Contributing Paper

Hydropower Dams

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Prepared for Thematic Review III.2:
International Trends in Project Financing

For further information see http://www.dams.org/

WORLD COMMISSION ON DAMS

THEMATIC REPORT

3.1 HYDROPOWER DAMS

3.1.1 Overview

Role in Global Generation

Hydropower currently accounts for approximately twenty percent of the world's electricity production, with about 650,000 MW installed and approximately 135,000 MW under construction or in the final planning stages. Notwithstanding this, there are large untapped resources on all continents, particularly in the areas of the world which are likely to experience the greatest growth in power demand over the next century. It is estimated that only about a quarter of the economically exploitable resource has been developed to date, leaving the potential for hydro to continue to play a large role in sustaining renewable global electricity production in the future.

However a number of factors are currently combining to prevent this potential being realised. In particular, the worldwide trend towards deregulation of the power industry is seriously impacting on the perceived "attractiveness" of hydro and this is being exacerbated by increasing sensitivity, and in some cases open opposition, on environmental grounds. As a result there has been a marked downturn in the numbers of new hydro projects being started, with the consequence that under present trends hydro is heading towards playing a smaller role in global generation in the future.

Current Situation

Deregulation of the power sector is invariably accompanied by privatisation of the generating function. This has led to the emergence of the Independent Power Producers (IPPs) which are private companies specifically created to finance, develop, own and operate powerstations. IPPs vary greatly in character and size, but they all have one common objective of commercial viability which tends to be measured in terms of their ability to raise funding and generate profits in the short-term. Unfortunately hydro tends to be a long-term, capital-intensive investment which does not sit easily with these objectives, and for this reason only about two percent (by capacity) of new IPP projects are hydro. The great majority of the remainder are fossil-fuel burning thermal generating plant (gas, oil, coal).

In recent years a number of countries with large hydro resources have actively pushed forward programmes to encourage private investment in the hydro sector. Although this has been successful as far as the sale of existing assets is concerned, the experience in terms of encouraging the private funding of new hydro projects has been disappointing. The record to date shows a high failure rate, with projects often taking several years to bring to financial closure and incurring excessively high up-front costs. Notwithstanding this a number of private hydro projects have been completed and governments continue to adjust their policy to try to overcome the obstacles. The international agencies are also closely involved, and the World Bank has recently commissioned a study into the modalities of private hydro financing with the objective of determining what other steps can be taken[1] to facilitate the process.

In parallel with these private sector initiatives, there remain many hydro projects being built by publicly-owned utilities in countries like China, India and Iran. At present these represent by far the larger proportion of hydro projects under construction, but the trend is towards public funding becoming scarcer and it is likely that when the present tranche of projects is completed it will not be replaced at the same level as before.

Irrespective of whether projects are being developed in the public or private sector, the environmental issues are looming larger and taking a more central role than in