80 MW Huanza project in Peru. Previously it had been the specialist advisor on the 92 MW Aconcagua project in Chile. In Colombia, it advised on the project risk and insurance of the 375 MW La Miel dam. It did the feasibility study on the \$141 million Tinguiririca dam in Chile.

#### ASIA

In 1996, Knight Piesold became part of the massive Three Gorges project in China [see main text]. Knight Piesold's other Chinese dam projects include the Gong Chuan, for which it reviewed a 40 MW low-head plant for a private developer in 1995. The Mianhuatan dam — a \$350 million, 600 MW hydropower dam Knight Piesold reviewed the engineering and studied the economics, financing and environmental impacts in 1995. The Asian Development Bank paid for the company's work on the Mianhuatan, as it did for identical work Knight Piesold did on the 220 MW Shanxi project in 1996-97 and the 540 MW Hongjiadu dam in the same years.

It should be noted that Pakistan is a major future market identified by Knight Piesold, specifically the Allai Khwar project. The company is now studying three river basins in Pakistan with a potential capacity, it says, of 2,600 MW. It has already done the preliminary designs for six dams there, the biggest 200m-high. Lahmeyer is also involved in this planning, both companies presence paid for by German financiers, SKYDO and KfW.

#### SOUTH-EAST ASIA

The Pergau dam in Malaysia [see main text]. Knight Piesold also worked on two other Malaysian dams, the \$80 million Serudong and the \$200 million Liwagu (its feasibility and environmental studies for the latter funded by UK government overseas development assistance).

The Nam Theun 2 dam in Laos [see main text]. In Vietnam, the company did the feasibility study and designed the tunnel liner, penstock and manifold for the 70 MW Song Hinh dam for the Vietnamese government, part of a lead contract won by Kvaerner Boving. The dam will cost \$142 million. It did the prefeasibility study for the \$550 million Ban Mai dam for the same government.

Knight Piesold has also been appointed by the Asian Development Bank to undertake studies of the future development of the power system in Laos to meet likely electricity demands. The project involves developing an inventory of hydroelectric power projects in the range of 5 MW-50 MW for the whole of Laos, and carrying out pre-feasibility studies on up to six projects. The work also involves environmental, social and economic studies.

The company has finished its part as project reviewers and designers for the \$120 million Tagaloan dam in the Philippines, and is continuing to do similar work on two other hydropower dams for the Salcon Power Corp. in the same country: the Timaban and Villa Siga dams. All three Philippine dams are funded by equity/commercial debt. It is also designing the \$250 million, 150 MW Casecanan dam in the Philippines for the Californian Energy Co.

In Indonesia, it consulted on the \$250 million, 217 MW Lower Larona for PT Inco and did the EIA on the \$450 million Tampur dam. The company's other South-East Asian dams are: the Balambano, Bertam, Karebe, Kota Bunyi, the Kuala Yong and Kuala Yong (regulating), Lepanto, Liaso (Liwagu), Ok Tedi (interim) and Serudong.

#### AUSTRALIA

The majority of Knight Piesold's dams in Australia have been for the storage of mine tailings. The company worked on the investigation, design and supervision of eight of the nine projects listed here, the exception being the Agnew, a 30m-high, composite rock-hydraulic filled dam for which the company worked up the design feasibility study. The largest in terms of crest length (8,000m) is the earth-fill Olympic dam. The highest dam is the 73m Tom Price Tailings. The others are Gunpowder (40m-high), Mary Kathleen (30m), the three Mount Gunson dams (25m, 17m and 30m respectively), and the 30m-high Pine Creek.

#### EUROPE

Company records show involvement in 12 European dams. It did specialist supervision work on the 120m-high Evinos, a water supply dam, and similar work in the design of the Arinteiro tailing dam

(50m) and the 39m-high Cerro do Lobo. It did the design feasibility studies on the Bent Farm flood control dam, the 22m-high water supply dam Navelengua, and the Guadelmez. Knight Piesold investigated, designed and supervised the small Baranco Diversion. The company has also valued the assets of some 40 dams and hydropower projects for Electricidade de Portugal. Knight Piesold's Turkish presence is getting much bigger: it is helping develop the \$320 million Kopru and \$300 million Kavsak dams for ATA Energy A.S., and did the environmental assessment for the Dilek Guroluk dam. It is the financial analyst for Turkey's 108 MW Cat dam, and environmental impact assessors of the \$100 million Sinahoca dam for Kepez Elektrik TAS. In internal documents Knight Piesold describes as • confidential• the names of three run-of-river dams it studied in 1995 for the Northern Utilities Corp. in Turkey. The company would not later divulge the names of the dams for this report.

Knight Piesold is involved in seven UK dams. All except North Wales' Connahs Quay (a cooling water dam) are tailings dams. They are the Camborne, Chelford, Magnesium Elektron, Warren North, Wheal Jane and Wheal Maid.

#### AND IN...

The company has worked in North America on the Key Lake tailings dam, and in India on the Malanjhand tailings dam and the \$250 million Almatti dam (for its client, Kvaerner Boving). In the Middle East, it has worked on the 47m-high Sinanhoca hydropower dam and the Sohar tailings dam, and four major hydro projects in Iran: the Marun HE, the Karkeh HE and the 1,000 MW Masjed-E-Soleyman. In New Zealand, it has worked on the Waihi, another tailings dam. Knight Piesold reviewed the \$275 million, 220 MW Egiin dam in Mongolia for the Malaysian Mining Corp and has worked in Canada (the Boston Bar, the Mamquam, Sulphurets Project). In Georgia, it advised Bolnisi NL on rehabilitating old dams and developing new ones. In Micronesia, it studied the Lehnmesi hydropower scheme, and in Tajikistan, it appraised a project in the Zeravshan river basin. In Costa Rica, it has worked on the Hidroelectrica Platanar and the Dona Julia, and in Belize on the 25MW Mollegon project.

#### SOURCES

McCully 1996: 249  
Knight Piesold: 1999b

- **KVAERNER (now GE Hydro)**

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Kvaerner Energy is — or was — a division of the London-based Kvaerner Group which is today being dismantled from what it has become: a debt-ridden, mismanaged global giant of 240 or more subsidiary companies involved in ship building, engineering, oil and gas exploitation, construction, pulp and paper, mining, property and power development. Kvaerner's fall, as brutal as it was apparently quick, erased one of the world's biggest names in hydropower supply.

The Kvaerner Group bloated itself with acquisitions during the 10-year reign of CEO Erik Tonseth until 1998, when the group lost 1.345 billion Norwegian kroner (NOK) before tax, from a profit of 8.512 billion NOK the year before. Its share price fell from \$29.25 to as low as \$4.05 in 12 months.<sup>1</sup>  
• 1998 was a year of considerable challenge for Kvaerner, • said the Board of Directors as they sacked Tonseth. • The combined impact of severe deterioration in the market place, high financial costs and poor operating performance turned the year in to a highly unsatisfactory one. •<sup>2</sup>

Kjell Almskog, the former Executive Vice President and a member of the Group Executive Committee of ABB, replaced Tonseth in October 1998 to oversee the making of • New Kvaerner • . The company's energy subsidiaries were earmarked as part of a huge sale.

For 130 or so years, up until 1975, the hydropower arm of Kvaerner rarely ventured offshore, only during temporary lulls in the Norwegian market from where it was then based in Oslo. But as the home market began stagnating and local opposition to dams intensified, the company decided to expand and focus on export. It made acquisitions in Sweden (Nohab Turbinteknik AB in 1981, Nordstjärnan in 1987 and Götaverken Energy AB in 1991); the UK (Boving Chambers Ltd in 1986 to form Kvaerner Boving); and Finland (Tamturbine OY in 1992 and Tampella Power in 1996). The company established a presence with these and other purchases in the US, New Zealand, Australia, China and beyond.<sup>3</sup>

Kvaerner Energy was more a collection of already established hydro- and thermal-supply companies related by little else than the prefix • Kvaerner • than a homogenous group. They operated • almost as stand alone companies, surviving or sinking by our own order books, • a senior officer at Kvaerner Boving said. • There was some exchange of R&D but no sharing of orders. We would send our own salesmen for our own orders. The only difference [after Kvaerner bought Boving Chambers] was that our profit, or loss, would go to Kvaerner. •<sup>4</sup>

Although a relatively minor part of the group compared to ship-building and other core activities, Kvaerner Energy was, during the salad days of the 1980s and early 1990s, one of the world's leading suppliers of turbines and other mechanical equipment for hydro and thermal power stations. Up to 70% of its equipment was exported. By 1992, it was selling 5 billion NOK (\$780 million) worth of mechanical equipment a year, of which 1.45 billion NOK was for hydropower. In 1993, Kvaerner won 90% of all international tenders for turbines. It actively sought to exploit bilateral aid to win hydro-projects overseas — indeed, a key reason for buying up foreign companies was to widen its base for winning hydro deals. The company boasted in advertisements of this ability to raise finance: • The location of [Kvaerner Energy] companies and representative offices in the world's major money markets and their highly skilled team of financial experts makes Kvaerner Energy the ideal partner to raise finance for proposed projects. •<sup>5</sup>

Kvaerner-made turbines have ended up in many of the biggest, most expensive and powerful dams in the world; its deals often won in consortia with construction and electrical experts such as ABB,

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Skanska, GE, Siemens and Sulzer. At its height, Kvaerner had a total turbine output of 85,000 MW, up to 13% of the world's installed capacity.

For a variety of reasons, including increased competition and a general slump in world markets, later intensified by the Asian financial crash, Kvaerner Energy lost money in the mid-1990s. Realising that the entire Kvaerner Group had been steering the wrong course<sup>6</sup> and was crippled with \$1.6 billion of debt, management began rationalising the energy portfolio from 1996 onwards. This process has today become part of the huge restructuring and retrenchment programme back to core activities. Ironically, by 1998 and 1999, Kvaerner Energy was reporting profits from a market [still] suffering from over-capacity. There were opportunities in China and Latin America, the company said, where 75% of its orders were being taken.<sup>7</sup>

Kvaerner went crackers, the Kvaerner Boving officer told this report. It bought in huge debt. The energy companies were profitable, but for the last 12 months no-one would do business with us when they didn't know who they'd be dealing with. The order books emptied. The businesses took a bashing simply because they were up for sale.<sup>8</sup>

Too much effort has gone into growth and too little into securing profits and cash, said CEO Kjell Almskog in the 1998 annual report. Kvaerner is now aligned on a new course . . . one where profit is pivotal and cash is king. We have set new priorities where contract margins, risk control, cost efficiencies and productivity are on top of the agenda.

In the third quarter of 1998, the companies of Kvaerner Energy were sold en bloc to GE Hydro, a subsidiary of the US GE Power Systems. It was a give-away. They sold the family silver, the Kvaerner Boving officer said. It is understood that Kvaerner Energy was sold for just \$72 million.<sup>9</sup> The price is pocket change for its new owner, which is part of the GE Power Systems division of the \$426 billion US conglomerate GE Group (begun by Thomas Alva Edison in 1878). The GE Group employs 293,000 people in 100 countries; its turnover was more than \$100 billion in 1998. Fortune, Forbes, Business Week and the Financial Times have variously rated GE as the World's Most Admired and World's Most Respected company and America's Greatest Wealth Creator for the past two years. The Group declares that its primary business strategy is to achieve growth by globalisation.<sup>10</sup> Around 900 former Kvaerner dam experts are, at the time of writing in December 1999, bracing themselves for a wave of redundancies following, the anonymous Kvaerner Boving source said, poorly-received visits by GE lawyers and salesmen jumping up and down and talking about 'exciting challenges for the future'.<sup>11</sup>

## **KVAERNER AND DAMS**

### **SONG HINH, VIETNAM**

The 70 MW Song Hinh dam was completed in 1998 and comprises a 43 metre-high, 880 metre-long earthfill dam on the Hinh river and five 15 metre-high auxiliary dams, with a total length of 4,600 metres, to contain the reservoir. The 45 square kilometre reservoir inundated 660 hectares of forests; 530 hectares of scrubland; 2,600 hectares of grassland (some with shrubs and scattered trees); 710 hectares of cultivated land; and the homes of 299 families, or 1,732 people. The families affected include people of the highland minority groups Ede and Bahnar [See sections on ABB and Electrowatt].

The dam's total cost of \$142 million was paid for by a \$36.4 million loan from the Swedish International Development Cooperation Agency; a \$20 million loan from the Nordic Investment Bank and Nordic Development Fund (NDF); and \$86.5 million from the state utility, Electricity of Vietnam.

A consortium of Swedish companies, ABB Generation AB and Kvaerner Turbin AB (part of Oslo-based Kvaerner), manufactured and supplied machinery for the dam. ABB delivered electro-mechanical equipment such as transformers and generators, while Kvaerner's \$20 million contract was for the supply of turbines and other mechanical equipment.<sup>12</sup>

A South-East Asian NGO criticised the project on a number of grounds including: lack of adequate environmental impact assessment; involuntary resettlement for which no direct consultation with the people is required, according to project documents; inadequate provision of project information to affected communities; inadequate compensation (villagers only received compensation for about 15%

of the total area flooded by the reservoir, with no compensation for flooded grazing, forest or fallow land); and failure to address the downstream impacts of the dam.<sup>13</sup>

The Nordic Development Fund states that in giving loans, • priority is given to projects with a positive impact on the environment• . In the case of the Song Hinh dam, it seems the positive impacts were for the companies who won the contracts to design and supply equipment for the dam. The links between Sida and NDF's funding and the benefits to the Nordic dam building industry are illustrated by the fact that all the contracts for the design of the dam and supply of machinery went to Nordic companies. Sida and NDF rescued a financially dubious and environmentally and socially damaging project in Vietnam in order to support Nordic dam building consultants and contractors through contracts to ABB Generation AB, Kvaerner Turbin AB, Norconsult International, VBB Anlaggning AB, Swed-Power, Skanska and Jaakko Poyry Consulting AB.

The companies involved in the Song Hinh project are often found in the same consortia, or working on the same hydropower projects. For example, Sweco is part of Skanska's consortium with ABB and Kvaerner for the Swedish financed Uri dam in Kashmir. Norconsult is part of the Kvaerner consortium building the Pangué dam in Chile. Sweco reviewed the environmental impacts of the Xeset dam in Laos (for which Kvaerner provided turbines), the Kotmale dam in Sri Lanka and Pangué in Chile, all funded by Swedish aid. Swedpower and Norconsult carried out the feasibility study for the Swedish-Norwegian funded Epupa Falls dam in Namibia.<sup>14</sup>

#### CARUACHI, VENEZUELA<sup>15</sup>

One of the biggest hydropower projects of the 1990s, the Caruachi project is located in the state of Bolívar in south-eastern Venezuela. It is one of a series of dams and generating stations which together are called The Lower Caroni Development scheme.

The Lower Caroni Development scheme comprises five dams: Macagua I, Guri, Macagua II, Tocoma and Caruachi. Of these, Macagua I and Guri have already been built and Macagua II is under construction. Tocoma and Caruachi were inaugurated in 1998.<sup>16</sup> When completed in 2003, the development project will generate, in total, an estimated 16,300 MW. The main gravity dam at Caruachi will be 55 metres-high and 360 metres-long and the reservoir will inundate 238 square kilometres. The powerhouse will be equipped with 12 turbines, each with a capacity of 173 MW, so the dam's total capacity will be 2,076 MW.

The total cost of the Caruachi project is estimated at \$1.55 billion. The Inter-American Development Bank (IDB) has approved a \$500 million loan to Venezuela for the Caruachi project, and the Nordic Investment Bank has provided a \$60 million loan. In 1994, the state-owned energy company, Electrificación del Caroni (Edelca), signed contracts for electro-mechanical equipment for Caruachi worth \$450 million with an international consortium consisting of Norwegian company Kvaerner Energy, Canadian company General Electric and Austrian company Elin. According to Kvaerner, this is the largest contract for hydropower equipment in the 1990s. Kvaerner's share of the contract is \$205 million — the largest Norwegian delivery ever to South America. Kvaerner Energy will provide 12 turbines to Caruachi.<sup>17</sup> Norway's export credit agency, the Guarantee Institute for Export and Credit (GIEK), has provided \$190 million worth of guarantees for the contract.

Many indigenous Indian peoples depend on the streams and rivers that connect with the Caroni river for fishing and drinking water. The project will disrupt local settlements, affecting infrastructure and services. At least 1,014 people will be displaced by the project, losing homes and farmland. The reservoir will form an extensive, shallow body of water with relatively little circulation. Large volumes of organic matter and minerals are expected to accumulate in the impounded water, conditions which create an ideal breeding ground for carriers of tropical diseases such as mosquitoes. The area of river to be flooded contains about 170 islands, approximately 80% of which will be submerged by the reservoir. The islands and the forests along the Caroni river represent a unique and scarce habitat for several species.

The cumulative impact of the five dams will change the Caroni from a free-flowing river into a series of gradually lower reservoirs. This will have extensive impacts on hydrology, water flow, sediment transport and erosion, leading to major changes in the ecosystems of the area. In the revised 1993 project environmental summary, the emphasis is on studying the impacts of the Caruachi dam solely in the area between the Guri and Tocoma reservoirs. From a hydrological and ecological point of view,

this analysis is both unreasonable and illogical. As the Caruachi project is part of a larger scheme, the Norwegian NGO FIVAS, is calling for the cumulative effects of the entire development to be evaluated.

#### HIGH ASWAN DAM AND THE SOUTH VALLEY (TOSHK) PROJECT, EGYPT

Construction of the 2,100 MW High Aswan dam began in 1960 and was completed 10 years later. The dam is 111 metres-high, with a width of nearly 1,000 metres. The reservoir, called Lake Nasser, is 480 kilometres long and up to 16 kilometres wide. The \$1 billion Aswan High dam became an expression of the political tensions of its time. It was financed by the Soviet Union a few years after the war inflicted upon Egypt by Israel, France and Britain. The dam became a nationalist icon and, according to Patrick McCully of International Rivers Network: • The primacy of the political motivations for building the high dam at Aswan is evidenced by the paucity of investigations into the dam's likely benefits and costs. •

Aside from its displacement of 113,000 people, the dam has had a massive impact on the Nile river — and correspondingly on agriculture and fishing downstream. Fully 98% of the fertile silt once deposited by the Nile on its floodplain and delta — home to the majority of Egyptian people — is trapped behind the dam in Lake Nasser. The result has been increased chemical inputs in farming downstream and the degradation of the Nile Delta. The loss of silt reaching the sea has also had an impact on fishing: sardine catches fell from 18,000 tonnes to 1,000 tonnes per year once the dam was closed; other fish catches dropped 70% and shrimp catches declined by two-thirds. Output from the dam suffered from low water levels; the Aswan achieved only a 40% plant factor in the 1980s, according to government records. Despite dam proponents' claims about the Aswan's irrigation benefits, the actual area of irrigated land in Egypt in 1989, according to FAO statistics, was virtually unchanged from the area irrigated in 1961.

Kvaerner, which was involved in the construction of the High Aswan dam, continues its involvement today. In February 1998, it won a contract for a new project to pump water from Lake Nasser to irrigate 50,000 hectares of land in the South Valley at Toshka on the lake's western bank. The Egyptian government awarded a \$436.6 million contract to a consortium of Kvaerner, Hitachi and Egypt's Arabian International Construction to build a pumping station — which will be the world's largest — at Toshka.<sup>18</sup>

#### BHUMIPHOL, THAILAND

The 535 MW, 154 metre-high Bhumiphol dam, built in 1964, was the first large dam in Thailand supported by the World Bank. The dam inundated 30,000 hectares along the valley of the Ping river, and displaced 20,000 people, some of whom are still fighting for compensation today.

One of the major problems throughout the 26 years the dam has been in operation has been the tensions between the dam's multipurpose roles for electricity generation, flood control and irrigation. In March 1994, the reservoirs of the Bhumiphol, together with the World Bank-funded Sirikit dam, held only 7% of their total usable volume.<sup>19</sup> A history of the World Bank from 1973 records:

• *The electricity-generating capabilities of the Ping river, on which the Bhumiphol Dam was built, were substantially overestimated . . . Taking into account the shortfall in the generating capacities of the Bhumiphol dam and the . . . disappointments in the project's contribution to agricultural output, a current reassessment of this sizeable multipurpose development effort would probably call into question its economic justification.* •<sup>20</sup>

The result has been a constant struggle between those who want to use the multipurpose dam for irrigation — the farmers of Thailand's Central Plains — and the Thai utility, the Electricity Generating Authority of Thailand (EGAT), which wants to use the water for electricity generation. It is usually EGAT that wins and the farmers who suffer. The Thai government, which initially encouraged farmers to plant two crops of rice per year with irrigated water from the Bhumiphol dam has in recent years demanded that farmers cease planting the second crop. The Director-General of the government's Royal Irrigation Department (RID) announced at the end of 1998's rainy season that less than half of Thailand's paddy fields — most of which are in the central plains — could be farmed in the coming season. The RID's Director-General, Pramote Maiklad, told the Bangkok Post newspaper in November 1998 that, • It's not that farmers will be arrested if caught working in the rice fields. It simply means that their crops wither if there is no rain because we won't give water. •<sup>21</sup> Because of the Bhumiphol dam's fundamental problems, the Thai government is now proposing to build yet more dams — this

time on the Salween and Moei rivers in Burma — to feed up to 14,500 million cubic metres of water into the Bhumiphol's ailing reservoir<sup>22</sup> [See sections on ABB and VA Tech].

#### KAPTAI, BANGLADESH

The 230 MW, 46 metre-high Kaptai dam was built with US funding in 1962 on the Karnafuli river in south-east Bangladesh. Its 65,600 hectare reservoir in the Chittagong Hill Tracts displaced more than 100,000 people of the Chakma ethnic minority — one-sixth of the total Chakma population — and flooded about two-fifths of their cultivable land. Patrick McCully of the International Rivers Network notes: • The resulting land shortage and resentment of the government helped spark off the bloody conflict between the Buddhist Chakma and Muslim Bengali settlers which has ravaged the region since Kaptai was completed in 1962. •<sup>23</sup>

#### ZIMAPAN, MEXICO

Kvaerner, along with ABB, supplied equipment for the 292 MW Zimapan dam on the Moctezuma river. The \$417 million project was partly funded by the World Bank, and construction began in 1989.

#### BAKUN, MALAYSIA

In 1996, Kvaerner Energy won a major contract to supply turbines to the 2400 MW Bakun dam in Malaysia [See box on Bakun]. As a partner in the international consortium headed by ABB, Kvaerner's \$130 million order was to supply the six 420 MW turbines for the hydropower project.<sup>24</sup>

#### NATHPA JHAKRI, INDIA

In 1995, Kvaerner Energy won a contract to supply six 250 MW turbines for the \$11.2 billion, 1,500 MW Nathpa Jhakri project. The order was part of a \$41.3 million contract awarded to an international consortium including ABB, Siemens and Sulzer Hydro.<sup>25</sup> Kvaerner Boving then won an additional contract for capital goods for the project in 1996. The £22.85 million loan for the order, provided by Barclays Bank, was backed by the UK's Export Credits Guarantee Department [See box on Nathpa Jhakri].<sup>26</sup>

#### LESOTHO HIGHLANDS WATER DEVELOPMENT PROJECT, LESOTHO

In February 1996, Kvaerner Boving was awarded a \$1.2 million contract for the design, supply, delivery and erection of valves and ancillary equipment for the Muela hydropower project in Lesotho. The fabrication of equipment was largely undertaken by the company's subsidiary, Kvaerner Markham UK<sup>27</sup> [See box on Lesotho Highlands Water Project].

#### PANGUE, CHILE

In 1993, Kvaerner Turbin AB, the Swedish subsidiary of Kvaerner Energy, was awarded a contract by the Pangu SA power utility to supply hydropower equipment for Chile's Pangu dam. The \$70 million order consisted of engineering, fabrication, installation and commissioning of electro-mechanical equipment at the power-plant.<sup>28</sup> In 1995, Kvaerner Energy won another two contracts, in a consortium with Voest Alpine and Mecanica Pesada, to deliver equipment worth \$1.2 million<sup>29</sup> [See box on Pangu].

1 Gorenstein, N., 1998.

2 Kvaerner, 1998.

3 FIVAS, 1996.

4 Kvaerner, 1999.

5 Kvaerner Energy (undated).

6 Kvaerner, 1998.

7 Kvaerner, 1998.

8 Kvaerner, 1999.

9 Kvaerner, 1999.

10 GEC, www .

11 Kvaerner, 1999.

12 International Water Power and Dam Construction, 1996a.

13 Watershed, 1998f.

14 Usher, 1997: 68.

15 FIVAS, 1996.

16 Headline.com, 1998.

17 WP&DC, 1994.

18 Financial Times, 1999h.

19 The Nation, 1994.

20 Mason, E. S. et al, (1973).

21 Watershed, 1999a.



22 Watershed, 1999b.  
23 McCully, P., 1996.  
24 International Water Power and Dam Construction, 1996d.  
25 International Water Power and Dam Construction, 1995a.  
26 Power in Asia, 1996c.  
27 International Water Power and Dam Construction, 1997a.  
28 WP&DC, 1993.  
29 International Water Power and Dam Construction, 1995a.

### ***KVAERNER: DAMS AT A GLANCE***

BANGLADESH: Kaptai [see main text].

CHINA: Three Gorges [see box on Three Gorges]; Tianhuangping, Xiaoshan, Kaishangtun, Lubuge.

INDIA: Bhivpuri, Mulshi, Nagarjunasagar, Nathpa Jhakri [see main text], Panchet Hill (Damodar Valley), Sawalkote, Uri, [see section on Skanska], Teesta IV and V, Upper Krishna. The \$1 billion Upper Krishna hydroelectric project is situated in the northern part of the Indian state of Karnataka. The Chamundi Power Co., an international consortium, was granted approval by the Karnataka government to build a 960 MW dam. The consortium included Kvaerner Boving Ltd, the UK subsidiary of Kvaerner Energy.

INDONESIA: Kotapanganji, Renun.

LAOS: Theun-Hinboun, Xeset.

MALAYSIA: Pergau [see box on Pergau].

NEPAL: Khimti Khola. The 60 MW Khimti Khola, about 100km east of Kathmandu, was Nepal's first private sector power project. Statkraft was the largest investor in the project with 73%, with ABB and Kvaerner taking a 5% stake each in the \$140 million project. ABB and Kvaerner supplied the electro-mechanical equipment for the plant.

PAKISTAN: Ghazi Barotha.

PAPUA NEW GUINEA: OK Menga, Yonki.

SRI LANKA: Victoria (Mahaweli).

THAILAND: Bhumiphol Unit 8 [see main text].

TURKEY: Ozluci, Ozluce.

VIETNAM: Song Hinh [see main text].

EGYPT: Aswan High Dam and South Valley Project [see main text].

GHANA: Kpong.

LESOTHO: Lesotho Highlands (turbines to Muela dam, and cement to Katze dam through subsidiary) [see main text].

SUDAN: Roseires

TANZANIA: Kihansi, Pangani Falls.

UGANDA: Karuma Falls, Owen Falls [see main text].

ZAMBIA: Kafue Gorge.

ZAMBIA/ZIMBABWE: Kariba [see section on Coyne et Bellier].

BRAZIL: Furnas, a 1,216 MW dam on the Rio Grande, built in 1963 whose 144,000 hectare reservoir displaced 8,500 people. Salto Caxias [see section on ABB and Introduction].

CHILE: Pangu and Ralco [see main text and box on Biobio], Aconcagua, La Florida.

COLOMBIA: La Miel.

MEXICO: Zimapan [see main text].

PERU: Carhauquero.

VENEZUELA: Caruachi [see main text].

SOURCES:

McCully: 1996

European Power News: 1992

International Water Power and Dam Construction: 1995, 1996e

- **LAHMEYER INTERNATIONAL**

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Lahmeyer International's parent company was founded on 30 September 1890 as Kommanditgesellschaft W. Lahmeyer & Co by engineer Wilhelm Lahmeyer and private Frankfurt banking houses.<sup>9</sup> Lahmeyer designed and constructed power plants, electricity transmission lines and power distribution systems in Germany and other European countries. From the outset, Lahmeyer was involved in hydropower design: in 1898, the company designed the 1 MW Sinaia Hydropower plant in Romania.<sup>2</sup>

#### **Lahmeyer International Today**

Lahmeyer International is partly owned by the company Lahmeyer Aktiengesellschaft,<sup>3</sup> which (in its present form) was established on 14 April 1997 through the merger of Rheinelektra AG and Lahmeyer Aktiengesellschaft (AG) für Energiewirtschaft. Rheinelektra AG was founded in 1897 with the goal of supplying electricity to south-west Germany.<sup>4</sup>

Lahmeyer AG is a management holding company listed on the Frankfurt stock exchange, and its major shareholder is RWE AG. In February 1999, RWE AG announced its intention to buy up 100% of Lahmeyer AG.<sup>5</sup> The other main shareholder had been Allianz AG<sup>6</sup> with 15.15% of shares, while the rest of the shareholders were individuals and institutional investors.<sup>7</sup> RWE has been the majority shareholder in Lahmeyer since 1923,<sup>8</sup> and is Germany's fifth largest company.<sup>9</sup> RWE also owns RWE Energie AG — Europe's largest private energy company — and the construction company Hochtief AG (Lahmeyer International and Hochtief worked on the Chixoy and Chulac dams in Guatemala and the Lesotho Highlands Water Project). RWE is currently in the process of restructuring and will focus on companies involved in energy production and distribution, water supply and water treatment.<sup>10</sup>

Lahmeyer International was founded on 2 February 1966 and has been involved in projects in over 120 countries, with offices and representatives in 85 countries. Lahmeyer International employs 900 people and has 12 subsidiary companies with a total staff of almost 2,000. The group works in the fields of energy, hydropower, water resources, transport, civil engineering and project management. In 1997, Lahmeyer International won almost 12% of all power plant contracts worldwide, ranking second in the world according to the US-based McCoy Power Reports.<sup>11</sup> Forty-five per cent of Lahmeyer International's projects are in Germany, the rest are won abroad. In 1995, company turnover was \$257 million.<sup>12</sup> Lahmeyer International is owned by Lahmeyer AG (LAG) (80%), Germany's largest bank Deutsche Bank AG (10%) and Dresdner Bank AG (10%).

Both Dresdner Bank and Deutsche Bank fund dam construction. In March 1997, Dresdner came to the rescue of Endesa, Chile's largest electricity utility, by agreeing to buy out the World Bank's IFC loan for the Pangué dam, after the IFC withdrew from the project alleging breaches of contract by Endesa. A month earlier, World Bank president James Wolfensohn had written to Endesa threatening to declare it in default because of its • less than constructive approach to its environmental and social obligations . . . under the IFC financing agreements• .<sup>13</sup> The Luxembourg branch of Dresdner loaned Endesa \$150 million to buy out the IFC loan, thus becoming the main financier of the Pangué dam. Dresdner officials told German NGO Urgewald that the IFC itself recommended Endesa refinance through Dresdner<sup>14</sup> [See box on Pangué].

In 1997, German banks including Dresdner agreed to loan more than \$270 million for the purchase of turbines and generators for the Three Gorges dam in China.<sup>15</sup> Dresdner is one of the lead banks in phase 1A of the Lesotho Highlands Water Development Project (LHWP), and Lahmeyer International is part of the consortium responsible for the design and supervision of the Mohale tunnel and the Muele dam, part of the LHWP.<sup>16</sup>

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Deutsche Bank is one of the potential funders of the Nam Theun 2 dam in Laos, a project for which Lahmeyer International produced an alternatives study. Adolf Wannick, head of project development at Lahmeyer International's hydropower division, dismissed the question of a potential conflict of interest: • The shares of Dresdner Bank and Deutsche Bank are negligible in our company. What is 10%? Deutsche Bank are silent shareholders here. I don't know where the conflict of interest could be. •<sup>17</sup>

In the Ukraine, Lahmeyer International has the job of decommissioning the Chernobyl nuclear power plant and is simultaneously working on a masterplan for the completion of three nuclear power plants there.

Lahmeyer International has been involved with a number of controversial dam projects. Yet, when Adolf Wannick was asked about his company's involvement in Arun III (Nepal), Bakun (Malaysia), Yacreta (Argentina), Nam Theun 2 (Laos) and Chixoy (Guatemala), he said:

• *Lahmeyer has been involved and this is history, because all these projects are either finished or given up, so it's not worthwhile to speak about these dams.* •<sup>18</sup>

When asked whether Lahmeyer International has a specific ethical policy, Mr Wannick said:

• *Look, our company has to take care of . . . 800 employees. We are not politicians, and we have to look for work for these employees.* •<sup>19</sup>

### **Lahmeyer and the World Commission on Dams**

Engelbert Oud of Lahmeyer International is an advisor to the Commission Secretariat. Oud has written several articles in praise of hydropower. For example, in • *Global Warming: A Changing Climate for Hydro* •,<sup>50</sup> he argues that Northern-based utilities should get • CO2 credits • for building dams (or establishing plantations) in the South, thus avoiding the need to reduce CO2 emissions at home.

In his article, • *Hydropower in Lao PDR* •,<sup>51</sup> Oud gushes over the potential of building large dams in Laos without mentioning any impacts on local populations. In fact, the only hint in the article that there might be people actually living in Laos (other than stating the total population figure) is a reference to the 60,000 people who would be • resettled • if the Pa Mong dam were constructed, a project that was shelved in the mid-1970s.

Yet Oud sees himself as a • neutral advisor • and says: • I don't consider myself a promoter of hydropower . . . I am only interested in level playing field comparison of options which remains a complex and difficult task. •<sup>52</sup>

When Wannick was questioned about the World Commission on Dams, he confused it with the industry's global lobbying body, International Commission on Large Dams (ICOLD). On the WCD he said: • This is something new. But frankly I have no opinion, I cannot give you comments, I do not know this organisation. I know ICOLD, and this is the most knowledgeable institution, I would say in this context . . . ICOLD is playing a very important role, but this World Commission, I cannot comment, because I do not know much about this. •<sup>53</sup>

### **WORKING FOR THE ENVIRONMENT?**

#### **THE ERM-LAHMEYER INTERNATIONAL JOINT VENTURE**

In April 1998, the environmental division of Lahmeyer International and ERM Umwelt Consult — the German branch of UK-based Environmental Resources Management — merged to form the joint venture ERM Lahmeyer International GmbH. The company has 100 staff and is based in Neu-Isenburg, near Frankfurt.

According to the publicity material, the new joint venture aims to become Germany's leading environment consultancy and to work internationally • utilizing the excellent worldwide reputation of German environmental know-how. • However, Adolf Wannick of Lahmeyer International's hydropower division said that the joint venture had more to do with commercial expediency than environmental expertise: • We had a strong group of environmentalists, up to 100 people at the peak . . . We were not so happy with them because of the commercial aspect, there were too many people and only few contracts. So we had to sell them out. They are now in a new company, ERM, and what they are doing, I don't know. •

ERM Group (Environmental Resources Management) was established in the 1970s, and has worked on environmental planning and consulting projects throughout the world. ERM employs 2,500 staff, and has an annual turnover of \$280 million.

ERM's web-site on environmental reporting and communications is revealing: • The true value of environmental communications is beginning to be realised by senior executives and plant managers alike: in many cases, communications are having a direct impact on the profitability of operations and in avoiding and/or removing social and political obstacles to plans. •

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.

In 1999, ERM was commissioned by the UK Export Credits Guarantees Department to review the environmental impact assessment for the Ilisu dam [see box on Ilisu] and to propose mitigatory measures. Despite a government undertaking to Members of Parliament that the ERM review would be made publicly available as soon as it was finished, the Department of Trade and Industry (DTI) refused to publish it for several months. The report was critical of the project. Nonetheless, the DTI ignored its recommendations and announced, in January 2000, that it was • minded • to fund the project.

One of the new ERM/Lahmeyer joint venture projects is the Caspian Environmental Programme initiated by the UNEP, UNDP, the World Bank and the European Union. The Volga river used to supply 80% of the water flowing into the Caspian Sea – but now the river is dammed, the water supply has been cut by almost 70%.

## **LAHMEYER AND DAMS**

### **YACYRETA, ARGENTINA/PARAGUAY**

Lahmeyer International is the second company in CIDY, the ten-company consortium responsible for engineering and construction supervision on the 2,700 MW Yacyreta dam.<sup>20</sup> According to a June 1999 report by the Inter-American Development Bank (co-funder of the dam with the World Bank), work has still to be completed on the dam, which only running at only two-thirds capacity, ten years after the planned completion date<sup>21</sup> [See box on Parana dams].

### **BAKUN, MALAYSIA**

Lahmeyer International was the lead consultant for the now-cancelled 2,520 MW Bakun plant on the Balui river in Sarawak.

In 1979, the German government offered technical assistance to Malaysia • resulting in the formation of the SAMA engineering consortium under the leadership of Lahmeyer International • .<sup>22</sup> The company also played a lead role in drawing up the construction contract and supervising construction on the diversion tunnels. The dam was cancelled on 4 September 1997. The company has proved itself unwilling to engage in debate with critics of its work on Bakun.

In 1995, Dr. Weilou Wang, a regional planner at Dortmund University in Germany, questioned the assumptions made in SAMA's feasibility studies on the Bakun dam. This prompted two of Lahmeyer International's directors, Dr. J. Zimmerman and R. Wigand, to write to Dr. Wang's head of department, accusing Wang of making statements that were • false and without foundation • . They also said Wang had • not only tarnished the reputation of our company, but also had given a bad name to German engineering science and to his university • <sup>23</sup> [See box on Bakun].

### **CHIXOY, GUATEMALA**

Lahmeyer led a three-company consortium called LAMI which planned, designed and supervised construction for Guatemala's 300 MW Chixoy dam.<sup>24</sup> The dam was funded with two loans from the World Bank, the first in 1978 of \$72 million, and a second for \$44.6 million in 1985.<sup>25</sup> Around 3,400 indigenous people lost their homes and lands to the reservoir, and many lost their lives. In 1982, state-backed death squads murdered hundreds of villagers living in the proposed reservoir area. Many of the survivors believed that the National Institute of Electrification (INDE), Guatemala's state-owned electricity utility, encouraged the violence to clear the reservoir area. In their feasibility study for the dam, LAMI stated: • In the tract of the study . . . there is almost no population •<sup>26</sup> [See box on Chixoy].

#### LESOTHO HIGHLANDS WATER DEVELOPMENT PROJECT, LESOTHO

Lahmeyer International has played a key role in promoting the LHWP. Among the project's financiers are Dresdner Bank and Hermes. Lahmeyer International was part of the Lahmeyer Macdonald consortium, with Mott Macdonald (UK) and Consult 4 (South Africa), which produced the 1986 feasibility study for the LHWP. Lahmeyer Macdonald won the contract to design and supervise the 33 kilometre-long, \$125 million Mohale tunnel for the LHWP. The tunnel connects the Mohale and Katse reservoirs, and is partly funded by the World Bank.<sup>27</sup> The Lahmeyer Macdonald consortium carried out an environmental audit for the 72 MW Muela dam in 1997, another part of the LHWP. In November 1999, Lahmeyer International was one of 12 multinational companies involved with the project to be charged with corruption. The company is alleged to have paid \$8,674 to the project's former head, Masupha Sole. Dr. J. Zimmerman, head of the hydropower section of Lahmeyer International, has denied the allegations [See box on the Lesotho Highlands Water Development Project].

#### CHULAC, GUATEMALA

A slightly restructured LAMI was re-hired for the \$1,250 million, 450 MW Chulac dam.<sup>28</sup> Work began in 1981 before the feasibility studies were complete. Hochtief AG won the construction contract, and \$137 million was spent on two diversion tunnels, access roads and camps. Work was stopped in 1982 when it was discovered that the rock was too weak to support the dam. Roberto Balsells, former president of INDE, says that the opportunity to embezzle funds was the main reason the Chulac dam project was started. The project began without the approval of INDE under the dictatorship of General Romeo Lucas Garcia.<sup>29</sup>

#### NAM LEUK, LAOS

In 1992, in association with New Zealand company Beca Worley International (BWI), Lahmeyer International produced an environmental assessment impact study for the Nam Leuk dam.<sup>30</sup> The EIA was criticised in a report produced for the Lao Ministry of Forestry,<sup>31</sup> which said that it • does not address the potentially serious impacts of the project • and described the EIA as • substandard and inaccurate in a number of aspects •.<sup>32</sup> In 1995, the French consulting engineering company, Sogreah, won the contract to produce a second EIA<sup>33</sup> [See section on Sogreah].

#### NAM THEUN 2, LAOS

Lahmeyer International worked with Beca Worley International (BWI) on the Nam Theun 2 Study of Alternatives for the World Bank.<sup>34</sup> The dam is proposed on the Theun river, the fourth largest tributary of the Mekong river, in central Laos. The reservoir would flood 450 square kilometres of the Nakai Plateau and result in the eviction of 4,500 people. Despite the fact that the dam may never be built, the Lao military-run logging company, BPKP, has clear-cut about half of the proposed reservoir area.<sup>35</sup>

In 1993, Transfield Holding Ltd, an Australian company, won the contract to develop the \$1.2 billion project. Transfield formed a consortium called the Nam Theun 2 Electricity Consortium (NTEC) consisting of Transfield (10%), Electricite de France (30%), the government of Laos (25%) and three Thai-based companies: Italian-Thai Development (15%), Merrill Lynch Phatra Thanakit Securities (10%) and Jasmine International (10%). In October 1999, Jasmine announced that it intended to sell its stake.<sup>36</sup>

The developers are looking to the World Bank to provide a \$94 million • partial risk • guarantee, without which the project is unlikely to get commercial funding and to proceed. The World Bank, in turn, will not make a decision on whether to provide the guarantee until a power purchase agreement (PPA) is settled between the government of Laos, the project developers, the Thai government and the Electricity Generating Authority of Thailand (EGAT). Negotiations over the PPA are currently stalled, with EGAT asking a price for electricity too low for the project to be economically viable in the eyes of

the developers.<sup>37</sup> During negotiations in November 1998, NTEC raised the proposed output of the dam from 681 MW to 900 MW, thus making the previous economic and alternatives studies at least in part redundant.

Part of Lahmeyer International and Beca Worley International's 1997 Study of Alternatives involved a • public participation workshop• , although neither consultant had any previous experience in such work. Bert Oud<sup>38</sup> of Lahmeyer International was the project manager for the study. He described the study as • innovative in the terms of its holistic approach and because of the public workshops with stakeholders. •<sup>39</sup> In fact, the contract allowed the consultants considerable power in the decision-making process. According to the terms of reference: • The first step would be to identify key stakeholders at the local/regional and national levels and then decide which stakeholders would be consulted at which step in the process. •<sup>40</sup> Having hand-picked the • stakeholders• , the consultants announced the • public participation workshops• only 12 days before they took place. The consultants wrote the agenda for the meetings and structured the discussions and the working groups within the workshops. They decided both the participants' fields of expertise and the major relevant disciplines. They fed the • output• from their • stakeholders• into a Lahmeyer International-designed software package, called MOSES (Multi-Objective Scenario Evaluation). They then concluded the dam should go ahead. The invitations sent to • stakeholders• asking them to take part in the • public participation workshop• did not make clear that one of the potential commercial funders of the Nam Theun 2 project is Deutsche Bank, nor that Deutsche Bank owns 10% of Lahmeyer International.

#### BIRECIK, TURKEY

Lahmeyer International is involved in the 672 MW Birecik dam. In 1995, the Syrian government demanded that Turkey stop work on the Birecik dam. Syria claimed that the dams on the Euphrates river would prevent Syria from receiving its rightful allocation of water, violating international law and renegeing on Turkey's previous commitments on water sharing. Coyne et Bellier is consultant to the Turkish government and investors.

#### SENTANI, INDONESIA

Lahmeyer International advised one of the German government's export credit agencies, Kreditanstalt für Wiederaufbau (KfW), not to invest in the Sentani hydropower plant, West Papua. This was the only project that Adolf Wannick of Lahmeyer International could name that his company had recommended should not go ahead. He said, • The Sentani project was on this far away island, in Indonesia. I think it was abandoned for ethnic and environmental reasons. •

#### ARUN III, NEPAL

Lahmeyer International produced the feasibility study, tender design and construction design for the \$1 billion, 68 metre-high, 201 MW Arun III dam.<sup>41</sup>

The World Bank withdrew its proposed funding of this dam in August 1995, accepting the arguments of local communities and NGOs opposed to the project.<sup>42</sup> The company won the contract for construction supervision through a closed tendering process, involving no competition. The Nepal Electricity Authority (NEA) stated that the German government made Lahmeyer International's involvement a condition for its contribution to Arun. Dipyk Gyawali, who resigned from the NEA board over Arun, told Der Spiegel in 1994 that the contract with Lahmeyer was made under the old feudal regime, and that the close connection between the royal family and Lahmeyer is well known in Nepal.<sup>43</sup>

#### KINDA and TASANG, BURMA

Lahmeyer International was involved in the 56 MW Kinda dam completed in 1988. According to Adolf Wannick:

• *We did a successful project in Burma, which as I understand it, has guaranteed the production of energy for this country during very critical periods. At that time there was a military government, but there were no human rights issues as they came up with Aung San Suu Kyi.* •

In April 1998, Lahmeyer International did the pre-feasibility study for the Tasang dam in Shan State, north-east Burma. The developer is the Thai company, GMS Power, which is also involved in the Theun Hinboun dam in Laos. Since March 1996, the Burmese military regime has relocated more than 300,000 people, at gunpoint, from 1,400 villages in the central region of Shan State.<sup>44</sup> Wannick said

that Lahmeyer had no projects in Burma other than the Kinda dam: • Burma, we are not under temptations in this way, let us say, because there is nothing. •

### CHICO, THE PHILIPPINES

In 1973, Lahmeyer International produced a technical feasibility study funded by the World Bank for four dams on the Chico river with a total capacity of 1,010 MW.

The dams threatened to displace some 80,000 Kalinga and Bontoc people from their ancestral lands, destroying their villages and rice terraces.<sup>45</sup> When locals protested against the project, the Marcos regime tried to undermine resistance with bribery and obfuscation. However, resistance hardened and the people resorted to civil disobedience to prevent surveyors getting access to the area. Engineers' campsites were dismantled and roads were blocked, prompting the government to send in the army and initiate a campaign of violence.<sup>46</sup> The Igorot leader Macliing Dulag was assassinated, and many people took to the hills and joined the New Peoples Army in defiance of the imposed development programme.<sup>47</sup>

The conflict endured long after the World Bank pulled out and the project was cancelled. Local villages were repeatedly bombed and subjected to counter-insurgency programmes as a result.<sup>48</sup>

Adolf Wannick said of his company's involvement in the Chico dams:

• *I remember we were blamed in the Philippines, but these projects have never been built. There were resettlement issues and there was a lot of noise. But we came very soon to the conclusion that it was not worthwhile maintaining a position that was wrong. The trouble from such projects is so big, it's not worth acting against it.* •<sup>49</sup>

1 LAG, 1999a.

2 LI, www 1.

3 LAG.

4 LAG, 1999a.

5 LAG, 1999c.

6 Allianz AG is a large group of insurance companies.

7 LAG, 1999b.

8 LAG, 1999a.

9 RWE, 1999.

10 Wannick, 1999.

11 LI, 1998a.

12 IWP&DC, 1996: 3.

13 Urgewald no date.

14 Johnston and Turner, 1998; Brown, 1997.

15 CER, www 1.

16 Dodwell, 1992.

17 Wannick, 1999.

18 Wannick, 1999.

19 Wannick, 1999.

20 IRN, 1997a.

21 IDB, 1999.

22 Failer and Abong, 1995: 24.

23 McCully, 1996: 265.

24 IRN, 1997a.

25 WFP, 1995.

26 McCully, 1996: 75.

27 H&D, 1996c.

28 Davidson, 1987: 3.

29 Davidson, 1987: 3-4.

30 LI & BWI, 1992.

31 Anon., 1994.

32 Anon., 1994.

33 IRN, 1999d: 23.

34 LI, www 2; IRN, 1997a.

35 IRN, 1999d: 34.

36 TN, 1999b.

37 TERRA, 1999b.

38 Oud took leave from Lahmeyer International in 1999 to work as a consultant at the secretariat of the World Commission on Dams.

39 Oud, 1999.

40 LI & BWI, 1996: 11.

41 EDF, 1998a; McCully, 1996: 230.

42 McCully, 1996: 21.



43 Der Spiegel, 1994.  
44 Watershed, 1998i: 40.  
45 Bello et al., 1982.  
46 Pearce, 1992.  
47 Drucker, 1984; Fay 1987.  
48 Survival International News, 1985 (7):1.  
49 Wannick, 1999.  
50 Oud, 1993b.  
51 Oud, 1993a.  
52 Oud, 1999.  
53 Wannick, 1999.

## **LAHMEYER: DAMS AT A GLANCE**

### **ALGERIA**

The Ministère de L'Hydraulique contracted Lahmeyer International to oversee the rehabilitation of 17 dams (constructed between 1867 and 1970). The reconstruction was carried out between 1982 and 1985.

### **ARGENTINA/PARAGUAY**

Yacyreta [See main text].

### **ARMENIA**

Lahmeyer International was involved with modernisation programme for hydropower plants in Armenia.

### **BANGLADESH**

Lahmeyer International worked on the modernisation of the Kaptai hydro-power plant.

### **BURMA**

Kinda and Tasang [See main text].

### **CHINA**

The company is working on phase two of the Guangzhou dam. Voith is supplying four pump turbines, with a total capacity of 1,224 MW.

### **DOMINICAN REPUBLIC**

Lahmeyer International worked on the Los Toros hydropower plant.

### **EGYPT**

In 1996, the company produced a feasibility study for the 85 MW Naga Hammadi dam on the river Nile. Germany's KfW is funding the \$378 million project. In 1998 the Egyptian government appointed Lahmeyer International to plan the Toshka pumping station which aims to extract water from behind the High Aswan dam to irrigate 400,000 hectares of what is currently part of the Nubian desert. According to the plans, 350 cubic metres per second of water will be pumped into a new 200km-long canal system via what would be the world's largest pumping station. Sogreah won the contract for the construction supervision of the pumping station and the design of the canal.

### **ETHIOPIA**

Lahmeyer International has been involved in dam-building in Ethiopia since the 1960s, including the Awash III [see section on Electrowatt], Fincha, Aba Samuel and Chemoga Yeda [see section on Knight Piesold] dams and is currently working on preliminary studies for three hydropower projects in the country. In 1998, the Ethiopian Electric Power Corporation awarded the company the contract for the tender preparation, construction and design planning and construction supervision for the \$270 million, 140 MW Gojeb dam.

### **GERMANY**

Lahmeyer International worked on the 1,060 MW Goldisthal pumped storage plant, Thuringen, due to be completed in 2002-3. VA Tech Voest MCE supplied hydromechanical equipment. It also modernised the Sockingen dam on the Rhine river and worked on the Heidelberg-Karlstor hydropower plant.

## GUATEMALA

Chixoy and Chulac [See main text].

## ICELAND

Lahmeyer International is involved in the 120 MW Sultartangi [See section on Skanska].

## INDONESIA

Sentani [See main text].

## IRAN

The Iran Water and Power Development Corporation (IWPC) contracted a consortium comprised of Lahmeyer International, Nippon Koei (Japan) and Moshanir (Iran) to do a feasibility study for the \$1 billion, 170m high, 2,000 MW Godare-Landar hydro-power plant. It is also involved in the 1,000 MW Karun I, the 900 MW Karun IV, the 127m high, 400 MW Karkheh, the 2,000 MW Upper Gotvand and the 500 MW Rudbar Lorestan hydro-power dams.

## JAMAICA

Lahmeyer International is working on the rehabilitation of five mini-hydropower plants in Jamaica.

## LAOS

Nam Leuk and Nam Theun 2 [See main text]. In 1996, the company produced a masterplan for hydropower development for Laos, funded by the European Commission. It also wrote the environmental impact assessment for the Nam Song dam, winning the contract after producing a study in 1990 which recommended increasing the capacity of the existing Nam Ngum reservoir by diverting water from the Nam Song and Nam Leuk dams. Lahmeyer International has produced the feasibility studies for the Nam Mang 3, and has worked on the Nam Nang 5 dam.

## LESOTHO

Lesotho Highlands Water Development Project (LHWP), including the Mohale and Muela dams [See main text].

## MALAWI

Lahmeyer International is responsible for the design and construction supervision of the World Bank • National Water Development Project• in Malawi. It also carried out design and construction management of the 21m high Mpira water supply dam and the 24m high Mzuzu water supply dam, and worked on the Tedzani 3 hydropower dam and the Kasungu water supply dam.

## MALAYSIA

Bakun dam [See main text]. The company also worked on the 170 MW Liwagu hydropower plant.

## MALI

Lahmeyer International worked on the modernisation of the Silingui hydro-power plant.

## MAURITIUS

In February 1997, the Central Tender Board of Mauritius awarded Lahmeyer International the contract to update a preliminary study, planning and construction supervision of the 30m high, 3000m long Midlands dam. Water from the proposed reservoir is intended to meet the increased demand resulting from increased tourism in Mauritius. The project cost is \$45 million and the completion date is 2001.

## NEPAL

Arun III dam [see main text]. The company designed the original 69 MW Marsyandi dam, funded in 1984 by the World Bank. In 1997, the Nepal Electricity Authority contracted Lahmeyer International to update a feasibility study, and to • expand its scope to meet the requirements of financing institutes• in the words of Lahmeyer International's press release, on the \$100 million, 42 MW Middle Marsyangdi hydropower plant. KfW funded the study.

## PAKISTAN

In 1995, the Sarhad Hydel Development Corporation (SHYDO), Pakistan commissioned Lahmeyer International and Knight Piesold (UK) to produce conceptual and feasibility studies of the hydropower potential of the Allai Khwar river. The studies were financed by KfW. Lahmeyer International was

involved in the construction of the 140 MW Allai Khwar dam, and also worked on the 170 MW Kuz Khwar and the 700 MW Chor Nala dam.

#### PHILIPPINES

Chico dams [See main text]. Lahmeyer produced the feasibility study for the 101m high, 60 MW Abuan hydropower project and was involved in the Agus hydropower dam.

#### SLOVENIA

Lahmeyer International worked on the modernisation of three hydropower plants on the river Drava in Slovenia.

#### SRI LANKA

Lahmeyer International is part of the consortium (with Electrowatt and a Japanese company) for the planning and supervising construction of the 48m-high, 80 MW Kukule Ganga hydropower plant, due to be finished in 2002. The project cost is \$125 million, financed in part by Japan's OECF. Lahmeyer International is responsible for the underground civil construction work.

#### SWAZILAND

Lahmeyer International was involved in the 19 MW Maguga dam. Sogreah also worked on this project.

#### SYRIA

In 1993, Lahmeyer International and Electrowatt Engineering won the contract to assist in the planning and construction supervision of the 630 MW Tishrin hydropower plant.

#### TANZANIA

In 1996, the company produced a conceptual study of possible hydropower development in Tanzania, commissioned by Tanzania's national electric supply company Tanesco. Tanesco also commissioned Lahmeyer International to produce a feasibility study of the most promising option, which Lahmeyer International identified as the 9 MW Lower Nakatuta dam

#### TURKEY

Birecik [See main text].

#### UGANDA

Lahmeyer International is involved in the 350 MW Kalagala dam in Uganda.

#### ZAMBIA/ZIMBABWE

Lahmeyer International did several studies and evaluations including environmental assessments for the planned 176m high, 1,600 MW Batoka Gorge Hydropower project.

#### SOURCES:

EDF: 1998a  
Dansie: 1995  
H&D: 1996c  
H&D: 1996a  
IDB: 1999  
IRN: 1999d: 24  
IRN: 1997a  
IWP&DC: 1996a  
IWP&DC: 1997b  
IWP&DC: 1997d  
LI: www 2  
LI: no date  
LI: 1996  
LI: 1997a  
LI: 1997b  
LI: 1998c  
LI & BWI: 1992  
McCully: 1996: 230  
Sogreah: www 1  
Voest: 1998b  
Wannick: 1999  
WW&EE: 1999

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The firm Siemens and Halske was established in 1847 by Werner von Siemens. In 1858, Werner's brother William Siemens founded a British subsidiary, Siemens Brothers. Another brother, Karl Siemens, established a Siemens and Halske factory in St. Petersburg.<sup>10</sup> The UK subsidiary went public in 1881 and the Berlin parent company in 1897. William Siemens was the first president of the British Institute of Electrical Engineers and was knighted by Queen Victoria.<sup>2</sup> At the start of the 20th century, Siemens employed more people in the UK than in Germany.<sup>3</sup> Among William Siemens' memorials was a window in London's Westminster Abbey, which was removed at the start of World War I.<sup>4</sup>

As a result of this war, the UK firm, Siemens Brothers, was severed from the German firm, Siemens and Halske, and the UK government took over the German share capital in the company.<sup>5</sup> But in 1929, Siemens Brothers entered into association with the Berlin parent company, which by then was a huge firm.<sup>6</sup> At the outbreak of World War II, however, the British government once again expropriated all shares in Siemens Brothers owned by Siemens and Halske.<sup>7</sup> Siemens Ltd was registered in the UK in 1965.<sup>8</sup>

#### *Siemens Today*

The company is now one of the largest electrical and electronic companies in the world with 444,000 employees in June 1999 and annual sales in 1998 of more than \$60 billion.<sup>10</sup> Heinrich von Pierer, Siemens' President and CEO since 1992, is a close friend of Helmut Kohl and Gerhard Schroder (Germany's former and current chancellors).<sup>11</sup>

Siemens AG has 16 divisions including Energy, Industry, Transportation, Health Care, Lighting, Components, Information and Communications and Financial Services. The Energy segment is further divided into Power Generation (Kraftwerk Union – KWU) and Power Transmission and Distribution (EV). KWU develops, engineers and builds fossil-fueled, hydroelectric, nuclear and renewable-energy power plants.<sup>12</sup> In 1998, KWU employed 27,500 people and had sales of \$7.5 billion.<sup>13</sup>

Launched on 1 October 1997, Siemens Financial Services (SFS) advises customers on how to structure financing deals and helps them access venture capital. SFS finances Siemens' operating units, handling internal transfer operations, as well as handling project financing.<sup>14</sup>

Siemens has nine principal subsidiaries in Germany, 31 in Europe, 14 in the US, nine in South America, 12 in Asia-Pacific, and one in South Africa. In total, Siemens has over 1,000 subsidiaries and around 150 associated companies.<sup>15</sup> Fully-owned Siemens subsidiaries include Siemens Nixdorf Informationssysteme and Osram GmbH. Siemens has a joint venture with Bosch for home appliances.<sup>16</sup>

Siemens conducts 66% of its business outside Germany. One-fifth of Siemens' business comes from Asia.<sup>17</sup> Siemens 1998 Annual Report states, • International business continues to fuel growth at Siemens. Whereas domestic business stagnated, demand in the Company's international markets remained buoyant. •<sup>18</sup> In the first nine months of the 1999 financial year, 71% of all Siemens' new orders were international.<sup>19</sup>

Siemens has more than 570,000 shareholders, and 40% of shares are held outside Germany. Siemens shares are traded on eight German exchanges, as well as on the stock exchanges in Amsterdam,

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Brussels, London, Paris, Vienna, Basel, Geneva and Zurich.<sup>20</sup> The only shareholder with more than 5% shares in Siemens AG is the Siemens family, with 7%.<sup>21</sup>

The 1998 financial year was not a good year overall for Siemens: the semi-conductor division recorded a loss of \$650 million, KWU lost \$35 million.<sup>22</sup> The Asian economic crisis resulted in a sharp decline in growth in the region and a fall of 25% in orders.<sup>23</sup> In July 1998, Siemens management approved a ten-point programme to achieve a sustainable improvement in profitability.<sup>24</sup> In the first nine months of FY 1999, Siemens' sales in Asia-Pacific increased by 24%, and new orders increased by 8%. These figures seem to be accounted for largely by a 58% increase in sales in China.<sup>25</sup>

### ***Takeovers and Mergers***

In the late 1980s and 1990s, there were a series of takeovers and mergers in the Siemens group. Heinrich von Pierer, Siemens' CEO, said that Siemens has changed more in the last three years than it did in the previous 50 years.<sup>26</sup> Since 1992, Siemens has sold businesses with a total turnover of \$4.1 billion and bought others with total sales of \$7.1 billion. Some 60,000 jobs have been lost, many in Germany.<sup>27</sup>

In the UK, Siemens and US company GEC took over Plessey in 1989, and Siemens acquired majority shares in Oxford Magnet Technology in 1989 and Osram in 1990. Siemens acquired Parsons Power Generation from Rolls Royce in 1997. Another subsidiary, Siemens Metering, acquired the Central Quantum Office from British Gas Trading in 1998.<sup>28</sup>

In 1997, Siemens purchased the industry business segment of Electrowatt AG (including Electrowatt Engineering, Landis & Gyr and Vibro-Meter) for \$1.79 billion: since 24 September 1998, the company has operated from Zurich under the name Siemens Building Technologies<sup>29</sup> [See section on Electrowatt].

Siemens acquired Westinghouse Power Generation's fossil-fuel power plant business from CBS Corporation (New York) on 19 August 1998 for \$1.52 billion, and the company was renamed Siemens Westinghouse Power Corporation.<sup>30</sup> Siemens also wanted to buy Westinghouse's nuclear business but Westinghouse stopped the sale, apparently because of pressure from the US government, which did not want the operations to go to a foreign buyer.<sup>31</sup> In the first nine months of the 1999 financial year, Westinghouse accounted for more than one-quarter of KWU's total sales.<sup>32</sup> In July 1998, Siemens closed its \$1.98 billion semiconductor plant in North Tyneside, England, with the loss of 1,100 jobs.<sup>33</sup> The factory was opened in 1997 with £30 million of UK government grant aid.<sup>34</sup> Following the closure of the factory, however, Siemens has promised to repay some of the subsidy. Siemens sold their defence electronics business to Daimler-Benz Aerospace AG (Munich) and British Aerospace plc (Farnborough). Siemens now has no involvement with the defence industry which they say is currently undergoing a process of massive consolidation.<sup>35</sup>

### ***Voith Siemens Hydro***

On 21 July 1999, Siemens AG and J.M. Voith AG announced a merger of their hydropower activities into a joint venture — Voith Siemens Hydro. Siemens supplies generators, electrical instrumentation and control equipment, while Voith manufactures turbines and mechanical equipment. Voith has an installed capacity of 200,000 MW, and Siemens 120,000 MW.<sup>36</sup> The new company will employ 2,200 people,<sup>37</sup> and have annual sales of \$533 million.<sup>38</sup> Voith holds 65% and Siemens 35% of the new company, which will be based in Heidenheim, Germany.<sup>39</sup>

Voith and Siemens have worked on joint projects for more than 100 years, and both companies are currently working together on the Three Gorges dam [see box on Three Gorges] and Guangzhou II in China, Gitaru dam in Kenya, and Lajeado dam in Brazil.<sup>40</sup>

On 22 July 1999, Siemens CEO Heinrich von Pierer said of the merger: • The company's name is a clear signal to our customers that we have no intention of withdrawing from the hydroelectric business, but have made a long-term commitment to the industry, since this is the first time in our history that a company in which we hold a minority stake contains the word 'Siemens' in its name. •<sup>41</sup> Before the merger, hydropower accounted for around 3% of Siemens Power Generation Group (KWU) sales. The Voith Siemens merger boosts this to almost 10%.<sup>42</sup> Siemens and Voith between them have supplied equipment to some of the large dam disasters in the world.

## SIEMENS AND DAMS

### YACYRETA, PARAGUAY/ARGENTINA

The Entidad Binacional Yacyreta awarded Siemens and four other companies a contract worth \$45 million for five generators for the 2,760 MW Yacyreta dam.<sup>43</sup> According to a June 1999 report by the Inter-American Development Bank (co-funder of the dam with the World Bank), more work on the dam has still to be completed and it is only running at two-thirds capacity, ten years after the planned completion date<sup>44</sup> [See box on Parana/Yacyreta].

### THREE GORGES, CHINA

A consortium of Siemens, Voith and GE subsidiaries won a \$320 million contract to supply six generators for the Three Gorges dam.<sup>45</sup> In September 1997, a consortium of German banks, including Kreditanstalt für Wiederaufbau (KfW), Dresdner Bank and Commerzbank, signed a \$271 million loan package with China's State Development Bank to buy turbines and generators for the dam.<sup>46</sup> In November 1999, official approval was given for an export guarantee of 97 million DM to Siemens for the supply of 15 transformers. The dam will be the largest in the world, and will require the forced resettlement of from between 1.3 million to 1.9 million people [See box on Three Gorges].

### NATHPA JHAKRI, INDIA

Siemens is part of the consortium EUCONA, led by ABB and including Kvaerner and Sulzer Hydro, which won the \$41.3 million contract for the turbines to the 1,500 MW Nathpa Jhakri dam on the Satluj river in northern India.<sup>47</sup> As a result of height miscalculations, the dam will be able to generate its peak output for only half the time anticipated. The miscalculations led to the World Bank withdrawing its funding of the project. The dam is running four years behind schedule, and the cost has risen from \$1 billion in 1988 to \$1.7 billion<sup>48</sup> [See box on Nathpa Jhakri].

### ITAIPU, PARAGUAY/BRAZIL

Siemens supplied nine of the 18 generators to the 12,600 MW Itaipu dam, completed in 1982 on the Parana river on the border of Brazil and Paraguay.<sup>49</sup> Itaipu has the largest installed capacity of any dam in the world, and cost \$20 billion to build.<sup>50</sup> About 42,400 people were evicted to make way for the 135,000 hectare reservoir behind the dam. The dam drowned the Sete Quadras waterfalls, probably the greatest loss of the world's scenic heritage to a reservoir, according to Patrick McCully of the International Rivers Network, a US NGO. Before the dam, the Parana narrowed to 60 metres wide and more water than in any other waterfall thundered over 18 separate cataracts, each over 30 metres high.<sup>51</sup> The dam was supposed to generate 79,000 gigawatts of power per year, a plant factor of 78%. In fact, the average annual plant factor in 1993 and 1994 was just 58%.<sup>52</sup>

Skim-offs by the military rulers in Brazil and Paraguay helped boost the cost of the project to \$20 billion — up from the original estimate of \$3.4 billion. Brazilian journalist Paulo Schilling and Paraguayan ex-legislator Ricardo Canese described the building of the dam as • possibly the largest fraud in the history of capitalism • .<sup>53</sup> By 1990, EBI, the joint Brazilian-Paraguayan state enterprise formed to build the dam, ran up debts of \$16.1 billion as a result of the project. The huge debts are partly responsible for the hyper-inflation in Brazil since the mid-1980s<sup>54</sup> [See box on Parana/Yacyreta].

### MAHESHWAR, INDIA

Siemens is to supply of turbines and other equipment for the 400 MW Maheshwar dam on the Narmada river. In return for the contract to supply the turbines, the company is committed to contributing a non-voting share of 17% of project equity. ABB is to supply generating equipment.<sup>55</sup> In 1993, the Madhya Pradesh state government gave a 35-year concession to build and operate the dam to S. Kumars, an Indian textile company with no previous experience in dam-building. S. Kumars then set up the Shree Maheshwar Hydro Power Corporation (SMHPC) to build the dam. The construction cost is expected to be \$530 million<sup>56</sup> [See also section on ABB].

The Maheshwar Dam is part of the Narmada Valley Development Project, a plan to build 30 major, 135 medium and 3,000 small dams on the Narmada river and its tributaries. The Maheshwar site is upstream of the Sardar Sarovar dam, which has been the site of mass protests since the mid-1980s.<sup>57</sup> The dam would result in the eviction of some 40,000 people from one of India's most prosperous agricultural regions.<sup>58</sup> Heffa Schucking of the German NGO, Uргewald, who visited the area of the dam in 1998, described the resettlement planning as • the making of a resettlement fiasco • . Fifty families have already lost their land to the project, but none have been resettled.<sup>59</sup>

In October 1997, 10,000 people demonstrated at the proposed dam site, demanding a complete halt to construction.<sup>60</sup> The Madhya Pradesh government suspended work in January 1998 after some 15,000 protesters again occupied the site, pending a comprehensive review of the project, but this commitment was broken when work restarted in April 1998.<sup>61</sup> Protests and hunger strikes have continued throughout 1998 and 1999.

In 1997, the German government through its export credit insurance agency, Hermes, made an • in principle• decision to guarantee 85% of an export loan from Bayerische Vereinsbank (now Hypovereinsbank) for the purchase of turbines and other equipment from Siemens. The provisional decision has since become void, due to the lapse of time. However, the government is reported to be still considering supporting the project. In May 1998, PacifiCorp, a 49% equity holder in SMHPC, pulled out, and two German utilities, Bayernwerk and Vereinigte Elektrizitätswerke Westfalen (VEW), took over PacifiCorp's share. But in April 1999, Bayernwerk and VEW also pulled out of the project, following a public outcry over the dam.<sup>62</sup>

#### XINGO, BRAZIL

In December 1982, a consortium called CEMEX, consisting of Siemens, Siemens Brazil and Voith SA of Brazil, won the contract to supply the electrical and mechanical equipment for the 3,000 MW Xingo dam, on the Sao Francisco river. Construction did not begin until 1987. Financing came partly from a consortium of German banks.<sup>63</sup> Siemens' Brazilian subsidiary supplied six generators for the dam.<sup>64</sup> When it was inaugurated in December 1994, the dam had taken seven years to build at a cost of \$3.2 billion, twice its original budget. At that time, only one turbine was in operation — the remainder were installed by August 1997<sup>65</sup> [See also section on ABB].

#### *Siemens and the World Commission on Dams*

Asked about Siemens' involvement in the World Commission on Dams, Mark Derbacher, Siemens KWU press officer, stated:

• *Siemens is indeed taking an active part in the World Commission on Dams and has named a delegate to attend the meetings of the [WCD Forum, a consultative group involving representatives from industry, governments, NGOs and affected peoples' groups]. We welcome the efforts to find agreed upon standards for the evaluation of hydro power projects. Siemens is committed to the idea of sustainable development which means that ecology, economy and social living conditions have to be developed jointly as parts of a target triangle.*•<sup>66</sup>

He concluded by saying, • Voith Siemens is looking forward to becoming Number 1 in the hydro power market. •

#### *Siemens and Nuclear Power*

As well as its involvement in hydropower, several other Siemens business activities have raised concerns and controversy. The company constructed all 19 nuclear power plants currently operating in Germany. Siemens is constructing a new research reactor, the FRM-II, near Munich. In association with French company Framatome, Siemens is developing the European Pressurised-Water Reactor (EPR).<sup>67</sup> In April 1996, Siemens signed a contract to complete the Soviet-designed nuclear power plant at Mochovce in Slovakia. Described by critical shareholders as a • nuclear ruin•,<sup>68</sup> the plant remained an uncompleted shell after the fall of the Soviet Union. German energy firm Bayernwerk pulled out of the project, and CEO Eberhard Wild said, • We wouldn't be allowed to build this plant near Munich. • The German government insured the Siemens deal with an export credit guarantee of \$80 million.<sup>69</sup> Together with the Russian nuclear industry, Siemens is also constructing the prototype of a new generation of nuclear reactors near St. Petersburg.<sup>70</sup>

Siemens owns and operates two nuclear fuel fabrication plants, one in Lingen, Germany, and one in the US, bought in 1986 from Exxon-Nuclear. Two Siemens-built nuclear plants in Germany have never operated: the Kalkar Fast Breeder Reactor and the Hanau Plutonium/MOX plant.<sup>71</sup>

In 1973, Siemens completed the Borssele Nuclear power plant in The Netherlands, and in 1997 Siemens won the \$220 million contract to modernise Borssele.<sup>72</sup> Siemens has also built the following nuclear power plants: Goesgen (Switzerland); Trillo 1 and 2 (Spain); Atucha 1 and 2 (Argentina); Angra-2 (Brazil); and Righals 2 and 3 (Sweden), constructed with Westinghouse. In 1974, Siemens

started construction of two nuclear power plants at Bushehr in Iran (which were completed by Russia).<sup>73</sup>

Siemens is currently involved in Russia constructing the nuclear power plants Kalinin and Rostov, and upgrading the Kola plant. The company is also involved in a Russian/French/German venture to build a MOX fuel fabrication plant. Siemens is working in the Ukraine on the Khmelnytsky-2 and Rivne-4 power plants, which are planned to replace Chernobyl, in line with an agreement between G7 and the Ukrainian government in December 1995. The two plants are slated to be funded by the European Bank for Reconstruction and Development.<sup>74</sup> Siemens is, together with Russian and French firms, modernising the Kozloduy-5 and -6 nuclear plants in Bulgaria,<sup>75</sup> and has also won a \$165 million contract for a Chinese 1,000 MW nuclear power plant.<sup>76</sup>

The organisation International Physicians for the Prevention of Nuclear War (IPPNW), together with more than 130 organisations in Germany, is refusing to buy Siemens medical equipment until Siemens pulls out of nuclear power.<sup>77</sup> The Siemens Boycott Coordination Group in Berlin, with the support of 120 environmental campaigning groups in Germany and other European countries, is calling for companies to boycott all Siemens products.<sup>78</sup> Representatives from IG Metall, the trade union, have also demanded that Siemens stops building nuclear power plants: many of the union's members are employed by Siemens.<sup>79</sup>

### ***Siemens and the Nazis***

Siemens employed slave labour during World War II. According to Iwanna Diakiw, now aged 78, who produced electrical transformers for Siemens during the war: • I was forced to work through the night every night. The German guard hit me. One Russian girl tried to kill herself by drinking metal cleaner. • In September 1998, some German companies that used slave labour during World War II set up a fund to cover claims from 50,000 survivors.<sup>80</sup>

### ***USA, Jobs, NAFTA and Siemens***

Before the introduction of the North American Free Trade Area, Siemens, and many other US-based companies, made specific promises to create or maintain jobs under NAFTA, for example: • Siemens believes NAFTA would remove some of the current motivation to locate in Mexico to gain access to that market... The demand for equipment will increase and the impact of maquiladora operations will decline. Overall, NAFTA . . . would be a positive impact. •<sup>81</sup>

In fact, since 1994 Siemens has laid off 304 workers: 274 from a plant at Little Rock, Arkansas and 30 from a plant in El Paso, Texas, due to a • shift in production to Mexico • . In December 1997, workers at Siemens' plants in Marion, Kentucky, and in Little Rock, Arkansas, filed petitions with the US government Department of Labor's NAFTA Trade Adjustment Assistance programme stating they had lost their jobs due to NAFTA.<sup>82</sup>

### ***Price Fixing Allegations in Norway***

In 1997, the Norwegian authorities accused Siemens' Norwegian subsidiary of illegally fixing tender prices with ABB, and of dividing the market of electrical equipment supply to the hydropower industry between the two companies from 1990 and 1997. Siemens agreed to pay an \$850,000 out-of-court fine in April 1999, although neither Siemens nor ABB admitted guilt. • There were several reasons for accepting the fine despite our innocence, • according to Stein Bjoernbekk, press officer at Siemens Norway. • The Norwegian authorities had investigated the matter since August 1997, and this put a lot of pressure on the personnel involved as well for Siemens as a whole. The long process was also very costly because of our lawyer expenses. Therefore . . . we wanted to bring the matter to a swift end, and accepted the fine to avoid a long trial. •<sup>83</sup>

### ***UK passport fiasco***

Siemens' 1998 Annual Report described its \$192 million contract to install a computer system in the UK passport office. According to the company, it would offer • an innovative solution • to enable • the yearly volume of 3.5 million passport applications to be processed considerably faster than in the past • .

By June 1999, over 500,000 passport applications were unsorted. UK Home Secretary Jack Straw said the problem was caused by • teething problems • with Siemens system.<sup>84</sup> In March 1999, the UK



National Audit Office said that Siemens had collected most of its fees despite the computer system having been delivered more than a year late and was still not working in July 1999.<sup>85</sup>

- 1 Scott, 1958: 26.
- 2 Siemens, www 1.
- 3 Siemens, www 2.
- 4 Scott, 1958: 44.
- 5 Scott, 1958L 82-83.
- 6 Scott, 1958: 92.
- 7 Scott, 1958: 230.
- 8 Siemens, www 2.
- 9 Pierer, 1999.
- 10 Siemens, 1999: 2.
- 11 Wagstyl and Bowley, 1998.
- 12 Siemens, 1999: 10.
- 13 Voith Siemens, 1999.
- 14 Siemens, 1999: 56.
- 15 Siemens, 1999: 64.
- 16 Siemens, www 3.
- 17 Bowley, 1998a.
- 18 Siemens, 1999: 56.
- 19 Pierer, 1999.
- 20 Siemens, www 3.
- 21 Ramelsburger, 1999.
- 22 Siemens, 1999: 6.
- 23 Siemens, 1999: 57.
- 24 Siemens, 1999: 6-8.
- 25 Pierer, 1999.
- 26 Wagstyl and Bowley, 1998.
- 27 Wagstyl and Bowley, 1998.
- 28 Siemens, www 2.
- 29 Siemens, 1999: 64.
- 30 Siemens, 1999: 64.
- 31 Lewis and Wagstyl, 1997.
- 32 Pierer, 1999.
- 33 Siemens, www 2; Bowley, 1998b.
- 34 Wheen, 1999.
- 35 Siemens, 1999: 45.
- 36 Derbacher, 1999.
- 37 Voith Siemens, 1999.
- 38 Simonian, 1999.
- 39 Voith Siemens, 1999.
- 40 Derbacher, 1999.
- 41 Pierer, 1999.
- 42 Derbacher, 1999.
- 43 Reynolds, 1995.
- 44 IDB, 1999.
- 45 EDF, 1998a.
- 46 PiA, 1997.
- 47 IWP&DC, 1995d.
- 48 Cornerhouse, 1999: 13.
- 49 EDF, 1998a.
- 50 McCully, 1996: 20.
- 51 McCully, 1996: 33.
- 52 McCully, 1996: 139.
- 53 McCully, 1996: 251.
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- 55 IRN, 1999a.
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- 57 IRN, 1999a.
- 58 IRN, 1999a.
- 59 Schucking, 1999.
- 60 IRN, 1997b.
- 61 IRN, 1998a.
- 62 IRN, 1999a.
- 63 Moxon, 1997.
- 64 WP&DCH, 1995.
- 65 Moxon, 1997.
- 66 Derbacher, 1999.
- 67 Siemens-Boycott, www 1.
- 68 Critical Shareholders, www 1.
- 69 Critical Shareholders, www 2.
- 70 Siemens-Boycott, www 1.
- 71 WISE, 1999.

72 WISE, 1999.  
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78 Critical Shareholders, www 2.  
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80 Wheen, 1999.  
81 NAM, 1993.  
82 Public Citizen, 1997.  
83 Bjoernbekk, 1999.  
84 Siemens, 1999: 30.  
85 Wheen, 1999.

## *SIEMENS: DAMS AT A GLANCE*

### ARGENTINA

Yacyreta [see main text].

### BOLIVIA

Siemens supplied electrical equipment and Voith supplied turbines for the 7 MW San Jacinto dam, completed in June 1989. Coyne et Bellier supervised construction. Electrowatt was also involved in the project.

### BRAZIL

In 1997, Voith supplied half of all hydropower generating equipment in Brazil, including the Itaipu and Xingo dams [See main text]. Siemens and Voith were part of a consortium with Bardella SA which won the \$215 million electromechanical contract for the 800 MW Lajeado dam on the Tocantins river. Voith is to supply five turbines. Siemens won the contract to supply electrical equipment, including five generators, the transformer sub-station and the switchgear.

### CHILE

Siemens supplied generators for the 49 MW Mampi and the 75 MW Peuchen dams.

### CHINA

Between 1980 and 1997, Voith had a 30% share of the market of hydro-power generating equipment in China, including 15 projects with a total capacity of over 7,500 MW, the biggest being the Three Gorges dam [see main text]. Siemens led the consortium that won the \$90 million contract to supply the electrical equipment for the first extension of the Guangzhou plant. Voith was also a member of the consortium and provided the turbines, while Siemens supplied the generators and other electrical equipment. In September 1994, Voith signed a second contract worth \$40 million for Guangzhou Phase II, to supply four pump turbines. Siemens' Power Transmission and Distribution Group (EV) won a \$164 million contract to construct a 1,000 km-long high voltage electricity link between the Tianshengqiao hydroelectric plant to the city of Guangzhou Beijiao. In 1990, the high voltage electricity transmission line between Shanghai and the Gezhouba hydroelectric plant on the Yangtze river was commissioned. This was Siemens first high voltage transmission line in China. Both Voith and Siemens supplied equipment to the Sanxia dam, and in November 1997, Siemens won the \$4 million contract to supply electric cable for the Xiaolangdi dam on the Yellow river. Work on the \$4.5 billion project began in September 1994 [see section on Impregilo]. Voith also won a contract in the early 1990s to supply four 204 MW pump turbines for the Shisanling hydroelectric plant.

### GERMANY

Siemens' Brazilian subsidiary won a \$3.8 million order for generators for the Tosing dam in Bavaria. VA Tech Voest MCE won the contract to renew the turbines.

### INDIA

Maheshwar and Nathpa Jhakri [See main text]

### IRAN

Siemens' Brazilian subsidiary won a \$9 million contract to supply components for the Shahid dam.

## KENYA

Both Siemens and Voith supplied equipment to the Gitaru dam.

## LAOS

Siemens and Voith are both part of a consortium developing the Nam Ngum 2 dam. The consortium consists of Sri Uthong (Thailand), CH Karnchang (Thailand), Shlapak Development (USA), Bilfinger Berger (Germany), JM Voith (Germany), Noell (USA) and Siemens (Germany).

## NEPAL

Voith supplied turbines and Siemens supplied electrical equipment to the 69 MW Marsyangdi dam. Construction started 1986 and was completed in 1990.

## PAKISTAN

In 1997, Voith won the contract to supply and install five turbines to the 1,500 MW Ghazi Barotha dam, on the Indus river. The \$2.24 billion project is partly funded by KfW and OECF. The German portion of the work is secured by a guarantee contract with Hermes Credit Insurance. The dam is scheduled for start up in 2002. Impregilo is the lead company in the consortium acting as main contractor for the project [see section on Impregilo]. VA Tech Voest MCE is supplying the penstocks for the project.

## SLOVAKIA

In November 1994 Siemens' Brazilian subsidiary signed a contract to supply four generators for the Cunovo dam. Siemens Brazil and Siemens Germany signed a \$9.5 million deal in the same year to supply nine generators as part of the modernisation of three dams on the Drava river.

## TIBET

In 1991, Voith won a contract to supply four 21 MW pump turbines for the Yang Zhuo Yong hydroelectric plant.

## USA

Siemens designed the system for replacing the stators, and won the contract for the refurbishment works for the generators at the Grand Coulee dam. VA Tech Voest MCE won the contract for the renewal of the turbines at Grand Coulee. In 1995, Voith upgraded the First Bonneville Powerhouse on the Columbia River, Portland, Oregon – a \$40 million deal. The Tennessee Valley Authority also gave Siemens a \$20 million contract to modernise 29 hydroelectric plants in Tennessee.

## SOURCES:

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EDF: 1998, 1998a  
H&D: 1997a, 1998  
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TN: 1999a  
Voest: 1999a, 1999b  
Voith Siemens: 1999  
WP&DCH: 1991, 1995, 1995b, 1995d

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Skanska AB was founded in 1887<sup>11</sup> and built Sweden's first concrete bridge in the same year.<sup>2</sup> Today, Skanska is Scandinavia's largest construction group<sup>3</sup> with 39,000 employees<sup>4</sup> and one of the major property owners in Sweden.<sup>5</sup> The group is divided into four areas of operations: Skanska USA, Skanska Sweden, Skanska Europe and Skanska Project Development and Real Estate.<sup>6</sup>

Skanska's largest shareholder is Industrivarden, an investment company, with 29.9% of the votes in Skanska (and 7.4% of the capital stock). Inter IKEA, part of the IKEA home furnishings group, has 10.1% of the votes and 2.5% of the share capital in Skanska. Industrivarden and Inter IKEA bought all of the shares held by the investment company Custos Skanska in September 1998.<sup>7</sup> Swedbank owns the largest amount of capital stock, with 13.4% (7.8% of voting power). Non-Swedish shareholders own 12.8% of capital stock and 7.6% of voting power.<sup>8</sup> IKEA and Skanska are to set up a jointly owned consortium to construct and sell • Live Smart• low-cost standard housing units.<sup>9</sup>

Skanska has around 50 subsidiaries including Beers Construction Co. (US), Costain Group plc (UK), Poggenpohl Group (Germany), Sundlink Contractors HB (Sweden) and Tidewater (US).<sup>10</sup> The company operates in around 50 countries<sup>11</sup> with the aim, according to their 1998 Environmental Report, to • continue internationalization, primarily by means of continued growth in the United States and expansion in European markets. •<sup>12</sup> In 1998, operations outside Sweden accounted for 72% of the year's order bookings. Net sales in 1998 amounted to \$7.5 billion, of which 68% was in markets outside Sweden.

Skanska embarked on a restructuring programme in late 1997.<sup>13</sup> Some of the mergers, sales and buy outs include:

- In 1997, Skanska sold its holding in Sandvik (the cemented carbide and steels company);
- In April 1998, Skanska bought Hanson's construction operations, including Tidewater Construction Corporation, CDK Contracting Co. and Nielsons Inc. The deal puts Skanska in the top ten largest construction firms in the US;<sup>14</sup>
- On 1 November 1998, Skanska sold the Kymmen hydroelectric power plant to Gullspeng Kraft AB, at a loss of approximately \$7 million.<sup>15</sup> Skanska built the 57 MW dam, and Gullspeng has operated it since production began in 1987;<sup>16</sup>
- In December 1998, Skanska announced its intention to buy a 70% share in Switzerland's largest construction company, Karl Steiner Holding AG;<sup>17</sup>
- In 1998, Skanska Oy, Skanska's Finnish subsidiary, bought the construction operations of Polar, making Skanska Oy the second biggest construction company in Finland;<sup>18</sup>
- In 1998, Skanska sold its forest operations and related timberland assets;
- In 1999, Skanska bought SADE Ingenierma y Construcciones S.A., Argentina's second largest construction company, at a cost of \$60 million.<sup>19</sup>

## **SKANSKA AND DAMS**

Skanska has been involved in a number of dams worldwide, many of them the subject of intense criticism from environmental and development groups. Skanska Raise Boring AB, an independent Swedish company within the Skanska Group, has also been involved with construction of penstocks and cable shafts for hydropower projects in Guatemala, Mauritius, Norway, Indonesia, Italy, Panama, Peru, Pakistan, Sri Lanka, Malaysia, India and Sweden.<sup>20</sup>

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Writing in the company's 1998 Environmental Report, Claes Bjork, Skanska's CEO, says:

• *In some cases, Skanska should refrain from participating in a project. This may be true, for example, when we believe that a project's negative environmental or social consequences will be too large. In recent years, we have refrained from bidding on a number of projects for these and other reasons. When we decide to submit a tender and receive an assignment to carry out a project, we must be able to accept this responsibility. We cannot hide behind official permits or the terms of our contract with the client.*•<sup>21</sup>

Bjork's comments are at odds, however, with the fact that Skanska is one of the contractors currently bidding for a contract to build the Ilisu dam in Turkey. Ilisu will involve the forcible resettlement of 25,000 people, many of whom have already been moved from the reservoir area at gunpoint [see box on Ilisu].

Skanska is currently undertaking a • comprehensive evaluation of hydroelectric power projects that Skanska has completed in developing countries over the past 20 years. • Carried out by Skanska employees, the review aims to determine how the project is viewed today in the country, what went well, what went badly, and what Skanska's image is in the country. An early conclusion is that • necessary relocations of local residents near the hydroelectric power projects in question have been limited. •<sup>22</sup> In September 1999, however, Ivar Leek of Skanska's Management System stated: • There is no report available yet, • and so far no field work has been carried out.<sup>23</sup>

#### ILISU, TURKEY

Skanska is one of the companies hoping for a share of the contract in the \$1.52 billion contract for the Ilisu dam on the Tigris river. The dam would displace 25,000 people [see box on Ilisu].

#### URRA I, COLOMBIA

Skanska signed the contract for the construction of the 340 MW Urra dam on the Sinu river in 1984 but the \$700 million project was delayed by financing difficulties, and Skanska only started construction in 1993. A group of banks from the Nordic countries, Canada, Venezuela and Colombia funded the dam. Skanska's share of the project is 80%.<sup>24</sup> Skanska anticipate finishing the Urra dam in 1999 at a projected cost of \$312 million.<sup>25</sup> Sixty per cent of the finance is in the form of loans, from the Nordic Investment Bank, Export Development Corporation of Canada, Russian company Energomachexport and the World Bank.<sup>26</sup> The Swedish export credit agency also provided guarantees through the Nordbanken bank.

The reservoir started filling in November 1999. It will flood 7,400 hectares, including old-growth forest and the lands and homes of 411 families, few of whom have legal land titles. Over 2,800 people will be evicted in all. The Embera-Katio indigenous communities living in the area of the river Sinu were not consulted and will lose their fisheries — their staple protein source. Another indigenous group, the Zenu, who live downstream of the dam will be affected by proposals to drain the seasonally inundated lands which they rely on for fishing and agriculture.<sup>27</sup>

The Urra project is in an area that has been the scene of conflict between left-wing guerrillas and right-wing paramilitaries in one of the world's longest-running civil wars. At least three Embera-Katio have been killed for leading opposition to the dam. One man, 70-year-old Alonso Jarupia, was shot in the back in August 1998 by a group of a dozen masked paramilitaries. Two Skanska engineers were kidnapped on 14 December 1995 by local guerrillas as they were travelling to work on the Urra dam.<sup>28</sup>

The dam has been built but, in November 1998, Colombia's constitutional court blocked flooding of the upstream land, saying the government should negotiate a compensation deal with the Embera-Katio. The Indians are not against development, according to local community leader Kimy Pernia Domico, but they want land in exchange for what will be flooded as well as an environmental plan for the region and attention to education and health problems. Some Embera-Katio have taken cash settlements, but Pernia said that would leave them open to exploitation by unscrupulous merchants and bar owners. • We can't eat money, • he told reporters during a 1999 visit to Canada to oppose EDC's support for the dam.<sup>29</sup>

#### EL GUAVIO, COLOMBIA

Skanska Raise Boring AB bored two penstocks both over 500 metres long, and a 485 metre-long surge shaft for the El Guavio hydroelectric power plant.<sup>30</sup> In 1983, more than 200 people were killed in a landslide during construction of the Guavio dam.<sup>31</sup> When Colombian authorities announced the compensation package for farmers evicted by the Guavio dam in 1981, sharp lawyers and other middlemen familiar with Colombia's land acquisition system arrived in the area and offered farmers cash payments of about half the market rate of the land. Around 60% of the farmers, many of whom were illiterate and had no experience of dealing with official paperwork, handed over their land titles to the conmen who then claimed the full value of the land from the authorities.<sup>32</sup>

#### KISHEN GANGA, KASHMIR

Skanska has formed a consortium with Norconsult<sup>33</sup> to build the proposed \$500 million,<sup>34</sup> 330 MW Kishen Ganga dam in the Gurez Valley. The number of people to be evicted to make way for the dam is not clear. Skanska claim the figure is 7,000 people, but admit that 25,000 people is within the margin of error.<sup>35,36</sup>

In 1998, Thomas Pehrson, head of the project at Skanska International, told Norwegian NGO Nor-Watch:

*Relocating people is not our responsibility, but that of our employer, Power Development Corporation. However, if conditions regarding forced resettlement are tied to the project financing, I believe we may influence the process.*

He explained that the project developer, Power Development Corporation, is trying to find an area to which the entire resettled population may be moved.<sup>37</sup> Meanwhile, Lars Wuopio, Norconsult's business area manager, stated: In negotiations, we have requested guarantees from the customer so that they assume social responsibility for the families, about 7,000 people, who will have to evacuate the area.<sup>38</sup>

Local communities have demonstrated against the dam. Farida, a young Dard Shin student, wrote this in a letter to the regional government:

*You can build new modern houses for us, but you can not create homes for us. It has taken us centuries to transform our mud houses into the home of Dard civilization . . . This dam will devour our homeland where our culture has flourished for centuries. It threatens our distinct identity. We will not let ourselves be sacrificed for a developmental project that has least benefits for us.*<sup>39</sup>

#### URI, KASHMIR

Skanska was the lead partner in a consortium with SWECO (a Swedish firm of dam designers), ABB AB (electrical equipment suppliers), and Kvaerner Boving (mechanical equipment suppliers from the UK) for the \$560 million civil works contract for the construction of the 480 MW Uri dam in Kashmir.<sup>40</sup>

The dam was completed in May 1997,<sup>41</sup> funded with loans from Sweden, Scandinavia, India and the UK. The land acquisition associated with the project led to the project being delayed for 18 months.<sup>42</sup> Fighting in Kashmir during the construction period (between Indian security forces and groups fighting either for a Kashmiri annexation to Pakistan or for an independent Kashmiri state)<sup>43</sup> meant that construction workers were ferried to the site by helicopter to avoid the risks of travelling by road.<sup>44</sup> Two of Skanska's employees were kidnapped during the construction works, and later released.<sup>45</sup>

#### PERGAU, MALAYSIA

Skanska was a specialist contractor on the 75 metre-high, 600 MW Pergau dam, which was funded by the British government and the Malaysian Tanaga Nasional Berhad. According to project officials, the dam will only be used at peak energy hours because the volume of water allows the dam to operate for only a few hours.<sup>46</sup> In 1993, the World Bank criticised the project, arguing that it would be more cost effective to build gas fired power stations<sup>47</sup> [See Balfour Beatty for more information on Pergau].

#### KOTMALE, SRI LANKA

Skanska built the Kotmale dam, part of Sri Lanka's massive Mahaweli Project.<sup>48</sup> The contract was awarded without any competitive bidding, and construction began in 1979. However, after limestone caverns were discovered beneath the dam, the entire project had to be moved 200 metres downstream. Construction engineers admitted that geological surveys had revealed the original site to be flawed but that no-one had coordinated the results or drawn the appropriate conclusions.<sup>49</sup>

Construction mishaps, in addition to the need to move the dam, played havoc with the costs of the project. According to a 1981 World Bank report on Sri Lanka, • Of all the projects in the Mahaweli Programme, the cost of the Kotmale project has risen the most since 1979. • Later reports by the World Bank acknowledge that the long-term macroeconomic impacts of the Accelerated Mahaweli scheme as a whole have proved almost entirely negative, leading to severe balance of payments problems for the country [see section on Balfour Beatty].

The dam required the relocation of 13,000 people and flooded 1,410 acres of paddy fields. Commenting on the social impacts of the Mahaweli scheme as a whole, H. Witanage, of the Environmental Foundation Sri Lanka, told the South Asia hearings of the World Commission on Dams: • *We have had good and bad experiences as a result of large scale dams. In 1991 as a result of the Mahaweli project, about 20% of the rice and about 55% of the chilli consumption of the country were produced in the Mahaweli command area. But today, many of the farmers are facing various problems. The Mahaweli project promised water for two thirds of the country and planned to export electricity to India. Until the end of April 1992, more than 111,400 families or about 700,000 people were resettled. They lost their fertile homelands and [were] resettled in colonies.*•

• *The Mahaweli has failed to bring about the promise and failed to provide adequate water for the farmers. Thousands of ancient [water] tanks in the dry zone were bulldozed. Environmental implications such as the increase in on-site soil loss rates, degradation of downstream water quality, loss of natural forest cover, eutrophication of reservoirs, changes in seasonal flow regimes of rivers, sedimentation of reservoirs are very critical . . . due to lack of water in the reservoirs because of no maintenance of the catchment we had to face power cuts. Total generation from hydro was reduced by 28% in 1996 due to dry weather. The total extent cultivated under the Mahaweli command during the 1996 cultivation year decreased by 13% to 119,100 hectares.*•<sup>50</sup>

The Mahaweli scheme has also been linked to increased ethnic violence in the region.

#### YALI FALLS, VIETNAM

In May 1997, the Swedish International Development Cooperation Agency (Sida) awarded a \$3.2 million contract to Skanska to provide training in tunnel-building for hydropower projects in Vietnam. The contract includes on-the-job training at the 720 MW Yali Falls dam construction site<sup>51</sup> [see section on Electrowatt].

#### Skanska and its subsidiaries worldwide

##### ORESUND

In 1995, Sundlink Contractors, a 37% owned Skanska subsidiary,<sup>52</sup> won the contract to build the Oresund bridge linking Denmark and Sweden. Skanska made its first proposal for the bridge in 1936 – the bridge will finally open in 2000. The project involves building an artificial island, a 7.8 km-long bridge with four lanes of roads and a lower level for trains, and a 8.2 km-long tunnel.<sup>53</sup>

##### SCANCEM

The size of some of Skanska's companies is illustrated by the case of Scancem, the Scandinavian cement company. Scancem was formed in 1996 through a merger between Aker (Norway) and Euroc (Sweden). Through its majority shareholding of Euroc, Skanska became a major shareholder in Scancem. In 1998, the European Commission declared the merger of Scancem's Swedish, Finnish and Norwegian cement operations in violation of EU competition law.<sup>54</sup> In November 1998, the European Commission approved a settlement proposal, in which Skanska undertook to sell its shareholdings in Scancem, and ensured that Scancem sold its Finnish cement operations, thus reducing Scancem's share of the Nordic cement market.<sup>55</sup> A new Scancem board of directors was elected 21 December 1998.<sup>56</sup> Scancem was established in 1986 as a cooperation between Aker (a Norwegian company involved in cement, building materials and oil and gas technology) and the Swedish company Euroc to deal with their international activities in the fields of cement and coal.<sup>57</sup>

##### COSTAIN

In June 1996 Costain, a Skanska subsidiary, won the contract to build the \$150 million Newbury bypass in the UK. The construction of the road faced probably Britain's largest ever environmental protests, resulting in around 1,000 arrests. In January 1996, a consortium led by Costain and Securicor won the contract to design, construct, finance and operate the 800 person Parc prison in South Wales – the first Private Finance Initiative (PFI) prisons contract in the UK. Securicor had no previous

experience of running prisons, and ran into what a Parliamentary Select Committee described as • operational difficulties• when the prison opened.<sup>58</sup> Skanska and Costain won the \$120 million contract to refurbish and extend a shopping and leisure centre in Uxbridge, London. The project involves a new 60,000 square metres retailing and entertainment centre, parking for 1,600 cars, refurbished buildings on and • remodelling• of the High Street, and widening roads to create dual-carriageways. It is expected to be finished by Feb 2001.<sup>59</sup>

#### HALLAND RIDGE

In 1997, a serious accident took place at Skanska's Halland Ridge rail tunnel construction site in Bastad, Sweden, caused by an underground toxic leak of the grouting agent Rhoca Gil.<sup>60</sup> The toxic leak required extensive clean-up work in 1998,<sup>61</sup> and waterproofing was subsequently carried out by lining the tunnel with concrete. The Swedish government appointed a commission of inquiry, which submitted its final report in November 1998. The Swedish government is to decide on the future of the project in 1999.<sup>62</sup> Rhodia Sverige AB is suing Skanska for unpaid invoices for the sealing agent Rhoca Gil supplied for the Halland Ridge project. Skanska is in turn suing Rhodia for supplying a • faulty and hazardous• product.<sup>63</sup>

- 1 Skanska, www 1.
- 2 Sundlink, www 2.
- 3 Brown-Humes, 1993.
- 4 Skanska, www 1.
- 5 Loughborough, www 1.
- 6 Skanska, 1999: 18.
- 7 Skanska, www 3.
- 8 Skanska, 1999f: 17.
- 9 Skanska, 1999e.
- 10 Skanska, www 2.
- 11 Skanska, 1999g: 1.
- 12 Skanska, 1999g: 1.
- 13 Skanska, www 3.
- 14 Skanska, 1998a.
- 15 Skanska, www 3.
- 16 Skanska, 1998g.
- 17 Skanska, 1998h.
- 18 Skanska, 1998d.
- 19 Skanska, 1999d.
- 20 NRI, www 1.
- 21 Skanska, 1999f: 2.
- 22 Skanska, 1999g: 24.
- 23 Leek, 1999.
- 24 Brown-Humes, 1993.
- 25 Skanska, 1999c.
- 26 Yapa, 1994.
- 27 Yapa, 1994.
- 28 IWP&DC, 1995e.
- 29 Knox, P., 1999.
- 30 NRI, www 1.
- 31 McCully, 1996: 87.
- 32 Guggenheim, 1990.
- 33 Norwatch, 1998.
- 34 Gray, 1997.
- 35 EDF, 1998b.
- 36 Norwatch, 1998.
- 37 Norwatch, 1998.
- 38 Skanska, 1998c.
- 39 IRN, www.1.
- 40 EDF, 1998; H&D, 1996d.
- 41 Skanska, 1999c.
- 42 H&D, 1997a.
- 43 Norwatch, 1998.
- 44 IWP&DC, 1995a.
- 45 Norwatch, 1998; H&D, 1997a.
- 46 EDF, 1998.
- 47 CEI, 1997.
- 48 Skanska, 1999c.
- 49 Alexis, L. 1985.
- 50 Witanage, H 1999.
- 51 Watershed, 1997.
- 52 Sundlink, www 2.
- 53 Sundlink, www 1.



54 Hofsten, 1999.  
55 Hofsten, 1999.  
56 Skanska, www 3.  
57 FIVAS, 1996.  
58 HMSO, 1998.  
59 Skanska, 1998f.  
60 Skanska, 1999g: 19.  
61 Skanska, 1999f: 4.  
62 Skanska, 1999g: 19.  
63 Skanska, 1998e.

## **SKANSKA: DAMS AT A GLANCE**

### **BRAZIL**

Skanska Raise Boring AB drilled 11 shafts with a total length of 1,100 metres for the Serra Da Mesa hydroelectric power plant.

### **COLOMBIA**

Urta I and El Guavio [see main text].

### **ICELAND**

In 1997, Skanska was the lead company in the joint venture that won the contract to build the \$54 million, 120 MW Sultartangi dam on the Pjorsa river. The other members of the consortium are Istak (Iceland) and Phil & Son (Denmark). Sultartangi will be the fourth dam Skanska has constructed in Iceland. Completion is anticipated in January 2000. When the Sultartangi station starts, per capita electricity in Iceland will be the highest in the world. Lahmeyer is also involved in the project.

### **KASHMIR**

Uri [see main text]. Skanska has formed a consortium with Norconsult to build the proposed \$500 million, 330 MW Kishen Ganga dam in the Gurez Valley.

### **MALAYSIA**

Pergau [see main text].

### **PANAMA**

In 1994, Skanska won a provisional BOO (Build-Own-Operate) contract for the 130 MW Esti hydropower project.

### **PERU**

In April 1999, Skanska was the lead contractor in a consortium that won the \$120 million contract to construct the 134 MW Yuncan hydropower plant. Skanska's share is 60% and the other companies in the consortium are Cosapi (Peru) and Chizaki (Japan). Financing came from Japan's OECF. Completion is anticipated in June 2002.

### **SRI LANKA**

Kotmale [see main text]. In March 1997, Skanska signed an memorandum of understanding with the Sri Lanka Electricity Board to sign a contract to construct the 78 MW Kukule Ganga dam. The \$55 million contract depends on approval from Japan's OECF which is providing soft loans for the project. Lahmeyer International and Electrowatt are part of the consortium responsible for planning the dam.

### **TURKEY**

Ilisu [see main text].

### **VIETNAM**

Yali Falls [see main text].

### **WALES**

Skanska's UK subsidiary, Costain, worked with Balfour Beatty on the \$300 million Cardiff Bay Barrage – the largest dam in Europe outside of The Netherlands. The completion of the barrage was nine months behind schedule, with \$7.5 million cost overruns [see section on Balfour Beatty].

**SOURCES:**

Brown-Humes: 1993

EDF: 1998

Financial Times Surveys: 1999

Gray: 1997

H&D: 1996d

IWP&DC: 1997

Landsvirkjun: www 1

Norwatch: 1998

NRI: www 1

Skanska: 1999c, 1999d

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Founded in 1923 as a hydraulics laboratory in Grenoble,<sup>12</sup> Sogreah today is one of the top French consulting engineering companies, employing 400 people. The company has projects in more than 50 countries around the world, and has been expanding its international business for the last 50 years.<sup>2</sup> Sogreah is divided into three sectors: energy and dams; development and environment; and urban and industrial development. Energy and dams accounts for 30% of the company's sales, and is further subdivided into thermal power stations; dams and hydropower plants; tunnels and canals; power transmission grids; and urban waste incineration.<sup>3</sup> Many of Sogreah's current contracts involve water supply, irrigation and sewage works.<sup>4</sup>

On 1 January 1999, Sogreah's management bought the company from Alcatel, the former owner, after Alcatel decided to refocus on telecommunications. The company is now independent of any industrial or financial group,<sup>5</sup> and is owned and run by seven partners. No shares are publicly traded in Sogreah.<sup>6</sup> Sogreah still owns 60% of the Laboratoire d'Hydraulique de France (LHF), a private 16-staff company which undertakes research into various aspects of water development projects.<sup>7</sup>

## **SOGREAH AND DAMS**

### **LESOTHO HIGHLANDS WATER DEVELOPMENT PROJECT, LESOTHO**

Sogreah was the lead company in the SCBG-Europe consortium, with Coyne et Bellier (France) and Sir Alexander Gibb (UK), responsible for engineering services from preliminary studies to final commissioning for the 180 metre-high Katse dam, part of the massive Lesotho Highlands Water Project.<sup>8</sup> Together with South African companies, SCBG formed the Lesotho Highlands Consultants consortium.<sup>9</sup>

The rock below the dam was found to be poorer quality for engineering work than anticipated, which

- gave rise to concerns about the ability of the concrete arch to withstand the loads exerted by the reservoir under extreme loading,
- according to Anthony Collings, a Sogreah partner, who worked in Lesotho for six years. Sogreah subsequently redesigned the dam and foundations to accommodate the weak rock.<sup>10</sup> Despite the criticisms of the LHWP, Anthony Collings, who was the project manager on the Katse dam, said, • I don't think there was any controversy, apart from certain phases of the project when things were criticised. We applied our best engineering to those projects and the problems that arose from them. We regard the Katse dam frankly, at all levels, as a very great success. •<sup>11</sup>

Sogreah is one of a number of multinational companies that have been charged by the Lesotho authorities with corruption linked to the project. It is alleged that the company • wrongfully, unlawfully and corruptly made payments [and/or] transfers • of \$13,578 to Marsupho Sole, former head of the Lesotho Highland Project Authority [see box on LHWP].

### **TURKWELL GORGE, KENYA**

Sogreah produced preliminary design reports for the \$270 million Turkwell Gorge dam in Kenya. Sogreah's reports paved the way for an offer from the French government for a complete package of loans to finance the project. Without going out to competitive tender, the French construction firm,

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Spie Batignolles, won the construction contract, and French companies supplied turbines, generators and transmission equipment.<sup>12</sup>

In March 1986, an internal memorandum written by Achim Kratz, then EC delegate to Kenya, was leaked to the Financial Times.<sup>13</sup> The memo stated that the contract price was • more than double the amount Kenya's government would have had to pay for the project based on an international competitive tender. • The memo continued, • The Kenyan government officials who are involved in the project are fully aware of the disadvantages of the French deal . . . but they nevertheless accepted [it] because of high personal advantages. •<sup>14</sup> Kenyan observers say that these • personal advantages • included payments of millions of dollars to Kenyan president Daniel Arap Moi and then Energy Minister Nicholas Biwott.<sup>15</sup> When the dam was completed in February 1991, the Kenyan press described it as • the whitest of white elephants • and a • stinking scandal • . For two-and-a-half years after completion, the dam operated at less than half its designed generating capacity, and when it was officially opened by President Moi in October 1993, the reservoir was less than a quarter full.<sup>16</sup> As a result of the corruption scandal surrounding the Turkwell Gorge project, international donor aid to Kenya's energy sector was frozen for a decade and only began to return in late 1996.<sup>17</sup>

In August 1999, electricity in Kenya was rationed until the onset of the rainy season — not expected until six months later. Officials reported that reservoir water levels in Kenya are now at the lowest level since the mid-1960s<sup>18</sup> [see section on Knight Piesold].

#### NAM LEUK, LAOS

In April 1996, Sogreah produced the environmental impact assessment (EIA) for the \$110 million, 60 MW Nam Leuk dam. The dam was financed by the Asian Development Bank (\$52 million), Japan's Overseas Economic Development Fund (OECF) and the Lao government. Sogreah's EIA was the second on the project — in 1992 Lahmeyer International and Beca Worley International produced an environmental impact assessment for Nam Leuk,<sup>19</sup> which was heavily criticised in a report produced for the Lao Ministry of Forestry.<sup>20</sup>

A review of Sogreah's 1996 EIA by Dr Guy Lanza of the University of Massachusetts found serious problems with the consultant's methods and conclusions. Lanza's review includes the following statements:

- The baseline data outlined in the report are extremely weak.
- Only limited streamflow data is provided for the Nam Leuk dam site and the Nam Poun diversion, and there is no flow data for areas above and below the dam site.
- Many vitally important questions about the environmental consequences of the project are either not addressed or are based on incorrect assumptions and/or invalid interpretations of the limited data provided in the EIA.
- The EIA also fails to provide realistic options to deal with the numerous problems that will result from project construction and operation.<sup>21</sup>

Sogreah's Anthony Collings dismissed Lanza's criticism, saying: • I think that's part of the problem. We are exposed to criticisms that have as their origin an anti-dam or an anti-project intent. There is nothing we can ever do to satisfy such a person. •<sup>22</sup> He continued, • It's very easy for a free-wheeling environmentalist to come in and criticise a project. I don't regard that as very helpful really. I think that it's no more credible, frankly, than a consultant. •<sup>23</sup> Despite criticism of its environmental impact assessment, Sogreah went on to win a \$5 million commission to carry out the detailed design of the dam, to supervise construction and to prepare a Social Action Plan.<sup>24</sup>

In July 1997, the ADB suspended construction of the dam because of the poor quality of the work carried out by the main contractors, China International Water and Electric Corporation. Work resumed four months later, but, in February 1998, reports of logging outside the reservoir area exposed new problems with Sogreah's supervision of the construction work.<sup>25</sup> Sogreah's work on the Nam Leuk dam involved little consultation with villagers living near to the river. One villager at Ban Pak Leuk downstream of the dam site said in March 1998, • We were not told in advance about the project. We only heard about it when they began repairing the road. It is only very recently that people from the project have come to talk to us. •<sup>26</sup>

Sogreah's Social Action Plan was completed in January 1998. One of its proposals is to tax villagers employed by the dam contractors to clear vegetation from the reservoir area. The money raised through

these taxes would then be used to construct fish-breeding ponds to replace the fisheries destroyed by the dam. In effect, critics argue, villagers will not only lose their fisheries and their livelihoods; they will also be taxed to pay for the new • development• , offered by the dam developers as compensation.<sup>27</sup>

#### PAK MUN, THAILAND

Sogreah did design work on the 136 MW World Bank-funded Pak Mun dam.<sup>28</sup> Supposedly a • run-of-river• design, the dam resulted in the collapse of the Mun river fisheries, despite the addition in 1994 of a \$1 million fish ladder.<sup>29</sup> Rapids upstream and downstream of the dam were destroyed during construction. The 60 square kilometre reservoir behind the dam inundated seasonally flooded forests, farmland and common grazing land.<sup>30</sup>

Two EIAs were carried out for the project in 1982 and 1984. Both related to a different dam design at a location about one kilometre from the site where the dam was finally completed in 1994. In 1991, Dr Mark Rentschler of the US Treasury Department, reported to the US government:

• The environmental assessment prepared for this project does not appear adequate to allow the [World Bank's] Board of Directors to evaluate the environmental soundness of the project. •<sup>31</sup> The EIAs did not study seasonal fish migrations between the Mun and the Mekong rivers — migrations that were effectively stopped by the dam.<sup>32</sup>

In a 1998 report on • involuntary resettlement• at Pak Mun, the World Bank states: • Fish catch and income have decreased almost 50% since 1994• .<sup>33</sup> Villagers are still demanding compensation for their loss of livelihood: in March 1999, over 3,000 villagers occupied the dam site in protest.<sup>34</sup> Previously, the Assembly of the Poor, including Mun river villagers, protested outside Government House in Bangkok in 1995, 1996, and 1997 — the last protest involving over 20,000 villagers camping for 99 days.

Before the dam was constructed, Gimboong Jomkamsing, a Mun river villager, said to World Bank Executive Directors, • There is a close relation between the Mun River and the people. If the river is destroyed, the fish will be gone forever. The Mun River is the life of the people and the community. •<sup>35</sup> In 1995, one year after the dam was completed Thongcharoen Seehatham, another Mun river villager, said, • Pak Mun dam destroyed our river, the Mun River. The dam destroyed our fishing communities and our culture. To destroy a river, to destroy communities and culture, is a terrible thing. •<sup>36</sup>

#### DAI NINH, VIETNAM

Between 1996 and 1998, Sogreah worked on the \$450 million, 300 MW Dai Ninh hydropower dam.<sup>37</sup> The Dai Ninh project plans to transfer water from the Dong Nai river via an 11 kilometre-long tunnel to the Luy river. The anticipated completion date for the project is 2003.<sup>38</sup> Sogreah produced a review of the feasibility study and economical report in 1995,<sup>39</sup> and worked with SNC Lavalin of Canada on the technical study.<sup>40</sup> Sogreah and Pacific Rim Power of Canada subsequently completed the design and prepared the bidding documents for the project.<sup>41</sup> The reservoir behind the dam, if built, would flood 20 square kilometres, require the forced resettlement of 1,200 people and flood some or all of the land of a further 3,600 people.<sup>42</sup>

The World Bank's role in the development of the Dai Ninh dam is far from transparent. In 1997, then-World Bank task manager for Dai Ninh, Darayes Mehta, stated that the Bank had assisted in preparing the project studies. A year earlier, the Vietnam Investment Review reported: • A World Bank official in Hanoi said the Bank planned to finance part of the construction, but no figures for its support have yet been fixed• .<sup>43</sup> The World Bank's Project Information Document (dated January 1995) states that the Bank's contribution, if approved, would be \$175 million.<sup>44</sup> In response to requests for clarification in October 1999, the World Bank said, • The Bank has dropped this project from its portfolio• .<sup>45</sup> The project did not go to the World Bank's board. The Bank invited Japan's OECF to cofinance the dam and, according to Anil Malhotra at the Bank, OECF • offered to provide all the finances for the project. •<sup>46</sup>

#### **Sogreah and the World Commission on Dams**

Anthony Collings, a partner with Sogreah, said that the company is • interested• in the World Commission on Dams. He continued:

• *I think that it's probably fair to say that we greatly appreciate the idea of the Commission. We're anxious that it seems for the moment to be rather a loaded dice, in the sense that it's very much more*

*the environmental and anti-project lobby that is reflected in the Commission than a true balance between all of the interests. And that is a bit of a worry.*

*• One could say that some of the personalities on the Commission are people we know, and we're quite positive about, but even so they could possibly be regarded as anti-dams people. If you look at the Commission members, it's dominated by those people who would generally speaking be recognised as anti-dams people.*

*• I mean people like Kader Asmal: I have very good feelings about him in the sense that we've been involved together in fact in the Lesotho project, and he is a man who has very high professional standards, I'm quite happy with that. Nevertheless I know him to be an anti-dams man. I think that may not be a bad thing as long as it's a properly measured input, and I think we can probably expect that from Kader Asmal. It's whether the overall Commission is really balanced to the extent that we'll get from it something that will be persuasive to all parties. • <sup>47</sup>*

- 1 Collings, 1999.
- 2 Sogreah, www 2.
- 3 Sogreah, www 4.
- 4 Sogreah, www 1.
- 5 Sogreah, www 1.
- 6 Collings, 1999.
- 7 LHF, www 1.
- 8 WP&DC, 1991.
- 9 Collings, 1999.
- 10 DWAf, www 1.
- 11 Collings, 1999.
- 12 Ozanne, 1991.
- 13 McCully, 1996: 261.
- 14 Ozanne, 1991.
- 15 McCully, 1996: 262.
- 16 McCully, 1996: 262.
- 17 Goldman and Wrong, 1996.
- 18 Reuters, 1999.
- 19 LI & BWI, 1992.
- 20 Anon., 1994.
- 21 Lanza, 1996.
- 22 Collings, 1999.
- 23 Collings, 1999.
- 24 IRN, 1999d: 24.
- 25 IRN, 1999d: 23.
- 26 IRN, 1999d: 26.
- 27 IRN, 1999d: 27.
- 28 WP&DC, 1991; Collings, 1999.
- 29 Watershed, 1995a: 20-21.
- 30 Watershed, 1996: 17-18.
- 31 Watershed, 1996: 18.
- 32 Watershed, 1996: 18.
- 33 Watershed, 1998b: 49.
- 34 Pannapa, 1999.
- 35 Watershed, 1996: 22.
- 36 Watershed, 1995a: 21.
- 37 World Bank, 1995; Sogreah, www 4.
- 38 JICA, 1996.
- 39 Lotti, 1996: 104.
- 40 Mehta, 1997.
- 41 HRW, 1996: 40.
- 42 Lotti, 1996: 42.
- 43 VIR, 1996.
- 44 World Bank, 1995.
- 45 Grimm, 1999.
- 46 Malhotra, 1999.
- 47 Collings, 1999.

## **SOGREAH: DAMS AT A GLANCE**

### **BENIN**

Electrowatt formed a consortium with Sogreah of France to provide consulting services for the \$140 million Nagbeto dam. A \$30 million World Bank loan helped fund the project.

## CAMEROON

In 1976 Sogreah produced a feasibility study for the Mokong irrigation dam which would in theory irrigate 7,200 ha. A subsequent study by the Cameroon Secretariat of Agriculture identified the same lands as not appropriate for irrigation, and a 1997 EIA case study, by a group including the Cameroon Association for EIA, concluded that the project was • not sustainable• .

## COSTA RICA

In 1998, Sogreah began work on the master plan for the Reventazon river basin.

## CYPRUS

Sogreah worked with Sir William Halcrow and Partners (UK) on the World Bank-funded Southern Conveyor Project for Water Resources Development. The project included a dam, reservoir, water supply pipelines and treatment works.

## EGYPT

The Egypt New Valley Project aims to irrigate 400,000 ha of land with water from Lake Nasser via the Toshka pumping station – 260 kms south of the Aswan dam. Sogreah won the contract for the supervision of the construction of the pumping station and for the design of the 100 km-long main canal. Lahmeyer International worked on the plan for the pumping station. Sogreah also worked on the 78 MW New Esna dam.

## FRANCE

Sogreah is working on the flood protection scheme for the city of Rennes, including • studying development scenarios aimed at mitigating the corresponding impacts. •

## JORDAN

Sogreah worked with the local company, Sajdi and Partners, on studies for water conveyancing systems from two proposed storage dams on the Yarmouk and Jordan rivers. In September 1995, Sogreah bid for a further design contract on the project.

## KAZAKHSTAN

In 1987-1988, Sogreah worked on the Syr Darya and Aral Sea water resources management.

## KENYA

Turkwell Gorge [See main text]. Sogreah also worked on the 51 m-high Chemususu rockfill dam.

## LAOS

Nam Leuk [See main text]. Sogreah also worked on the 440 MW Nam Ngiep dam, providing environmental services to the project, in October 1999, and in the early 1990s the company produced a feasibility study for the 54 MW Xedon 2 dam.

## LESOTHO

Sogreah formed part of the SCBG-Europe consortium, with Coyne et Bellier (France) and Sir Alexander Gibb (UK), which was responsible for engineering services from preliminary studies to final commissioning for the 180 m-high Katse dam. Knight Piesold (UK) was also involved in a joint venture investigating, designing and supervising the building of the Katse [see sections on Coyne et Bellier and Knight Piesold].

## MALAWI

In 1997-1998, Sogreah worked on the Lilongwe water supply dam.

## MALI

Sogreah worked on the Markala dam rehabilitation.

## PAKISTAN

Between 1990-1998, Sogreah worked on the 180 MW Chashma hydropower plant, and it also worked on the 30 MW Jagran dam.

## PHILIPPINES

In 1995, the French government funded Sogreah to work as technical consultants on an IFC-backed programme to privatise the Metropolitan Manila Water and Sewerage System (MWSS). MWSS is the Philippine government-owned water supply, treatment and distribution utility. The company also worked on the 64 MW Amburayan dam.

#### RWANDA

Between 1997 and 1999, Sogreah worked on the 15 MW Nyabarongo hydropower scheme.

#### SWAZILAND

Sogreah worked on the 19 MW Maguga hydropower dam. Lahmeyer International also worked on this project.

#### THAILAND

Pak Mun dam [see main text].

#### TUNISIA

Sogreah worked on the Sidi Arch, R'Mel and El Breck dams.

#### VIETNAM

Dai Ninh dam [see main text].

#### SOURCES

Collings: 1999

EAB: 1997

H&D: 1997d

IFC: 1995

LI: 1998b

QED: 1995b

QED: 1995c

Sogreah: www 1

Sogreah: www 3

World Bank: 1984b

World Bank: 1984a

WP&DC: 1998



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**V**A Tech Voest MCE is the hydropower sector of the Austrian Voest-Alpine Technologie AG (VA Tech). VA Tech emerged in the 1990s from the privatisation of the Austrian state-owned Voest-Alpine, a huge steel and engineering group which was at one time Austria's largest firm. In 1985, Voest-Alpine suffered large losses after its trading company risked too much on the London oil market.<sup>13</sup> The entire board of Voest-Alpine was forced to resign,<sup>2</sup> and the company was restructured to become part of the newly created state holding company, Austrian Industries (AI), a conglomeration of steel and oil companies.<sup>3</sup> Fifteen thousand jobs were cut from the total of 100,000 at Voest-Alpine.<sup>4</sup>

Voest-Alpine ran into more controversy in February 1991 when 14 managers of Noricum, the weapons division of Voest-Alpine, were found guilty by an Austrian court for making illegal sales of weapons to Iran in 1984 and 1985, when Iran was at war with Iraq.<sup>5</sup> The deal was worth \$300 million, according to Peter Untereger, the former head of Noricum.<sup>6</sup> The Noricum scandal led to the Austrian government discontinuing all weapons production in state-owned enterprises.<sup>7</sup>

A 1993 Austrian privatisation programme led to the formation of Voest-Alpine Technologie AG (VA Tech) and Voest-Alpine Stahl.<sup>8</sup> VA Stahl inherited the steel-making activities of the old Voest-Alpine group.<sup>9</sup>

VA Tech's shares were publicly offered in 1995.<sup>10</sup> VA Tech generates 80% of its revenue from technological consulting, services and project management, and has sold off or closed down most of its industrial plants.<sup>11</sup> Described in the Financial Times as • one of Austria's greatest industrial success stories•,<sup>12</sup> VA Tech's income doubled from 1992 to 1996, and the share price tripled between its initial public offering in 1995 and August 1997.<sup>13</sup> In 1998, VA Tech's turnover was approximately \$3 billion with a staff of almost 18,000.<sup>14</sup> VA Tech's operations are divided into three groups with approximately equal sales: metallurgical engineering; energy and environment; and plant engineering and services.<sup>15</sup>

In 1998, VA Tech went through further restructuring, prompted by the financial crisis in South-East Asia and in the Russian business and financial markets. VA Tech bought the Rolls-Royce power transmission and distribution business and EZ Praha, the largest Czech electrotechnical plant builder.<sup>16</sup> In 1999, Voest-Alpine Industrienlagenbau (VAI, a fully-owned VA Tech subsidiary) bought Kvaerner Metals Equipment.<sup>17</sup>

VA Tech's hydropower division is VA Tech Voest Machinery, Construction and Engineering, a fully-owned subsidiary of VA Tech. In 1999, all the companies in the VA Tech group adopted the prefix • VA Tech•, because of • the positioning of VA Tech as [a] world brand,• according to Katharina Binovec, a spokesperson for VA Tech.<sup>18</sup> VA Tech Voest MCE was previously known as Voest-Alpine MCE.

In 1998, Voest-Alpine MCE employed about 6,000 people<sup>19</sup> and had a turnover of approximately \$800 million.<sup>20</sup> VA Tech Voest MCE manufactures turbines, penstocks, gates, valves, governors and other electro-mechanical equipment for hydropower plants. The company has supplied hydraulic turbines for over 2,000 contracts, with more than 60,000 MW installed capacity.<sup>21</sup> The VA Tech Voest MCE group

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includes VA Tech Hydro Vevey (Switzerland), PT VA Tech Voest (Indonesia), VA Tech Bouvier (France), VA Tech Bouvier (Canada), VA Tech Vamec Hidro Energetica (Brazil), and VA Tech Voest MCE Corp (USA). In 1992, Voest-Alpine MCE entered into a • strategic cooperation• with General Electric Hydro Canada.

### **Sulzer Hydro and VA Tech**

In October 1999, VA Tech and Sulzer AG of Switzerland signed an agreement under which VA Tech is to acquire the entire operations of Sulzer Hydro. Sulzer Hydro is one of the largest international suppliers of mechanical hydropower plant equipment and, in 1998, the company's sales were approximately \$220 million. Sulzer Hydro employs 1,650 people and has manufacturing plants and sales offices in Switzerland, Germany, Italy, Spain, North America, Mexico, Peru, India and China.<sup>22</sup> Sulzer Hydro has installed 16,000 turbines worldwide. The new company will operate under the name VA Tech Escher Wyss.<sup>23</sup> If the deal is approved, the merged company will be the world's second biggest maker of hydro-electric power plants.<sup>24</sup>

### **SULZER HYDRO AND DAMS**

#### **ILISU, TURKEY**

The Turkish Ministry of Energy chose Sulzer Hydro as the lead in a consortium to build the Ilisu dam. Sulzer will supply the generating equipment along with another Swiss company, ABB Power Generation. The Union Bank of Switzerland is arranging finance, and the Swiss government's export credit agency, Exportriskogarantie, is coordinating export credits and investment insurance guarantees. Exportriskogarantie has already approved an ECA-backed guarantee of 470 million Swiss francs to Sulzer and ABB for the equipment contract. Sulzer has commissioned the environmental impact study for the controversial project, a study which to date has been denied all attempts for public scrutiny [see box on Ilisu].

#### **NATHPA JHAKRI, INDIA**

A consortium called EUCONA, led by ABB and including Sulzer Hydro, won a \$41.3 million contract to supply turbines to the 1,500MW Nathpa Jhakri dam on the Satluj river in northern India. After 13 years getting the various clearances and approvals, it was discovered in 1994 that the level of the bottom of the dam wall was two metres below the figure given. The local State Electricity Board further miscalculated the height of the dam by another two metres. As a result, the dam will be able to generate its peak output continuously for only about half the time anticipated, thereby failing to meet peak demand in the region [see box on Nathpa Jhakri].

#### **THREE GORGES, CHINA**

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. 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. A minimum of 1.3 million people (latest estimates put the figure at 1.9 million) will be forced to leave. The dam is expected to cost at least \$43 billion – some unofficial estimates put the figure at \$75 billion – and would create a reservoir 400 miles long [see box on Three Gorges].

### **VA TECH AND DAMS**

VA Tech Voest MCE and its associated companies have supplied the mechanical equipment for numerous dams the world over. Between 1990 and 1995, the company supplied 80% of all hydromechanical equipment in Indonesia. Voest-Alpine has supplied hydraulic steel components and/or penstocks for almost every hydropower dam in Pakistan since 1993, including the bifurcator for the Tarbela dam – the world's largest bifurcator at over 13 metres in diameter. Many of the dams in which the company has been involved are renowned for the adverse social and environment impacts, including the Pangué dam (Chile), the Ertan dam (China), the Urra dam (Colombia), the Akosombo dam (Ghana), the Ghazi Barotha dam (Pakistan), the Tarbela dam (Pakistan) and the Caruachi dam (Venezuela).

#### **PANGUE, CHILE**

Voest-Alpine MCE supplied hydromechanical equipment to the Pangué dam,<sup>25</sup> the first of a six-dam cascade on the Biobío river in Chile. The indigenous Pehuenche people were not consulted before the

Pangue project was started and the plans and financing agreements already made. An independent anthropologist found that the Pehuenche people's human and constitutional rights had been violated, but the World Bank's IFC, which funded the dam, refused to release the report. Since its completion in September 1996, Pangue has produced only a fraction of its expected output because of low rainfall in the south of Chile [see box on Biobio dams].

#### SAN ROQUE, THE PHILIPPINES

In 1999, VA Tech Voest MCE was awarded the contract for the design, manufacture, supply and installation of 3,200 tons of steel liners for the San Roque dam, following the 1998 contracts VA Tech Voest MCE won for the dam.<sup>26</sup>

The 345 MW San Roque dam is planned for the Agno river in the Cordillera region of the Philippines. The hydropower and irrigation project is the last in a series of three dams on the Agno river which, over 45 years, have severely disrupted the lives, economy and environment of the region's Ibaloi people. The dam is opposed by thousands of Ibaloi people. Over 925 families would be displaced, and tens of thousands living downstream would face impacts to their livelihoods due to erosion and the destruction of fisheries.

In July 1999, the US-based NGO International Rivers Network coordinated an independent review of the Environmental Impact Assessment (carried out in 1984 by Test Consultants, and updated in 1997 by Pirnie/HEC International). The review found that the reservoir could fill with sediment much faster than the EIA predicts; the accumulation of toxic sediments could poison the water in the reservoir; and the dam could trigger earthquakes and worsen the flooding of the Agno river.<sup>27</sup>

One hundred and sixty families were evicted in 1998 after their homes were bulldozed to make way for the project. They have since spent more than a year in a temporary resettlement site waiting for the Philippine National Power Corporation to complete the permanent site. The resettlement areas offer no suitable farmland, no school and no health clinics.<sup>28</sup> No compensation has been offered for farmlands, crops, plants or trees from the proposed reservoir area.

JEXIM, the Japanese export credit agency, is currently supporting the project and has already approved a \$302 million loan for the San Roque Power Corporation – a joint venture between Marubeni, Kansai Electric (both Japanese companies) and Sithe Energies (a US company) – and is considering a further \$400 million of support. Although environmental and social impact assessments have been undertaken for the project, JEXIM has refused to make them available to those affected by the project or to NGOs in Japan.<sup>29</sup>

Recent changes to Philippine law have recognised the right of local communities and indigenous peoples to veto destructive projects. Yet according to opponents of the dam, local opinion has not only been ignored but cynically misrepresented. Filipino authorities, for example, told JEXIM that the project had the necessary local support, despite affected communities being strongly opposed.

Local indigenous groups accuse the government and the companies of using patronage and the promise of future government development grants for the area to engineer the region's municipal authority into consenting to the project. Although the Itogon Municipal Council at first opposed the dam, it is now split on the issue, following a visit by the then President of the Philippines, Fidel V. Ramos, and officials from Marubeni. In a statement condemning the Council, the Cordillera Peoples' Alliance charges:

• *In order to protect their personal interests as bureaucrats and traditional politicians, the Municipal Council has succumbed to the bribery of the national government in the amount of Peso 50 million in infrastructure projects. This they have done in [betrayal of] the basic rights of their constituency, whose lives, land and livelihood are now endangered by the dam project. The Council has reduced the issue to money matters as if this were the only way to govern. This is an outright misrepresentation of the peoples' interests.*<sup>30</sup>

Lorenzo Demot of the Council of Elders of the Shalupirip Santahnay Indigenous Peoples' Movement also points out that claims of support for the dam amongst those who will be resettled are highly misleading. Most residents in the area, he claims, are tenants who are afraid to voice their opposition publicly because they do not own the land they are tilling and living on. In many cases, their landowners support the project or have agreed to sell their land to the company.

JEXIM has merged with Japan's bilateral aid agency, the Overseas Economic Co-Operation Fund (OECF), to form a new institution. This institution will be the world's largest single source of public financing for infrastructure projects and other investments in low-income countries, dwarfing even the World Bank. The Ibaloi are seeking international support for their struggle against the dam. • We are determined to fight against the project to the limit of our capacity• , says a statement issued in September 1998. • We will not be a party to our own death. •

#### ERTAN, CHINA

VA Tech Hydro Vevey supplied governors for the 3,300 MW Ertan hydropower dam.<sup>31</sup> The work is part of a \$776 million contract won by Impregilo of Italy to build the dam along the Yalong river, a tributary of the Yangtze river in Sichuan province. Impregilo leads the Ertan Joint Venture, which also includes Torno (Italy), Dumez (France), GTM (France), Holzmann (Germany), Hochtief (Germany) and Changian Gezhouba Engineering Bureau 8B (China).<sup>32</sup> The implementing agency is the Ertan Hydroelectric Development Corporation (EHDC) [See section on Impregilo for further information on Ertan].

#### BHUMIPHOL, THAILAND

Located on the Ping river in north-west Thailand, the World Bank-funded Bhumiphol dam was first commissioned in 1964 with a capacity of 140 MW. Subsequently more turbines have been added to upgrade the capacity to 535 MW. By 1990, the original turbines were worn out, and the Electricity Generating Authority of Thailand (EGAT) awarded three separate renovation contracts to VA Tech Voest MCE for all six turbines.<sup>33</sup> The last two renovated turbines are due to be commissioned in January 2001.<sup>34</sup> The 30,000 hectare reservoir behind the dam is the second largest in Thailand, and led to the forced eviction of 20,000 people. The dam has never operated to its full capacity. In March 1994, the reservoirs behind the Bhumiphol and Sirikit (both World Bank-funded) dams contained only 7% of their total usable volume. EGAT's answer is to propose yet more dams on the Salween river, on the Thai-Burma border so as to divert water into the Bhumiphol reservoir [see sections on Kvaerner and ABB].

#### URRA I, COLOMBIA

In 1997, Voest-Alpine MCE won an order from Skanska, the main contractors, to design, supply, install and commission intake/outlet steel linings and gates for the Urra I dam on the Rio Sinu in the State of Cordoba<sup>35</sup> [see section on Skanska].

#### CIRATA, INDONESIA

Completed in 1998, VA Tech Voest MCE designed, manufactured and installed four Francis turbines and other hydromechanical equipment. The Cirata dam is Indonesia's largest hydropower plant.

#### **VA Tech and the World Commission on Dams**

According to Katharina Binovec, a spokesperson for VA Tech, the company is, • as far as we know, not• involved in the World Commission on Dams. In response to questions regarding whether VA Tech sees the WCD as a constructive process, she replied, • cannot say as we don't know. •<sup>36</sup>

1 Newham, 1988.

2 ECN, 1988.

3 Rodger, 1992.

4 Newham, 1988.

5 CDI, 1991.

6 Dempsey, 1989.

7 CDI, 1991.

8 Blum, 1993.

9 Frey, 1997.

10 Frey, 1997.

11 Frey, 1997.

12 Frey, 1997.

13 Frey, 1997.

14 Voest, 1999b.

15 Frey, 1997.

16 VAI, www 1.

17 VAI, 1999.

18 Binovec, 1999.

19 Voest, 1999b.

- 20 Voest, 1999b.
- 21 Voest, www 2.
- 22 Voest, 1999b.
- 23 Binovec, 1999.
- 24 Hall, 1999.
- 25 IWP&DC, 1995h.
- 26 Voest , 1999a.
- 27 IRN, 1999e.
- 28 IRN, 1999e.
- 29 Berne Declaration, 1999: 9.
- 30 CPA, 1999.
- 31 Voest, www 3.
- 32 H&D, 1996e.
- 33 Voest, www 2.
- 34 Voest, 1997.
- 35 Voest, 1998a.
- 36 Binovec, 1999.

## **VA TECH, SULZER: DAMS AT A GLANCE**

### **AUSTRIA**

Voest-Alpine MCE supplied Pelton turbines for the Ausserfragent dam in the south of Austria. In September 1997, Bouvier SA (the French subsidiary of Voest-Alpine MCE) won a contract for the design and installation of the turbine and other electro-mechanical equipment for the 671 kW Gosslitzbach dam. Voest-Alpine MCE supplied Pelton turbines for the 42.8 MW Oschenik dam in the south of Austria.

Seesperre-Plansee dam. The Plansee lake has been dammed since 1903, and regulation of the lake was done by outlet gates. In December 1997, Voest-Alpine MCE with Bouvier Hydro won the contract to design, supply and install a 1 MW pit turbine to replace the gates.

VA Tech Bouvier Hydro won the contract to replace the turbines in the 1.7 MW Strechenbach dam, built in 1908, and supplied new runners for the existing Pelton turbines at the Uttendorf dam, a 30 MW dam in the Stubach Valley, completed in 1950.

### **BANGLADESH**

In 1998, a consortium of ABB SAE Sadelmi (Milan) and Voest-Alpine MCE completed the refurbishment and upgrading of the first two generating sets (from 41 to 47 MW) of the Karnafuli dam in the south-east of Bangladesh. ABB and Voest-Alpine manufactured and supplied the original electromechanical equipment for the dam.

### **BHUTAN**

Voest-Alpine supplied two Pelton turbines, the 1.3 km-long penstock and other equipment for the 23.8 MW Basochhu dam in Wangdi Phodrang province. The dam was funded by the Austrian government, and was due to be completed in 1999.

### **BOSNIA**

The Jablanica dam on the Neretva river, 80kms south-west of Sarajevo, was completed in 1958. Hydro Vevey modernised the governing system in the early 1970s, and in 1998 Hydro Vevey supplied a new turbine for the Swiss government- and World Bank-funded modernisation of the 33 MW dam.

### **BRAZIL**

In May 1998, Vamec Hidro Energetica (the Brazilian subsidiary of Voest-Alpine MCE) announced it had won the contract for the supply and engineering of the 1.5 km-long penstock for the 6 MW Ervalia dam. In December 1997, Vamec Hidro Energetica was awarded a \$2 million order for the rehabilitation of two Kaplan turbines at the Salto Grande dam. In November 1998, Vamec Hidro Energetica announced it had won the \$5 million contract for the electromechanical equipment. VA Tech Bouvier Hydro will engineer the four • S• type turbines for the 5.2 MW Sao Gabriel da Cachoeira dam.

### **CANADA**

VA Tech Bouvier Canada supplied \$3 million worth of electromechanical equipment for the 5 MW Batawa 4 dam on the Trent Severn Waterway near Trenton, Ontario.

## CAMEROON

Only a few years after completion in 1988, the concrete structure of the 384 MW Song Loulou dam and powerhouse started to crack, resulting in damage to the turbines and requiring costly repairs. Hydro Quebec of Canada won a \$1 million contract, funded by the state utility Societe Nationale d'Electricite du Cameroun (SONEL) to investigate the problems with the Song Loulou dam. One turbine was repaired with funding from the Cameroon government, and the Swiss government granted \$5 million for the rehabilitation of the remaining seven turbines. VA Tech Hydro Vevey (the Swiss subsidiary of VA Tech Voest MCE) won the contract.

## CHILE

VA Tech Hydro Vevey supplied one 39.5 MW Francis turbine to the Loma Alta dam. Voest-Alpine MCE Chile was the main contractor and manufactured and installed the penstock for the Rucue dam.

## COSTA RICA

Voest-Alpine MCE supplied turbines for the 132 MW Angostura dam, the largest power station in Costa Rica. The dam was partly funded by the Inter-American Development Bank. Bouvier Hydro supplied two Francis turbines, generators and valves for the 11 MW Rio Lajas dam.

## CZECH REPUBLIC

Voest-Alpine MCE supplied two pit turbines and other hydromechanical equipment for the Libice dam, commissioned in January 1998.

## FRANCE

Bouvier Hydro was responsible for the inclined shaft design for the 2.3 MW Capdenac dam on the Lot river in the south-west of France, due to be commission in 1999. In February 1998, a consortium of Bouvier Hydro and Fournie-Grospaud signed a contract to supply, install and commission all electromechanical facilities for the Pierre-Benite dam on the Rhone. In December 1998, VA Tech Bouvier Hydro signed a contract with Electricite de France to supply equipment for repairs to the Valliere power plant.

## GERMANY

In February 1998, Voest-Alpine MCE and Bouvier Hydro won contracts to supply • S• type turbines for the 569 kW Antonstahl and the 177 kW Schonheide dams in Saxony. Voest-Alpine MCE supplied pressure shaft lining and hydraulic steel structures for the 1,060 MW Goldisthal dam, in Thuringen. Due to be completed in 2002-3, Goldisthal is Germany's largest pumped storage power station and is estimated to cost \$530 million. The total value of the VA Tech group's contracts for the project is approximately \$44 million. Lahmeyer International also worked on the Godisthal dam.

In September 1997, Voest-Alpine MCE won the contract for design, supply, installation and commissioning of the • S• type turbine and generator equipment for the 310 kW Linden dam in Bavaria, and VA Tech Voest MCE won the contract to renew three Francis turbines at the Toding dam in Bavaria. Siemens' Brazilian subsidiary supplied generators.

## GHANA

In September 1998, a consortium of Voest-Alpine MCE and GE Hydro Canada won the \$11 million contract to refurbish the six Francis turbines of the 912 MW Akosombo dam, which were commissioned between 1965 and 1972. The Impregilo Group originally constructed the dam [see Introduction • Hydropower – Into the Future• and Impregilo section for further information on Akosombo].

## GREECE

Commission in 1990, the 115 MW Pigai dam is on the Aaos river in north-west Greece. In 1986, Voest-Alpine won the contract for the design and supply of the electromechanical equipment. Components were manufactured jointly in Voest-Alpine's Vevey workshop and by Metka in Athens. The 128 MW Thissavros dam was built on the Nestos river between 1991 and 1997. Equipment for the dam was designed and supplied by a consortium consisting of Metka, Cegelec, Alstom and Hydro Vevey.

## GUATAMALA

Voest-Alpine MCE supplied turbines and other hydromechanical services for the 15.9 MW Secacao dam. VA Tech PSG organised the financial package for the dam's construction.

## INDIA

In early 1997, GE Hydro awarded Hydro Vevey the contract for design and supply of electromechanical equipment for the extension of the existing Kuttiyadi dam.

## INDONESIA

VA Tech Voest MCE supplied electromechanical equipment for the following dams: Cirata (1000 MW), Besai (92 MW), Singkarak (220 MW) Tulungagung (38 MW) and Balanbano. In May 1997, Voest-Alpine MCE signed a contract for the supply of hydraulic steel structures for the Balambano hydroelectric plant, on the Larona river, Sulawesi. In January 1996, a consortium of GE Canada, Elin Energieversorgung and Voest-Alpine won the contract to supply electromechanical equipment to the dam. The electricity from the plant will be used for the extension of an existing nickel mine.

Completed in 1998, VA Tech Voest MCE designed, manufactured and installed four Francis turbines and other hydromechanical equipment for the Cirata dam, which powers Indonesia's largest hydropower plant [See main text].

## IRAN

Voest-Alpine won the \$145 million contract to supply hydromechanical equipment for the 2,000 MW Karun-3 dam. An ABB-led consortium won the \$1.25 billion contract to build the dam.

## JAPAN

In June 1997, Voest-Alpine MCE commissioned two Francis turbines for the 8.6 MW Satsunaigawa dam on the island of Hokkaido. The turbines were designed and manufactured by Bouvier Hydro.

## MALAYSIA

In 1995, Voest-Alpine and Elin Energieversorgung formed a consortium with the government of Perak State to refurbish the Chenderoh dam. The contract is worth \$40 million.

## NAMIBIA

Voest-Alpine MCE supplied equipment for the modernisation of the 240 MW Ruacana dam.

## NIGERIA

Voest-Alpine supplied Kaplan turbines to the Kainji dam in 1972. Impregilo constructed the dam [See section on Impregilo].

## PAKISTAN

In 1993, Voest-Alpine supplied the bifurcator for the Tarbela dam – the world's largest bifurcator at over 13m in diameter. In late 1998, VA Tech Voest MCE won a \$14 million contract to supply and install five 225 metre-long penstocks for the 1,500 MW Ghazi Barotha dam on the Indus River. Voith won the contract to supply and install turbines [See Impregilo section for more information on the Tarbela and Ghazi Barotha dams].

## PERU

In May 1997, Bouvier Hydro signed a contract for the supply of the complete electromechanical package for the 5.5 MW Monobamba II dam in Chanchamayo province.

## PHILIPPINES

Located on the Magat river, the 370 MW Magat dam was designed to irrigate 100,000 ha. Built in 1983, Voest-Alpine supplied four Francis turbines and other hydromechanical equipment. In 1998, Voest-Alpine MCE upgraded the governor system with digital technology.

## EL SALVADOR

In April 1999 a consortium of VA Tech Elin and VA Tech Hydro Vevey won the contract for the rehabilitation of five Francis turbines for the 84 MW 5 de Noviembre dam, described by Voest as the first large rehabilitation in Central America.

## SLOVAKIA

In late 1998, VA Tech Voest MCE won the order to rehabilitate two Kaplan turbines at the Ladce dam.

- The order was received by ABB Energie AG Vienna based on a consortium agreement.
- The first

Kaplan turbine of the 38.1 MW Zilina dam on the Zah river was completed in December 1997. Voest-Alpine MCE supplied turbines and other hydromechanical equipment. A consortium of ABB SAE Sadelmi (Milan), ABB Energie (Vienna) and Voest-Alpine MCE (Linz) carried out the hydromechanical works.

#### SOUTH AFRICA

Voest-Alpine installed new digital speed governors at the 1,000 MW pump storage Drakensberg dam.

#### SPAIN

In November 1997, Hydro Vevey won the contract for the renovation of the speed governing systems of the 290 MW Saucelle 1 power plant in Salamanca. VA Tech Hydro Vevey designed and manufactured pump turbines and valves for the 85 MW Soutelo dam. VA Tech Voest MCE supplied other equipment. The company also designed and supplied pump turbines for the 34 MW Valparaiso dam, commissioned in 1988. The Valparaiso dam is one of three dams on the Rio Tera in northern Spain. In 1998 Hydro Vevey won a contract as part of the rehabilitation of the 10.2 MW Zorita dam.

#### SUDAN

In 1999, the National Electricity Corporation of Sudan signed a \$9 million contract with VA Tech Voest MCE for the rehabilitation of three Kaplan turbines in the 44 MW Roseires hydropower plant on the Blue Nile, 500 kms south of Khartoum. Completion is scheduled for October 2001. Impregilo was involved with building the Roseires dam.

#### SWITZERLAND

Va Tech Hydro Vevey supplied three Pelton turbines to the Amsteg dam, and in December 1998, a consortium of VA Tech Hydro Vevey and ABB won the contract to supply turbines for the rehabilitation of the 10 MW Aubonne dam, built in 1896.

Design and supply for the 1,250 MW Bieudron dam was carried out by a consortium including Sulzer Hydro and VA Tech Hydro Vevey. The first two units were commissioned in Autumn 1998. VA Tech Hydro Vevey won the contract to renovate the turbine at the 32 MW Croix dam in the Valais, Switzerland. In December 1997, Hydro Vevey won the contract to overhaul the Kaplan turbines at the 3.1 MW La Goule dam. VA Tech Hydro Vevey also worked on the modernisation of the Lavey dam. In 1989, Hydro Vevey won the order to supply a Pelton turbine from the electricity company of the state of Fribourg for the 3.2 MW Ste-Ann dam.

#### TURKEY

In March 1999, VA Tech Elin led a consortium that signed a contract to manufacture and supply steel structure equipment, penstocks and cranes for the 300 MW Borcka dam on the Coruh river near the border with Georgia. Other members of the consortium are VA Tech Voest MCE, Verbundplan (Austria), Strabag (Austria), Voith Hydro (Germany), Temelsu (Turkey) and Yuksel (Turkey). The consortium will build both the Muratli (see below) and Borcka dams on the Coruh river. Societe Generale, Nissho Iwai, ABN Anro, Erste bank and RZB are funding both dams, with KfW the joint lead arranger. The total project cost is \$600 million and includes two export credits and seven commercial loans.

VA Tech Hydro Vevey is part of the consortium (with ABB and Sulzer Hydro) supplying electromechanical equipment for the 680 MW Deriner dam. VA Tech Voest MCE are also supplying equipment for the dam. The financing of the \$700 million project involves an export credit facility covered by the Swiss and Austrian export credit agencies, and a \$315 million loan from the Swiss Bank Corporation. ABB Structured Finance acted as co-arranger with Swiss Bank Corporation on one of the loan facilities. The Deriner dam is the fifth biggest concrete dam in the world. Turkey's president Suleyman Demirel laid the foundation of the dam on 26 April 1998. The dam is located on the Coruh river in the east of Turkey, upstream of the Borcka and Muratli dams. The Coruh river flows into the Black Sea.

In June 1997, Bouvier Hydro signed the contract for the supply of the electromechanical works for the 16.5 MW Fethiye dam. VA Tech PSG was involved with financing the contract. Voest-Alpine supplied Francis turbines, installed in two stages in 1967 and 1976, for the 1,400 MW Keban dam. In March 1999, VA Tech Voest Alpine signed the contract to manufacture and supply structural steelwork, turbines, valves and governors for the 115 MW Muratli dam. The Muratli dam is the most downstream



of a proposed cascade of 11 dams on the Curah river. In June 1998, a consortium of VA Tech Voest MCE and VA Tech Bouvier Hydro won the contract to supply and install two • S • type turbines and other hydromechanical equipment for the 9.4 MW Sucati dam. Siemens AG Austria is the main contractor for electrical-mechanical equipment for the power plant.

VA Tech Bouvier Hydro also supplied Francis turbines, generators, valves and instruments for the 14.2 MW Tohma dam, in the south-east of Turkey.

#### USA

In 1992, VA Tech Voest MCE was awarded the contract to renovate the turbine and other equipment on the 64.4 MW Cabinet Gorge dam on the Clark Fork river, Idaho. In July 1999, VA Tech Voest MCE announced that it had won the \$40 million contract for the renewal of the 18 Francis turbines for the 2,520 MW Grand Coulee dam in a consortium with GE Hydro (Canada). Completion of the last unit is scheduled for 2007. Siemens won the contract for the generator refurbishment. Construction on the Grand Coulee dam began in 1937. When completed in 1941, the dam was the world's largest masonry structure, and the world's highest capacity hydropower installation.

VA Tech Voest MCE Corp. won the contract to supply three new Francis turbine runners for the 140 MW Hyatt dam in California and Voest-Alpine supplied Kaplan turbines for the John Day dam on the Columbia river, Oregon. In August 1998, the Water Reclamation District of Greater Chicago awarded Voest-Alpine MCE the order to rehabilitate the 13.5 MW Lockport power plant, built in 1907 and rehabilitated in 1936.

The US Army Corps of Engineers awarded a consortium of Voest-Alpine MCE and GE Hydro Canada an order for the rehabilitation of Kaplan turbines at the 45 MW Jim Woodruff dam. The order is valued at approximately \$4 million and is due to be completed in 2002.

#### VENEZUELA

Voest-Alpine MCE was responsible for the radial gates and hydraulic equipment for the 2,100 MW Caruachi dam. The contract is worth \$12 million and is due to be completed in the year 2000. Impregilo was involved in the preliminary works for the dam [See Impregilo section for further information on the Caruachi dam]. In 1991-92, Voest-Alpine MCE was involved in the Macagua dam.

#### SOURCES

CNW: 1998  
ENR: www 3  
IWP&DC: 1995b  
IWP&DC: 1995g  
IWP&DC: 1998a  
LI: www 2  
Nicholson: 1992  
SBC: 1997  
TPR: 1998  
Voest: 1997  
Voest: 1998a  
Voest: 1998b  
Voest: 1998c  
Voest: 1999a  
Voest: 1999b  
Voest: www 1  
Voest: www 2  
Voest: www 3

- **The Ilisu Hydropower Project, Turkey** (ABB, Balfour Beatty, Impregilo, Skanska, Sulzer Hydro)

Construction on the 1,200 MW Ilisu dam, the largest planned hydroelectric project in Turkey, is due to start in 2000 and is expected to take seven to eight years. Located on the Tigris river in Turkish Kurdistan, 65 kilometres upstream from the Syrian and Iraqi borders, the \$2 billion project is part of Turkey's South-Eastern Anatolia Project (Turkish initials • GAP• ). GAP is a \$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.

Originally planned as a Build-Operate-Transfer (BOT) scheme, the project failed to find a bidder. Subsequently, the Turkish Ministry of Energy opted to go ahead on its own, awarding the contract to a consortium led by the Swiss company, Sulzer Hydro. Construction has been subcontracted to a further consortium made up of, among others, Balfour Beatty, Impregilo, Skanska and the Turkish companies, Nurol, Kiska and Tekfen. ABB Power Generation and Sulzer Hydro will supply the generating equipment.

The Union Bank of Switzerland is arranging finance. Export credits and investment insurance guarantees are now being sought by the construction consortium from the export credit agencies (ECAs) of Austria, Germany, Italy, Japan, Portugal, Sweden, Switzerland, the UK and the US. Coordinated by the Swiss Exportriskogarantie, the ECAs are presently negotiating a • common position• on Ilisu. Switzerland has already given its conditional approval for an ECA-backed guarantee of 470 million Swiss francs for the equipment to be supplied by ABB Power Generation and Sulzer Hydro. Britain's Export Credits Guarantee Department (ECGD) is considering a £200 million investment guarantee for Balfour Beatty, which is leading the construction consortium, and has said that it is • minded• to give conditional approval. Italy's export credit agency, SACE, has approved a \$152 million guarantee, although this has yet to be confirmed by the Interministerial Committee on Economic Planning, SACE having formally requested an opinion on its financial involvement in the project.

In 1998, a report by the Swiss-based Berne Declaration highlighted major political, social, environmental and archaeological problems with the project. The report concluded that it violated numerous • internationally recognised benchmarks for the funding and implementation of infrastructure and development projects• , abrogating five World Bank policy guidelines on 18 counts and the OECD Development Assistance Committee's guidelines on projects involving involuntary resettlement. The Berne Declaration also warned that the project contravenes core provisions of the 1997 UN Convention aimed at preventing wars between states that share water resources. During the UN General Assembly which voted to approve the Convention, Turkey was among only three countries which opposed the new agreement. Indeed, World Bank support for the project has consistently been refused due to fears that the project will be used to interfere with the water supplies of downstream states.

### **Lack of Transparency**

Public access to the environmental impact study for the project, commissioned by Sulzer and undertaken by a team headed by Hydro Concepts Engineering (HCE) of Switzerland, has been consistently denied.

### **No Consultation**

The Ilisu Dam would flood an area of 313 square kilometres. As of January 2000, however, no consultation had taken place with those who would be moved — a clear violation of accepted international practice in projects involving resettlement — and even local elected officials have been denied access to project documents. Many officials were not even aware that the Turkish government had approved the project. Independent reports suggest that few local people are in favour of the dam as currently conceived. However, many are afraid to speak out. Since 1984, the region has been wracked by a savage armed conflict between the Turkish security forces and PKK guerillas fighting for Kurdish rights. Arrests, torture and disappearances are commonplace.

## **Underestimating the Numbers**

The project developers claim that the dam would flood 50 small villages and hamlets, in addition to the town of Hasankeyf. But a list obtained by a delegation to the region, organised by the London-based Kurdish Human Rights Project (KHRP) in late September 1999, puts the figure at 68 villages, and 57 more whose land would be partially flooded. All in all, a minimum of 36,000 people would require resettlement or would be affected by the project — twice the numbers admitted by Balfour Beatty. The company argues that the higher figures are based on a 1990 census and that many people have left the area in search of economic opportunities elsewhere. In fact, much of the out-migration has been under duress. KHRP has discovered that at least 19 villages in the reservoir area have already been evicted at gunpoint, in many cases their houses being razed to the ground. The evictions took place as part of military operations by the Turkish security forces against the PKK.

At present, most of those who have been forcibly evicted have not been compensated. Moreover, many would return if they were able to do so. As one of those evicted from the Ilisu reservoir area has stated:

- The army beat me up and they pushed us out of our homes. We are against the dam because one day we want to go back to our villages with our animals. We are living twelve to a room in Istanbul. We want to go back to our homes. •

The evictions are part of a wider pattern of human rights abuse in south-eastern Turkey. Thousands of villages in the region have been evacuated at gunpoint by the Turkish security forces over the past decade. Judgements of the European Court of Human Rights are evidence of widespread destruction of homes in the area. The Ilisu dam would remove any prospect of those already evicted from the reservoir area — possibly as many as 12,000 people — returning home. In addition, a resettlement plan for those still to be displaced has yet to be finished, let alone agreed. Most are likely to find themselves joining millions of other Kurds in the shanty towns of Batman, Diyarbakir and Istanbul.

## **Lack of Resettlement Plan**

Compensation terms have yet to be announced and will only be decided once construction has started. The experience of those resettled by other GAP projects, however, does not bode well for poorer oustees from Ilisu. Turkish law on resettlement has frequently been flouted and poorer, landless oustees have suffered disproportionately. In the case of the Ataturk dam, for example, only landowners have been compensated. Landless families have predominantly been left to fend for themselves.

## **Independent Monitoring Unrealistic**

The companies in the Ilisu consortium, together with the export credit agencies considering support for the project, have proposed that resettlement be subject to independent monitoring. However, the head of Turkey's dam building programme has made it clear that he is unprepared to countenance an independent monitoring team with powers to halt the project in the event of human rights violations.

- Conditions in the region • — the standard euphemism for the ongoing war — also make independent monitoring an unrealistic prospect. Detentions, forced evictions, the use of torture and constant police surveillance have created a climate of fear and intimidation in which it is well nigh impossible for people to voice opposition to the government without fear of retribution. There is a widespread perception amongst local officials, for example, that to challenge the project would be to invite prosecution. Organised opposition to the dam would be difficult, if not impossible. • Public demonstrations are forbidden without permission being granted — and it wouldn't be granted • , says one of those interviewed by KHRP. • A petition would be possible but the government would take no notice of it. Of course, as an individual, I can voice my concerns, but if an organised movement emerged against the dam, it would be crushed. •

## **Ethnic Cleansing?**

Many view Ilisu — along with other GAP projects — as part of a wider strategy of destroying the Kurds as an ethnic group. The dam would flood Hasankeyf, an ancient citadel of great cultural significance to the Kurds. • By destroying Hasankeyf, they hope to eliminate our history. Anything that wasn't created by Turkey, they want to destroy'. • More pragmatically, the dam would provide the authorities with a rationale for moving those in the reservoir area out of their villages and into planned urban areas where they can more easily be monitored and controlled. It would also cut off the escape routes of the Kurdish guerrillas to the mountains.

## **Water Wars**

Many are worried that Turkey will use the 22 proposed GAP dams to exert political pressure on Syria and Iraq by restricting the flow of the Tigris and Euphrates to the two downstream states, both of which rely on the rivers for drinking water, irrigation and electricity generation. The spare storage capacity of Ilisu's planned reservoir alone would be sufficient to block the flow of the Tigris for, on average, two to three months a year. Turkey has not consulted Iraq over the building of Ilisu. It is therefore already in violation of Article 5, Protocol 1 of the Treaty of Friendship and Neighbourly Relations between Iraq and Turkey, signed in March 1946. The Treaty states: • Turkey shall keep Iraq informed of its plan for the construction of conservation works on the Tigris and Euphrates or their tributaries, in order that these works may as far as possible be adapted, by common agreement, to the interests of both Iraq and Turkey. •

The dam also potentially violates agreements drawn up between Turkey and Syria, which has protested to both Britain and Switzerland over its involvement in the dam. According to a Protocol on regulating the flow of the Euphrates, signed by Syria and Turkey in 1987, Turkey should release southbound 500 cubic metres of water per second. It is likely that Ilisu will reduce flows below this level whenever the reservoir fills. Noting the strategic importance of water in the region, a report by the UK Defence Forum (a think-tank which advises the British government on regional risks) has warned that the GAP project as a whole is:

• *One of the region's most dangerous water time bombs. The dispute has not erupted yet because the project has not reached its full potential. By the time of its planned completion in 2010, the vital interests involved give it the potential to become one of the region's most dangerous flashpoints.* •

Balfour Beatty claims that minimum rates of discharge have now been agreed for the critical impounding period. The details of the agreement have yet to be released, however. It is therefore impossible to evaluate how far they meet the concerns of Syria and Iraq over the project.

## **Bringing Pressure to Bear**

Those interviewed by the KHRP unanimously expressed their opposition to the dam as currently conceived. Many requested that their concerns be made known to the authorities in the countries considering support for the dam, the majority of them in the European Union. Kerim Yeldiz of the KHRP also calls for international pressure on the developers:

• The Ilisu project appears to be part of a wider strategy aimed at eradicating the Kurds as an ethnic group, by both breaking up their communities and destroying their culture. The willingness of the international community, which now acknowledges its responsibility for ensuring respect for human rights worldwide, to back such a project without a meticulous examination of its implications would be grossly irresponsible. •

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- **Lesotho Highlands Water Development Project** (ABB, Balfour Beatty, Coyne et Bellier, Impregilo, Knight Piesold, Kvaerner, Lahmeyer International, Sogreah)

The Lesotho Highlands Water Project (LHWP), Africa's largest civil engineering project, involves the construction of five dams in Lesotho's Maluti Highlands over 30 years, due for completion in 2020. The scheme would divert about 40% of the water (called • white gold• by the project authorities) in the Senqu river basin, via a complex series of tunnels, to South Africa's Ash river and from there into the Vaal dam 70 kilometres south of Johannesburg. Official estimates put the total project cost at \$8 billion, but these costs are not thought to include numerous unforeseen and costly problems. These problems include serious damage to the riverbed where the water is delivered by tunnels — a cost that may not be incorporated into the project price — or that of defending the Katse dam from possible sabotage during a military invasion in September 1998, to list just two.

Lesotho, which is surrounded by South Africa, will sell the water to supply South Africa's Gauteng province. Without the Muela dam, the hydropower component of LHWP, Lesotho is completely dependent on South Africa for its electricity. However, LHWP's proponents did not study Lesotho's potential alternative energy sources, nor did they not study water conservation as an option. Experts believe, for instance, that water conservation could meet Gauteng's water needs for another 12 to 15 years.

Work began in 1986 with the construction of an access road linking the Katse dam site with the South African border. Phase 1A, already completed, consists of the 182 metre-high Katse dam on the Malibatso river, the 72MW Muela dam on the Nqoe river (45 kilometres north of Katse), 82 kilometres of water tunnels, and 200 kilometres of access roads at an estimated total cost of \$2.5 billion. Phase 1B of the project, due for completion in 2003, includes the \$1 billion Mohale dam on the Senqunyane river and the Matsoku wier, with about 35 kilometres of associated tunnels connecting the new reservoirs to Katse. The Mashai dam, scheduled for completion in 2008, would be built under Phase 2, and the Tsoelike dam would be completed in 2017 under Phase 3. The final phase would be the Ntoahae dam that is planned for completion in 2020. Doubts have been expressed as to whether or not there will be enough water in the river to build all the dams.

The Lesotho Highlands Development Authority (LHDA), a semi-autonomous state corporation, is responsible for overseeing the projects and for raising the finance. The Trans Caledon Tunnel Authority (TCTA) is the implementing agency for the small part of the project that takes place in South Africa. Both agencies are represented on the Joint Permanent Technical Committee (now called the Lesotho Highlands Water Commission), a supervisory body set up by Lesotho and South Africa.

### **The Companies**

Lahmeyer International was part of the Lahmeyer Macdonald consortium, with Mott Macdonald (UK) and Consult 4 (South Africa), which carried out the 1986 feasibility study for the LHWP. Dumez (France) and LTA (South Africa) started the access road to the Katse dam in 1989. Sogreah was the lead company, with Coyne et Bellier and Sir Alexander Gibb (UK) in the SCBG-Europe consortium which designed and supervised construction of the Katse dam. The Highlands Water Venture consortium led by Impregilo built the Katse dam. The other firms in the consortium are Hochtief (Germany), Bouygues (France), Keir International (UK), Stirling International (UK), Concor (South Africa) and Group Five (South Africa). The tender price was \$480 million, and the final cost \$510 million. Knight Piesold was also part of the design/supervision joint venture on Katse dam, according to company documents. The Lahmeyer Macdonald consortium carried out an environmental audit for the Muela dam in 1997. The Lesotho Highlands Project Consortium won the contract for the Muela dam. The consortium consists of Spie Batignolles, LTA, Campenon Bernard, ED Zublin and Balfour Beatty. ABB Generation and Kvaerner Boving formed a joint venture to install turbines, generators and ancillary plant at the Muela dam.

### **The Funders**

The off-shore funding of Phase 1A of the project involved 25 different facilities coordinated by seven lead banks in six different currencies, five multilateral agencies and five government aid programmes.

Five South African banks provided the bulk of the commercial loans and export credits. The commercial banks include Banque Nationale de Paris (which loaned \$19.7 million) and Credit Lyonnais (\$17 million) from France, Dresdner Bank (\$15.8 million) and Kreditanstalt für Wiederaufbau (KfW) from Germany, and Hill Samuel (\$14.5 million) from the UK. The World Bank loaned \$150 million to the project and the UK's Commonwealth Development Corporation \$36 million. Export credits included \$118 million from Germany's Hermes, \$82 million from the UK's Export Credit Guarantee Department, \$104 million from COFACE of France and \$107 million from SACCE of South Africa. In March 1993, the Norwegian Agency for Development Cooperation (NORAD) rejected an application by Kvaerner Energy for \$9.4 million in credit support for the Muela dam. Norway's aid minister Kari Nordheim-Larsen refused the funding because the contract was for one of a series of dams whose cumulative social and environmental effects had not been studied. Germany, France and Britain, however, provided bilateral aid.

### **Sanctions Busting**

When the project finance was agreed, South Africa — which will receive all the water from the project — was subject to international sanctions. To avoid the difficulties of international financiers openly aiding the then-apartheid regime, LHDA's financial advisers — Chartered WestLB — set up a London-based trust fund through which payments could be laundered. Although Lesotho was the nominal borrower for the project, South Africa is in fact responsible for repaying the loans. The fiction that Lesotho is the borrower is still maintained, however, in the face of criticism of the project. In 1998, for example, residents of a local township filed a claim with the World Bank's Inspection Panel, pointing out that as the project effectively ignores demand side management in South Africa, it is in breach of World Bank rules for water projects. In response, the Bank stated: • As important as demand side management in the water sector is, there is no specific reference in the project to such measures, nor is there a legal requirement in the loan for RSA [Republic of South Africa] to implement such policies, since this is a loan to [Lesotho-based] LHDA. •

### **Corruption**

The project hit the business newspaper headlines in August 1999 after the Lesotho government accused Masupha Sole, the former CEO of LHDA, of taking nearly \$2 million in bribes from ten companies and two consortia. The charge sheet listed details of who allegedly paid Sole, and how much they paid him:

- \* ABB, \$40,410;
- \* Impregilo, \$250,000;
- \* Sogreah, \$13,578;
- \* Lahmeyer International, \$8,674;
- \* Highlands Water Venture (consortium including Impregilo, the German firm Hochtief, the French firm Bouygues, UK firms Keir International and Stirling International, and South African firms Concor and Group Five), \$733,404;
- \* Lesotho Highlands Project Contractors (consortium including Balfour Beatty, Spie Batignolles, LTA, ED Zublin), \$57,269;
- \* Acres International (Canada), \$185,002;
- \* Spie Batignolles (France), \$119,393;
- \* Dumez International (France), \$82,422;
- \* ED Zublin (Germany), \$444,466;
- \* Diwi Consulting (Germany), \$2,439;
- \* LHPC Chantiers (international consortium), \$63,959.

Switzerland's highest court decided on 20 May 1999 to give legal assistance to the Lesotho government in its case against Sole. Swiss newspaper Sonntags Zeitung reported that a court there found evidence that the 12 companies had paid money into Sole's bank accounts — payments that Sole could not adequately explain. In November 1999, the Lesotho authorities announced that the companies were to be prosecuted for having • wrongfully, unlawfully and corruptly made payments/transfers • to Sole. The World Bank is considering paying for the prosecution.

The companies involved have denied the charges. Prior to the announcement that the Lesotho authorities would prosecute, Romano Allione of Impregilo told the Washington Post, • no payment for whatever sum at whatever time has been made by Impregilo • to Sole. Meanwhile, interviewed on 12 November 1998, Anthony Collings, a Sogreah partner and project manager for the Katse dam, said:

- We at the moment are still not in a position to say anything other than as far as we're aware nothing of that nature has ever gone on . . . We wasted quite a bit of time following up what was said in the newspapers about direct payments. We did a major search. We drew a complete blank. We found nothing in there that implied anything improper whatsoever.
- Dr. J. Zimmerman, head of hydro-power and water resources development at Lahmeyer International, described newspaper reports alleging his company's involvement in bribery as a pretense.
- We can safely state that we do not know of any payments to Mr. Sole and without knowing details we can also not contribute to the clarification of these wrong publications.
- Zimmerman said. Richard Chappell, an official at the Canadian Department of Foreign Affairs and International Trade, told Canadian NGO, Probe International, that it was
- not treating this issue at all
- , despite the involvement of Acres International, a Canadian company. Acres itself has denied any wrongdoing:
- We did not make any such payments and we have no knowledge of any improper transactions.
- In December 1999, the Lesotho authorities issued an arrest warrant against James Griffiths of Acres for failing to appear in court to hear charges against him.

The World Bank has promised an internal investigation of the charges. According to its guidelines, the Bank can debar companies found guilty of corruption from bidding on Bank-funded projects. The guidelines do not require that a company be convicted, only for their involvement to have been established

- through an administrative process that permits the accused firm or individual to respond to the allegations
- . Nor do the guidelines allow the World Bank any discretion: once it has been determined that a firm
- has engaged in corrupt or fraudulent practices in competition for, or in executing, a Bank-financed contract
- , action must follow. The guidelines apply not only to any joint ventures and subsidiaries involved but also to the parent company and any other subsidiaries. However, Daoud Khairallah, the World Bank's acting general counsel, has told the Washington Post that the Bank would act against firms only if it could prove that World Bank funds had been tampered with. Transparency International's director Jeremy Pope comments:
- If you're bribing, you're bribing; and if you're unfit to be bidding for business, you're unfit.

### **Water Wars**

In 1998, the project helped set off what one South African river ecologist called southern Africa's

- first water war
- . In September, South African troops invaded Lesotho, ostensibly to restore order in the face of public protests against the government. In fact, the invasion was prompted in large part by a concern to protect the Lesotho Highlands project — South Africa's largest investment in the region. When the shooting was over, 17 people had been killed near the project's Katse dam and many more had died fighting in the capital, which was left in ruins. South Africa's Star newspaper stated:
- Protection of the dam and its pipeline supplying [the region] with water was a top priority of the occupation forces.

### **Inequitable Access to Water**

Official claims that the project is needed to meet the water needs of South Africa's poor black communities are increasingly under challenge. The biggest obstacle to providing South Africa's poor with water is not so much a question of supply as of equity. As Lori Pottinger of the US-based NGO International Rivers Network points out:

- *Low income black people in the townships near Johannesburg are subject to often indiscriminate water cut-offs, inadequate taps (usually just one for every 50 people in a yard), inadequate pressure and badly leaking apartheid-era pipes. Only the rich can afford this project's expensive water, which has made water bills rise dramatically. The project's high costs also uses public funds that could have been used to fix these leaking pipes, which waste up to half the water that runs through them, and other efficiency measures.*

### **Suppression of Workers**

Labour conditions at the construction sites of the dams have also led to controversy. In 1996, workers on the Muela dam organised a series of strikes to protest about the unequal treatment of workers from Lesotho compared to those of other countries; Lesotho workers earn less for the same jobs than South Africans. The strikers were also protesting about police harassment and the contractors' dismantling of negotiating structures set up with the local construction workers' union. On 14 September 1996, the consortium of contractors building Muela (Spie Batignolles, LTA, Campenon Bernard, ED Zublin and Balfour Beatty) called the police to evict workers from the construction camp, shortly after sacking 2,300 Lesotho workers for

- illegally striking
- . At least five workers were shot dead and more than 30 injured. Despite promises to investigate the matter and to inform the public of its findings, the World

Bank and the Lesotho Highlands Project Authorities have never released any report on the incident. No representatives of the affected local communities were included on the committee that undertook the investigation.

### **Social and Environmental Impacts**

Meanwhile, associated social and environmental problems continue to mount. The 1986 feasibility studies carried out by Lahmeyer and Mott McDonald concluded that there were no major environmental obstacles to the project. No comprehensive environmental impact assessment was ever made, however, nor were erosion or sedimentation studies conducted for Phase 1A. The downstream impacts also appear to have been overlooked. Not surprisingly, the environmental and social impacts of the project have been more severe than predicted. Soil erosion, already a major problem, has been aggravated by the construction of the dams and will be worsened still further as displaced villagers are forced to cultivate and overgraze steeper hillsides. A preliminary estimate of soil losses has predicted that the tunnels and the Muela outlet will be completely blocked in 50 years.

### **Loss of Livelihoods**

Of the total land area of Lesotho, less than 10% is suitable for arable farming. The Mohale valley, which would be flooded when the Mohale dam is completed, contains Lesotho's most fertile land and is the only region in the country to produce a surplus. Phases 1A and 1B of the project will together result in the loss of 4,635 hectares of grazing land and 1,500 hectares of arable land, according to the World Bank. Measures taken to help the 24,000 people who lost their farms, homes or access to communal grazing land as a result of Phase 1 of the LHWP have been heavily criticised as ineffective. Because Lesotho has so little arable land, those evicted to make way for the reservoirs have not been given replacement farmland but are forced to find new livelihoods. The Mohale will affect another 7,400 people.

Initially, the project emphasised training for resettlers in skills that were useless in Lesotho. One of the project consultants, who had long experience with forced resettlement for dams, was reported to have said privately that the chance of the project creating alternative livelihoods for affected people was virtually nil. Two Lesotho NGO workers, Motseoa Senyane and Thabang Kholumo, reported in September 1999 that a social fund set up with LHWP revenues has been used as a tool for opportunistic politicians rather than for the benefit of resettled communities. In a letter to the Washington Post, they stated: In Lesotho, we see the same stretch of road repaired, torn up the next week, repaired again the following week and then torn up once more at the end of the month. We see workers increase the height of unused dams and then cut spillways in them that effectively reduce their carrying capacities to their original levels. These projects are supported by the LHWP's social fund. Meanwhile, the Butha-Buthe international school, originally built for the children of foreign workers employed on Phase 1A of the project, faces closure due to lack of funds. The school is one of the most modern ever to be built in Lesotho. If it closes, local school children will be deprived of a major educational resource.

### **Inadequate Compensation**

It has taken the LHDA years to build replacement houses for displaced people. Many of those displaced by powerline construction in 1990-91, for example, were still without housing in October 1995, according to the World Bank. Others who lost homes to earthquakes caused when the Katse reservoirs were filled were forced to live in temporary storage-shed type housing for months, including over a very harsh winter. Houses in the Mohale resettlement sites already suffer from cracked walls.

Villagers also complain that compensation payments have been inadequate or remain unfulfilled. The compensation package provided for a lump payment for people who lost less than 1000 square metres of land. Those who lost more were to receive an annual delivery of corn for 15 years. Even LHDA health officers admit that the handouts are insufficient to sustain the life of an individual. In 1993, an LDHA survey revealed widespread dissatisfaction, the majority stating that the cash compensation did not reflect the productive value of the land. The payments also failed to take account of the loss of wild plants, fuel wood and building materials.

Although the project authorities originally undertook to provide fodder to compensate for the loss of grazing lands, this was done for five years only. In 1997, the villagers were told that the implementation period for compensation would extend over 50 years and that they would receive money instead of fodder and grain handouts. No lump sums, however, would be paid unless villagers



could produce a financial plan. A year later, no payments had been made. Our cattle are dying, villagers wrote in a letter to the project authorities. Our oxen are becoming too weak to plough and sow the fields.

### **Worse Off Because of the Project**

Although some families may have benefited from the LHWP training schemes, others are worse off. A schoolchild whose family was uprooted by the Katse, when asked to comment on the dam, wrote:

There is nothing worse than working hard at something and then have something come and destroy it. We were satisfied with the way we were working. We were plowing maize and beans. We were eating fresh maize. We had trees. We had firewood and people were buying it from us. We were getting money and we were able to go to school. When LHDA came and destroyed everything that was important to my family, we started to become poor. The dam took our fields and our trees. That was the end of our money. We needed to look hard to find enough money for us to attend school. We were given maize, beans, and a little money, but it is not as much as we were producing before. That was the end of our fire and fresh maize. Now, when I look at the dam, I still get very angry.

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- **Itaipu, Yacyreta, Corpus Christi (Paraguay/Argentina/Brazil)** (ABB, Impregilo, Knight Piesold, Lahmeyer International, Siemens)

The Itaipu, a joint Paraguayan-Brazilian hydro-dam on the Parana river, began production in 1985. The dam — at 12,600 MW, the most powerful in the world — generates 60 times more electricity than Paraguay needs, 97% of which is sold back to Brazil netting Paraguay \$1.445 billion in royalty payments between 1989 and 1997. It is also the most expensive dam ever built. ABB provided electromechanical equipment for the project, and Siemens supplied nine of its 18 generators.

The Yacyreta dam, upstream on the same river, has an installed capacity of 2,700 MW (after having been scaled down from 4,050 MW). Impregilo and Dumez led a joint venture as main contractor. Lahmeyer International was the second company in the 10-company consortium responsible for the engineering and construction supervision, called CIDY. Harza was the lead company in CIDY. Voith Hydro and Dom. Eng. Works manufactured 13 of the turbines and Impsa and Cometsarsa the remaining seven. Voith did the hydraulic design for adjustable blade units, and Voith and GE Canada the mechanical design. Siemens supplied generators (with Ansaldo, Mitsubishi, Hitachi and Toshiba). Impregilo assembled the turbine-generators on site (with CIE, Sade and Iglys).

From January to September 1998, Paraguay received \$315 million in royalties from the Itaipu and Yacyreta hydroelectric projects. The majority (56%) of the funds was used to repay foreign debt. Local authorities in the areas around the two projects are now pushing for a share of the income. Royalty payments from Brazil for power from Itaipu are in arrears by \$106 million. Foreign exchange earnings from the Itaipu and Yacyreta hydroelectric projects have been in the \$400-\$500 million range since 1993.

There is widespread dissatisfaction in Paraguay with Brazil's dominance of the management of Itaipu and the contract terms. Itaipu's joint Paraguay-Brazil management commission is \$4.2 billion in debt because Brazil has made unilateral and successive electricity rate reductions since the project was completed in 1985. The sale price of electricity is below the production cost in order to subsidise the Brazilian power companies. Some have called for the Paraguayan government to repudiate its share of the debt on the grounds that the original treaty signed in 1973 expressly required that the sale price of electricity should cover all costs.

#### • Infamous Examples of Hydro-Corruption •

Author Paddy McCully says in his book *Silenced Rivers*:

• *The megadams on the Parana river are probably the most infamous examples of hydro-corruption. Brazilian journalist Paulo Schilling and Para-guayan ex-legislator Ricardo Canese have described the building of Itaipu as 'possibly the largest fraud in the history of capitalism'. Itaipu was originally projected to cost some \$3.4 billion, but skim-offs by the military rulers of Paraguay and Brazil and their cronies contributed to the cost skyrocketing to around \$20 billion.*•

The Yacyreta dam was famously described by Argentinian president Carlos Menem as a • monument to corruption • . The dam's costs soared from an original estimate of \$2.7 billion to \$11.5 billion, and the still unfinished dam is currently 10 years behind schedule. It has faced technical, financial, social and environmental problems. Three turbines had to be taken out of service in 1998 at a cost of \$5 million in lost production when cracks appeared. In May 1999, four turbines failed and the binational operating company, Entidad Binacional Yacyreta (EBY), is seeking damages from the manufacturers of \$200,000 for each day the turbines are inactive.

#### Monuments to Money and Madness

Eight out of 10 families in the Paraguayan capital, Asuncion, have electricity, but four out of five families living in rural Caazapa do not. Paraguay's state electricity company, ANDE, has warned of blackouts unless it gets \$845 million to finance its 1998-2002 investment plan for generation and transmission. The World Bank and the Inter-American Development Bank (IDB) refused to lend any more than \$350 million to ANDE until the government establishes a regulatory body that would permit private sector participation. ANDE wants to increase electricity tariffs by 30% to overcome its critical financial state.

The floodgates of Yacyreta's reservoir were closed in 1994 before a detailed environmental and social mitigation plan was in place. The reservoir has never been filled to its full capacity and the dam is operating at only 60% of its installed capacity, below the project's financial break-even point. Financing has not been found for the \$857 million worth of additional construction work required to fill the reservoir, and for past and future resettlement and environmental mitigation costs.

The project was economically justified on the assumption that Argentinian electricity demand would increase by 8-10% per year during the 1980s. In fact, demand grew by around just 2%, so that when the first turbines came on-line in the mid-1990s, Argentina already had a surplus of generating capacity. The World Bank Performance Audit Report says: • Based on the foregoing, the Audit concludes that Yacyreta was not a least-cost solution to expanded power supply and its relevance to the country's priorities was negligible. On several occasions, the Bank had good cause for stopping the project before the major civil works were too advanced. •

In 1998, the Argentinian and Paraguayan governments agreed in principle to privatise the scheme as a 30-year concession, including completion of the works, operation and maintenance of the dam. The governments see private finance as the only possibility for completing the dam. If ratified by the two governments, the scheme would involve selling the dam for \$1 billion. The World Bank lent \$860 million and the Inter-American Development Bank (IDB) \$840 million to the project. In February 1997, the World Bank authorised its Inspection Panel to • review and assess • the problems with the dam, following a request by the Paraguayan environmental human rights NGO, Sobrevivencia - Amigos de la Tierra Paraguay, and a group of people affected by Yacyreta. The Panel estimated that at least another \$2 billion would be needed to mitigate effectively the impacts of filling the reservoir to its final design level of 83 metres above sea level. The Panel stated, • one has to question seriously whether (Yacyreta's) debt would ever be repaid at 83 metres once the full costs are taken into account. •

The World Bank and the IDB are reluctant to lend more money for the project, as is the private sector, until the current ban on the sale of electricity from Yacyreta to third countries is lifted. Environmentalists have long claimed that the dam violates World Bank environmental standards and procedures for resettlement of local populations. The Bank found that rectifying the mistakes would require at least another \$130 million and take until the year 2000.

Despite pleas from the Paraguayan government, the Argentine government has refused to provide extra funds itself or give official guarantees for international finance for the completion of the project. EBY is unable to service the repayments on its outstanding debt of \$10.5 billion because the project is unprofitable. These funds are needed to build higher walls, as well as for the indemnification and resettlement of landowners whose land would be submerged.

In early 1999, EBY rejected 80% of the claims for additional compensation filed by the consortium, Eriday, building the project. Eriday, which includes Spain's Empresas Reunidas, Impregilo, and German-Franco Dumez, filed 544 claims, seeking \$800 million to \$1 billion in additional payments for expenses it says it incurred as a result of repeated delays in completing the project. EBY said it would discuss the remaining 20% of the claims. Eriday expected the rejection of the loans and has begun efforts to have them arbitrated. Argentine political forces, in the midst of a presidential election campaign, have demanded compensation. This represents the second time that major technical problems have occurred.

### **Displaced and Uncompensated**

Less than 25% of the 50,000 people who would be forced to move to make way for the Yacyreta's reservoir if fully filled have been resettled so far. The Inspection Panel outlines • unsanitary conditions . . . in many of the stagnant bays created by the reservoir (which) pose health risks to poor people living in low-lying urban areas. • The panel also found that thousands of people have lost their jobs as a result of the dam and have received no compensation. A June 1999 internal report to the Board of the Inter-American Development Bank points out • some serious problems in EBY's dealings with civil society, particularly people affected by the project and organizations that are speaking for them on the Paraguay side, as EBY's institutional credibility has eroded. •

The Itaipu dam, meanwhile, has drowned a large area of Atlantic forest, the fastest disappearing forest in Brazil. Many of the 42,000 people displaced by the dam moved to resettlement schemes in

Amazonia, with disastrous effects for themselves and for the indigenous peoples and forest of the region. The reservoir has caused the local spread of bilharzia, a debilitating water-borne disease, previously unknown in the area.

### **Failure to Consider Impacts**

The Yacyreta dam was fitted with \$30 million fish elevators whose design, according to the World Bank, was based on fisheries experts' knowledge of salmon migrations in the Columbia river. Although little is known about fish migration in the Parana river, it is known that fish migrate up and down the river several times during the course of their lives. • This aspect was not considered,• according to an internal World Bank evaluation of Yacyreta. So the Yacyreta's fish elevators only carry fish up-river. Those fish that do manage to negotiate the elevator and reach the reservoir face an unpromising future — when the first turbine was opened in 1994, more than 120,000 dead fish were found downstream, thought to have been killed by the lack of oxygen in the reservoir caused by rotting vegetation.

### **. . . And the Corpus Christi to Come?**

In the face of such massive debts, corruption, social and environmental issues, and uncertainty, Paraguay and Argentina remain publicly interested in finding private firms to undertake a build-operate-transfer (BOT) contract to carry out the 3,000 MW Corpus Christi project, located 11 miles north of Encarnacion on the Parana river. Knight Piesold — with funding, according to company documents, from the British government — undertook the • project preparation for private sector financing• from 1992-93, and is now preparing the feasibility study for alternative sites for the \$3 billion project. Government officials say they have begun to consider ways to finance the project.

Commercial viability of the Corpus Christi depends on selling the electricity to Brazil, whose government has stated that it is prepared to guarantee purchase of the electricity only if it is granted equal representation on the board of directors of Corpus Christi. However, there are public and environmental concerns about this project. In April 1996, the electorate of Misiones province, Argentina, voted overwhelmingly in a plebiscite — by a margin of nine to one — against the project. Community opposition, plus a general inclination among multilateral lenders against large hydroelectric projects, may work against this project, despite the governments' determination to proceed.

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- **Chixoy (Guatemala)** (Impregilo, Lahmeyer International)

The Chixoy dam was built during the military dictatorship in Guatemala, from 1976 to 1983, during a civil war. The project is notorious for the massacre by the Guatemalan armed forces of more than 400 Maya Achi indigenous people, mostly from the community of Rio Negro, one of the villages to be flooded by the dam.

### **The Companies**

The dam was funded with loans from the Inter-American Development Bank (\$105 million in 1978 and a further \$70 million in 1981) and the World Bank (\$72 million in 1978 and \$44.6 million in 1985), while the Italian government provided bilateral aid and export credit guarantees. Lahmeyer was the lead company in a three-company consortium called LAMI which planned, designed and supervised construction for the 300 MW dam. Formed in 1972, LAMI consisted of Lahmeyer International (Germany), Motor Columbus (Switzerland) and International Engineering Company (USA). Cogefar (Italy) — later to become part of Impregilo — and Swissboring (Switzerland) built the dam. Hochtief (Germany) was the contractor for the repair work on the tunnels.

### **Technical Blunders**

As well as being implicated in serious human rights abuses, the dam's designers and funders are responsible for a technical and economic disaster. A series of blunders, oversights and negligence led to lengthy delays and huge cost overruns. In 1974, LAMI produced a feasibility study recommending construction of the Chixoy dam. LAMI estimated that the dam would cost \$270 million. By the time it was completed in 1985, the dam had cost \$1.02 billion. No proper environmental impact assessment was ever undertaken for the project. Moreover, the technical studies undertaken were seriously flawed. For example, the dam's designers admitted that the dam was sited over a geological fault only when a major earthquake hit Guatemala in 1976, shortly before construction was due to start. The dam was redesigned to withstand earthquakes, delaying construction for 15 months and increasing the cost by 10%. When construction finally started, the dam's engineers discovered that the rock formations at the dam site were so riddled with faults and cavities that a second major redesign of the dam was needed. The costs of building the dam wall shot up 350% higher than anticipated in 1977. Next, the dam's engineers discovered another geological fault, which required yet more design changes, and the cost of the powerhouse more than doubled. Finally, the pressure tunnel intended to carry water from the reservoir to the powerhouse caved in twice during its excavation, delaying the construction by another 14 months. In the late 1980s, the state-owned electricity company, National Institute of Electrification (INDE), blamed LAMI for the tunnel collapse and threatened the consortium with a \$165 million lawsuit.

The Chixoy dam finally started to produce power in July 1983, but in the words of one World Bank official, • the damned thing wouldn't work• . Further damage to the pressure tunnel shut the powerhouse down after only five months. The repairs took two years and cost \$57 million, with costs largely covered by a second World Bank loan — this despite the Rio Negro massacre just three years earlier. Still more leaks were discovered in the tunnel in the early 1990s. The dam has never operated at more than 70% of its installed capacity. The World Bank's confidential 1991 Project Completion Report states, • with hindsight, [Chixoy] has proved to be an unwise and uneconomic disaster• . The final cost of Chixoy represented about 40% of Guatemala's total external debt in the late 1980s. Every year, around \$8 million is spent on structural maintenance of the dam.

The reservoir failed to fill during the rainy season of 1991 and cloud-seeding programmes ran on and off for a year in an attempt to increase rainfall over the reservoir. Robert Basells, who resigned as INDE president, has said • we were taken advantage of by the lending institutions, the engineering companies, everyone . . . The engineering companies overlooked warnings. They knew it was a lousy site. We contracted the best in the world. We spent a billion dollars and get nothing for it. Whose fault is it?• LAMI refuses to take any responsibility for the technical failures of the dam. • It is a pity for the country but I do not feel responsible. We believed our design and assumptions were safe enough,• said Martin Lommatzch, a LAMI official, to the Christian Science Monitor in 1987. Elsewhere, however, LAMI likened the methods used to evaluate the dam site to playing the lottery. Design flaws and technical failures have considerably shortened the dam's expected life. According to some sources,

Chixoy will not last for more than 20 years: in some areas of the reservoir, sedimentation has reached 100% of live storage while silt is rapidly encroaching on the entrance of the dam's tunnel.

### **Indigenous People Massacred**

The violence against the Maya Achi people is documented in detail in a 1995 report by the Washington DC-based human rights group, Witness for Peace.

The violence began in 1980 after INDE took villagers from Rio Negro, one of the villages to be flooded, to see the newly constructed resettlement site at Pacux. A community leader, speaking to Witness for Peace, explained the villagers' shock on seeing the site: • the people were upset by the construction of the houses and layout of the community . . . They were getting swindled and they knew it. • A few weeks later, military police from the dam site came to Rio Negro and shot seven people. In July 1980, two representatives from the village agreed to go to a meeting requested by INDE officials at the dam site. They took with them the village's only documentation of resettlement and cash payment agreements. The mutilated bodies of the two men were found a week later. The resettlement documents were never recovered. In February 1982, 73 men and women from Rio Negro were ordered by the local military commander to report to Xococ, a village upstream from the reservoir zone which had a history of land conflicts and hostility with Rio Negro. Only one woman out of the 73 villagers returned to Rio Negro — the rest were raped, tortured, then murdered by Xococ's Civil Defense Patrol, or PAC, one of the notorious paramilitary units used by the state as death squads. A month later, on 13 March, ten soldiers and 25 patrollers arrived in Rio Negro, rounded up the remaining women and children and marched them to a hill above the village. Seventy women and 107 children were massacred. Two months later, 82 more people from Rio Negro were massacred. In September, 35 orphaned children from Rio Negro were among 92 people machine gunned and burned to death in another village near the dam. Reservoir filling began soon after this final massacre.

In a study based on interviews with survivors, Witness for Peace reports:

• *They were strangling many of the women by putting ropes around their necks and twisting the ropes with sticks. They were also beating other women with clubs and rifles and kicking and punching them. 'I remember one woman', Jaime [a survivor who was 10 years old at the time] relates. 'A soldier jumped up and kicked her in the back. He must have broken her spine, because she tried to get up but her legs wouldn't move. Then he smashed her skull with his rifle' . . . The patrollers killed the children by tying ropes around their ankles and swinging them, smashing their heads and bodies into rocks and trees.* •

Although the companies involved in Chixoy have always denied knowledge of the massacres, local eyewitnesses say that a Cogefar lorry was used by the army during the massacre in Los Encuentros in May 1982. Moreover, 15 women kidnapped from their villages were subsequently taken to Pueblo Viejo, the construction site for the dam, and from there were carried away by helicopter.

The Rio Negro massacres occurred during a brutal government counterinsurgency campaign that left 72,000 Guatemalans dead or missing between 1980 and 1984. Yet local church workers, journalists and survivors of the massacres all deny that there was ever any organised guerrilla activity in Rio Negro, and all link the massacres to attempts to evacuate the reservoir area. A priest, Monsignor Giraldi, who challenged the official version of events in a book, *Guatemala Nunca Mas*, was murdered a week after its publication. One survivor of the massacre told Witness for Peace, • I'll tell you the real reason for the violence, they wanted our land for their cursed reservoir and dam, and we were in the way. • Yet all that LAMI had to say of the people living in the reservoir area, in their pre-feasibility document, was • . . . the population in the area of the studies is mainly indigenous. In the tract of the study . . . there is almost no population. •

### **No Redress**

In February 1999, the Commission de Esclarecimiento Historico, created under UN auspices to investigate the massacres of Guatemalan people during the 1970s and 1980s, classified the violence at Rio Negro as genocide, and included forced resettlement among the causes underlying the elimination of the Rio Negro community.

Local people have sought redress in national and international arenas, including the UN Working Group on Indigenous Peoples, the World Commission on Dams and the World Bank. After an internal investigation, the Bank acknowledged that a massacre had occurred but admitted no responsibility.

Criminal suits were brought against military leaders in Guatemala, leading to the conviction in November 1998 of three civil patrol commanders who were found guilty of murdering three people during the massacres. The final verdicts are still pending. Material and spiritual reparations are still awaited by those who survived. From 1984 to 1996, the issue of reparations for those resettled as a result of Chixoy were ignored. In 1996, after the massacres were exposed, the Bank acknowledged that those resettled had not been adequately compensated and urged that more land be purchased for resettlement. However, in 1998, INDE was privatised and the compensation terms had to be renegotiated with FONAPAZ (Fondo Nacional para la Paz). According to a report by an Italian NGO, Reform the World Bank, the new organisation has only agreed to implement whatever INDE agreed in 1980, a time of severe political repression. Even within this narrow commitment, many grievances remain unaddressed. No compensation is envisaged for the cultural losses, violence, intimidation, loss of livelihood and psychological damage suffered by affected communities.

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- **Pangue, Ralco (Chile)** (ABB, Electrowatt, Kvaerner, Voest-Alpine)

Plans to dam the Biobio river in southern Chile originated in the 1950s on the drawing boards of the then-state owned electricity utility, Empresa Nacional de Electricidad S.A. (Endesa). However, it was not until May 1990 that the newly elected Chilean government approved (the by then privatised) Endesa's plans for a series of six dams on the Biobio, with a total capacity of 2,300 MW. In December 1992, the International Finance Corporation (IFC), the private sector arm of the World Bank Group, approved a \$70 million loan to Endesa to build the 450 MW Pangue dam, the first of the proposed dams on the Biobio. The IFC also approved \$4.7 million in equity for the Pangue project.

The IFC brokered an additional \$28 million from the Swedish Board for Industrial and Technical Cooperation (BITS), \$14 million from the Norwegian Agency for Development Cooperation (NORAD) and \$100 million from 10 European banks. The IFC loan was bought out in March 1997 (after the Pangue dam was completed) when Endesa secured funds from Dresdner Bank, after the World Bank threatened Endesa with default because it failed to meet IFC environmental and social requirements.

### **The Companies**

In 1979, Electrowatt did a feasibility study for the two-stage development of the Ralco and Pangue dams. The EIA for the Ralco dam was carried out by Electrowatt's Chilean subsidiary, Electrowatt Ingenieros Consultores (Chile S.A.). In 1993, Kvaerner Turbin AB won the contract to manufacture and supply turbines for the Pangue dam. Kvaerner's bid was partly financed by \$28 million from the Swedish development authorities through the Board for Investment and Technical Support (BITS). Kvaerner Energy and Norconsult also benefited from \$8.2 million in mixed credits from the Norwegian Agency for Development Cooperation (NORAD) for Pangue. Voest-Alpine MCE and ABB both supplied hydromechanical equipment for the Pangue dam.

### **Construction Roads and Logging**

The impacts of the Pangue dam began in 1990, when the Chilean government built a road linking the isolated upper Biobio river with the Pan American Highway, to enable construction of the Pangue dam. The new roads into the area attracted timber contractors who tricked the local villagers into allowing them to log their forests in return for small sums of money. The loggers left with the timber while villagers were left to face the Chilean authorities whose forestry regulations require logging permits and reforestation. A number of villagers, unable to pay the fines, lost their land rights or were faced with eviction. Timber worth between \$3 million and \$18 million was stripped from Pehuenche community lands between 1988 and 1994 as a result of the Pangue dam project and its associated infrastructure.

### **No Consultation**

The indigenous Pehuenche people were not consulted before the Pangue project was started. Endesa informed affected villagers only after the plans and financing agreements were completed. Endesa, in consultation with IFC, established the Pehuen Foundation, supposedly to mitigate the socioeconomic impacts of the dam. In 1995, IFC hired an anthropologist, Theodore Downing, to evaluate the Pehuen Foundation. Downing's report details the Foundation's failure to address the problems caused by the dam, and concludes that the dam violated the human and constitutional rights of the Pehuenche. The IFC refused to release any part of Downing's review. In April 1997, IFC and Endesa signed a new agreement — without involving the Pehuenche in any negotiations — which allows the Pehuen Foundation to assist Endesa in removing the Pehuenche from the reservoir of the Ralco dam, the second of the Biobio dams.

### **The Rules Don't Apply**

In 1995, the Chilean group, Grupo de Accion por el Biobio (GABB), filed a claim with the World Bank's inspection panel, alleging that the IFC did not comply with the social and environmental conditions of its Pangue loan agreement. The World Bank rejected the claim on the grounds that the IFC is exempt from Inspection Panel investigations. However, World Bank president James Wolfensohn commissioned a report on IFC's role in the project. The report, written by team-leader Jay



D. Hair, stated that IFC failed to comply with 80% of its environmental and social directives. The IFC heavily censored much of the report before allowing its release.

In November 1997, the American Anthropological Association's Committee for Human Rights held a public forum, attended by officials of the World Bank, to discuss the Pangué-Ralco dams. Downing asked the officials whether they believed that the IFC or any other part of the World Bank Group held any responsibility for the damage caused to Pehuenche communities by the Pangué and Ralco dams. No one answered. When he asked whether anyone in the Bank had thought about anything that it might now do to help the Pehuenche deal with some of the damage, again there was silence. One might ask the same question to the companies who profited from their involvement through consultancies, supplying machinery or building the dam.

### **First in a Cascade**

Since its completion in March 1997, Pangué has produced only a fraction of its expected output because of low rainfall in the south of Chile and has lost close to \$30 million since its commissioning. Opponents of the Pangué dam argued all along that it was designed to operate in conjunction with the Ralco dam, a large reservoir dam immediately upstream of Pangué, and that the environmental and social impacts of both projects should be considered before the government agreed to build Pangué. An important role of the IFC was to reassure investors in Pangué that the dam was a stand-alone project.

Sure enough, construction on the 570 MW Ralco dam started almost as soon as Pangué was completed. The Ralco dam is designed to regulate the water flow to the Pangué and the other dams proposed downstream. The 3,400 hectare reservoir would require the forced eviction of 600 people, 400 of them Pehuenche. Endesa's proposed resettlement site is high in the Andean mountains above the dam, land used as summer pastures by the Pehuenche. In winter, however, the climate is severe, and in July 1997, according to Downing, the proposed site was covered in 1.5 metres of snow.

### **Legal Actions**

In July 1998, 100 Pehuenche people and their supporters attempted to block trucks going to the construction site of the Ralco dam. As a result of the protest, Chilean planning minister German Quitana stopped Endesa from working at the site. The government allowed work to restart in December 1998 after negotiating compensation for some of the families who were not considered in the original relocation plan. The Santiago Civil Claims Court ordered work to be stopped again in September 1999 as a result of legal action taken in 1997 by two Pehuenche people, Nicolasa and Berta Quintreman. The Court of Appeals allowed work to restart only 23 days later after receiving a petition from Endesa. However, the Chilean courts have still to consider the civil lawsuit which questions the legality of Electrowatt's environmental assessment for Ralco.

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- **Nathpa Jhakri (India)** (ABB, Electrowatt, Impregilo, Kvaerner, Siemens)

The 1,500 MW Nathpa Jhakri dam is currently being built on the Satluj river in northern India. The Nathpa Jhakri Power Corporation (NJPC), a special purpose company jointly owned by the Indian central government and the state government of Himachal Pradesh, is developing the project. It took 13 years to get the various clearances and approvals but in 1994, when NJPC finally started civil engineering works on site, it discovered that the actual level of the bottom of the dam wall was two metres below the figure given.

The Himachal Pradesh State Electricity Board added to the confusion by miscalculating the height of the dam by a further two metres. As a result, the dam will be four metres shorter than anticipated and will be able to generate its peak output continuously for only about half the time anticipated — one hour 40 minutes, instead of three hours. The dam will therefore fail in one of its prime objectives: helping to meet peak demand in the region. The Himachal Pradesh government has vetoed the idea of allowing the project developers to raise the height of the dam because they are now worried that to do so would inundate the head-race tunnel of the 250 MW Sanjay Bhaba dam upstream.

### **The Companies**

A consortium called EUCONA, led by ABB and including Kvaerner, Sulzer Hydro and Siemens, won the \$41.3 million contract for the turbines. Electrowatt won the contract for assistance and advice to the project authorities and consultants during the detailed design, preparation of tender documents and construction supervision. Impregilo won a \$234 million contract with Jindustan Construction (India) to construct the headrace tunnel and surge shaft. Kvaerner Boving is the lead contractor for the project.

### **Export Credits**

In 1996, the UK Export Credit Guarantees Department agreed to provide a \$36.5 million guarantee for a loan by Barclays Bank to Kvaerner Boving. Other funders include Banc Nationale de Paris, the Nordic Investment Bank, KfW of Germany and SBC of Switzerland. The project was also originally financed by a \$437 million World Bank loan, but the Bank withdrew after the Indian government admitted mistakes in calculating the height of the dam. The Bank also cited time and cost overruns and industrial unrest as reasons for withdrawing. By the time the Bank pulled out in October 1998, \$300 million of its loan had been spent. The dam is running four years behind schedule, and the cost has risen from \$1 billion in 1988 to \$1.7 billion, despite a worldwide fall in power equipment prices worldwide. As a result, the cost of the dam's electricity is expected to almost double, from 1.22 rupees per kilowatt/hour (Kwh) to 2.29 rupees. In May 1999, with the project reported to be facing an acute financial crunch, the Power Finance Corporation of India sanctioned a loan of Rs.1118 crore for the dam.

### **Strikes and Broken Promises**

Employees of the Himachal Pradesh State Electricity Board have gone on strike, alleging that their pay scales are far below those of NJPC employees. Continental Foundation, the joint venture constructing the dam (in which the Canadian construction company BFC Civil has a 45% interest), took out a claim against NJPC alleging that conditions on the project had changed. In 1998, NJPC paid Continental \$14.6 million as a first payment of its claim. Villagers of Nathpa are also unhappy about the project, which is named after their village. They promised to build a road two years ago but they have not done a thing. Hoshiar Singh, a villager, told a newspaper reporter in December 1998.

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- Bakun (Malaysia) (ABB, Lahmeyer International)

The history of the Bakun Hydroelectric Project on the Balui river in Sarawak, Malaysia, is a long and tortuous one. Originally planned by the Malaysian government in the early 1980s, it was abandoned in 1990 after a campaign by local indigenous communities and a downturn in the Malaysian economy. The decision to shelve the project was described by Malaysian Prime Minister Mahathir Mohammed as • proof that Malaysia cares about the environment• . In 1993, however, he revived the project, announcing that the \$6 billion dam would be privatised to Ekran Bhd, a Sarawak-based company with strong political connections to the ruling party. The contract was awarded without tender and apparently without proper costing.

Work began but was again abandoned three years later after the project developer failed to raise the necessary finance, a failure due in part to the 1997 Asian economic crisis but also to an international campaign to alert potential investors to its high risks. In 1997, the government announced that the dam was on • indefinite hold• — only to revive it yet again, albeit in scaled down form, in 1999. Although not built, the dam has already caused considerable environmental destruction. As originally planned, the reservoir would have flooded 69,649 hectares — an area bigger than Singapore — much of it forested. The area has now been clear cut. In addition, the Malaysian authorities have relocated 10,000 people (mainly Kayan, Kenyah, Kajang, Ukit and Penan peoples) from the planned reservoir site. Those resettled have been inadequately compensated and are now living in appalling conditions because of the poor quality of the housing at the resettlement site.

### **The Companies**

The twenty-plus years of plans and studies was a gravy train for the international consultants who won contracts on the project. When the project was first investigated in 1979, the German government quickly offered technical assistance. Lahmeyer International subsequently assumed leadership of the SAMA engineering consortium which undertook the 1983 feasibility and design studies. The feasibility study claimed that the dam would have a plant factor of 86%, subsequently scaled down to 80%. In 1996, London-based financial analysts Delphi International questioned SAMA's claimed plant factor in a highly critical assessment of Bakun's economic viability. When the project was revived in 1993, Lahmeyer (together with US engineering consultancy Harza) also played a lead role in drawing up the construction contract and supervising the building of the water diversion tunnel by the South Korean company, Dong-Ah Construction and Industrial Co. The job of clearing the reservoir area, in addition to much of the ancillary construction work, was subcontracted to companies controlled by Ting Pek Khiing, Ekran's chair. A number of international construction companies bid for the main contract or for parts of the project which, in addition to building the 205 metre-high dam, also involved laying 1,500 kilometres of overland cable and three or four 650 kilometre-long undersea cables to transmit the power generated to Peninsular Malaysia. ABB and Brazilian construction company Companhia Brasileira de Projectos e Obras (CBPO) were awarded the main construction package, including supplying the generators. Competing consortia included THT International, consisting of Tabung Haji Technologies, Siemens, Voith, Zublin, Impregilo, Dragados and Pirelli. In late 1997, ABB and Ekran fell into dispute over who would pay for cost overruns and ABB was unceremoniously sacked from the project. Subsequently, Malaysian Energy Minister Leo Moggie announced negotiations between Ekran and a new construction consortium including Siemens and Alcatel (France). Negotiations came to nothing, however, as the project soon collapsed in financial ruin, leaving the government to pick up the pieces.

### **Lack of Consultation**

Environment, human rights and development groups in Malaysia and abroad condemned the project from the outset. In addition to concerns over the impacts on the environment and indigenous groups living in the reservoir area, local villagers and NGOs complained repeatedly about the lack of transparency surrounding the project and its planning. Feasibility studies were kept private, consultation with affected villagers was extremely limited and no process was established to allow public comment of the Environmental Impact Assessment, parts of which were not made public. The EIA was approved by the Sarawak state government, a major shareholder in the dam project. It not only failed adequately to assess the socio-economic impact on local communities living above and below the dam; it also proposed that negotiations with them be postponed until after the decision to

build it had been made. As such, it flew in the face of internationally accepted standards on projects involving involuntary resettlement, including both the World Bank's policy guidelines and those of the OECD Development Assistance Committee. Commenting on the general failure to consult with those affected, Nyaban Kulleh, a resident of one of the communities to be flooded, told a journalist in 1994:

- No one has come forward to tell us what is happening. We don't want to go against the government. But if the government wants the Bakun project, why don't they think of us? They say this is development but we don't think that flooding our homes is development.

In 1996, the Kuala Lumpur High court ruled that the EIA was conducted illegally and that the Malaysian government had violated Malaysian environmental law in approving the dam. Even the normally compliant mainstream press described the EIA process as

- an abuse
- and a farce

### **Things Fall Apart**

In the event, finance proved the Achilles heel of the project. To implement the project, Ekran set up Bakun Management Sdn Bhd (a wholly-owned subsidiary responsible for project management) and the Bakun Hydroelectric Corporation Sdn Bhd (BHC), which would own and operate the dam. Ekran retained a 35% share in BHC, with external investors and partners providing the remainder of the equity and debt capital. From the outset, Ekran proved unable to raise the necessary finance on the international markets. Initially this was overcome by tapping Malaysian state-controlled companies for support, with agencies like Tenaga Nasional, Malaysian Mining Corporation and the Employees Provident Fund, as well as the Sarawak state government, taking major shares in the project. This was despite assurances from Ting, Ekran's chair, that the project would not have to rely on government money.

Doubts over the project's financial viability continued to grow, however, particularly following publication of Delphi International's damning report on the project. The report highlighted a number of risks associated with the project, including likely cost overruns, possible long-term technical problems with the dam structure, reservoir sedimentation and limited insurance cover. Delphi also said there were unresolved issues relating to decommissioning and

- a substantial risk

that the dam would produce less power than forecast, partly because of uncertainties in future rainfall as a result of global warming. Delphi calculated that the likely returns to investors would be substantially lower than the 11.5% claimed by Ekran. It warned bankers and other financiers that

- the dam carries an abnormal level of risk, much of it uncontrollable

In June 1997, investor doubts led Ekran to cancel a rights issue to help pay for its 35% in the BHC, which was due to be floated on the Kuala Lumpur stock exchange. The floatation never took place. In September, just hours after Ekran dismissed ABB from the project, Mahathir announced the

- indefinite postponement

of the project. The subsequent government bail-out of the project cost Malaysia an estimated M\$950 million, including M\$390 million to Ekran, M\$436 million to financial backers, M\$24 million to Dong Ah and M\$100 million to the Bakun Hydroelectric Corporation. In 1999, Ibrahim Anwar, who had been Deputy Prime Minister at the time, testified to a Malaysian court that Mahathir had instructed him

- to use Treasury funds to compensate the company without going through proper audit and account.

Leaving no room for doubt, Anwar went on to say:

- I'm referring specifically to Tan Sri Ting and Ekran.

### **Utter Desperation**

In 1999, the Malaysian government announced that it intended to go ahead with a scaled down version of the dam, with the undersea cable omitted. Even though the scaled down dam would not affect as many communities, all those in the reservoir area of the original dam have been relocated or are in the process of being moved to a resettlement site 300 miles away. According to a 1999 report by the Malaysian Coalition of Concerned NGOs on Bakun, the resettlement site is grossly inadequate. The new houses are poorly built and culturally inappropriate. There are no Certificates of Fitness for the buildings or for the site. The drainage is inadequate and the site lacks proper sewage.

Moreover, those relocated were informed only after arriving at the site that they would have to buy their house to get their keys. None have been compensated for the loss of their old homes, and compensation for the loss of other assets is conditional on their signing a Sales and Purchase Agreement for their new houses. The Coalition has written to Bucknalls, the UK-based company which acted as project consultant for resettlement, asking what action it intends to take

- by way of restitution to the local communities whose lives have been irreversibly worsened (some would say destroyed) by

the whole project. • Indeed, Dr Kua Kia Soong, a representative of the Coalition, described the forced relocation as • ethnocide• . A recent report by the Coalition says: • It is difficult to adequately capture in words the utter desperation and dislocation being experienced by the indigenous communities forcibly resettled because of the Bakun project. •

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- **Three Gorges (China)** (ABB, Knight Piesold, Siemens, Sulzer Hydro)

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. A minimum of 1.3 million people (latest estimates put the figure at 1.9 million) would be forced to leave. The dam is expected to cost at least \$43 billion — some unofficial estimates put the figure at \$75 billion — and will create a reservoir 400 kilometres long. The dam was shelved in 1989, however the project was revived and on 3 April 1992, the Chinese Congress approved the dam. In November 1998, building of the main 18,000 MW Three Gorges dam began after a coffer dam diverting the Yangtze river was closed.

### **The Companies and Funders**

A consortium of Siemens, Voith and General Electric subsidiaries are supplying six generators in a contract worth \$320 million to Three Gorges. ABB has won orders to supply eight generators, worth \$250 million, in addition to a \$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 \$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 \$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 Deutschmarks (DM) was provisionally approved 'in principle', along with 485 million DM in provisional guarantees from Kreditanstalt für Wiederaufbau (KfW), Dresdner Bank, Deutsche Bank and DG-Bank. According to environmentalist Sumi Kazuo, who has followed the project closely:

• *The German parliament had earlier passed a resolution condemning the Chinese government for its Tibet policy and relations between the two countries were deteriorating. [Meanwhile] the German Minister of Finance travelled to China and signed a declaration pledging to improve economic relations between the two countries. In other words, the Hermes financing was used as a lever to lessen Chinese anger.*•

In November 1999, the German government officially approved an export guarantee of 97 million DM to Siemens for the supply of 15 transformers. Switzerland, meanwhile, has provided guarantees of 211 million Swiss francs to ABB and Sulzer Escher-Wyss, and Canada has approved two loans: \$12.5 million to enable Toronto-based AGRA-Monenco to secure its first contract and, subsequently, \$153 million to support a turbine contract; awarded to General Electric Canada.

### **Resettlement and Corruption**

Bribery and corruption are reported to beset the project, according to local farmers who claim they are being cheated of government resettlement funds. In one township, local people petitioned the central government in protest against officials extorting fees and pocketing resettlement money. By the end of 1998, 95 officials had been brought to court on charges ranging from embezzlement to corruption and bribery.

Archeological relics have been stolen or smuggled from the proposed reservoir, including a Han dynasty • spirit tree• which was looted after a bulldozer disturbed a burial site at Jiangdongzui. The tree turned up in March 1998 at an auction in New York where it sold for \$2.5 million. Critics also charge that Chinese authorities have underestimated the land available for resettlement, and that much of what land is available is unsuitable for farming. In May 1999, China's prime minister Zhu Rongji admitted that the assumptions made by the dam proponents about the number of people to be resettled, and the amount of land they claim available for resettlement, was misplaced. Zhu recognised that farmers would be unable to move up hills on to terraces because the land was too steep. So far, the authorities have only managed to move 150,000 people since 1992. About 550,000 people must be moved in the next phase of the project, before 2003, when the first turbines are scheduled to start.

Concerns have also been raised that the resettlement of ethnic Han Chinese oustees in minority areas in western China will be used to consolidate central government control of outlying regions. These problems are now becoming apparent. With land becoming scarce, project authorities have been encouraging displaced families to migrate to remote provinces such as Xinjiang and Inner Mongolia as members of the paramilitary Construction and Production Corps. Such colonization programmes are extremely unpopular, both with the relocated families and the host populations. In October 1998, severe tensions arose in Kashgar after Three Gorges oustees had been relocated in the area. Eight policemen were killed and the city had to be placed under curfew. In May 1999, senior Chinese government officials admitted that • initial attempts to resettle displaced people in provinces like Xinjiang, Hainan, Hunan and Henan had been a failure• .

#### Safety Concerns

In 1997, US engineers who had studied the project warned that the rock edges of the 650 kilometre-long reservoir were unstable. In addition, there are fears that the tight construction schedule, coupled with shoddy construction work, could lead to a collapse of the dam, risking the lives of millions downstream. In December 1998, Zhu criticised the shoddy construction of new infrastructure to replace that being submerged.

The Chinese Academy of Sciences has also voiced concerns that the pollution in the Yangtze river, described as the biggest • sewer system• in China, will be seriously exacerbated because the dam would reduce its flow and hence its flushing capacity. In May 1999, the China Economic Times reported that efforts to stop soil erosion in the upper reaches of the Yangtze watershed had not only failed, but that the problem was getting worse. When asked by the Norwegian environmental and human rights group, FIVAS, about the role of foreign companies in the Three Gorges dam, Goa Di and Guo Yufang, both Chinese in exile, said: • You can compare the relationship between the [Chinese] government and the hydropower mafia as the relationship between the tyrant and his assistant. •

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- **European Dam Building Company Contacts**

For those with access to the Internet, James & James (Science Publishers) Ltd maintain arguably the most comprehensive global database of dam building companies, involved in every facet of dam technology. Their web site can be found at: <http://www.jxj.com/index.html>  
James & James publish • The World Directory of Renewable Energy Suppliers and Services • . Information from this publication can be accessed at:  
<http://www.jxj.com/suppands/renenerg/index.html#search>  
Another excellent site for researching companies associated with the hydropower industry is <http://www.hydropower.org/atlas/company.htm>

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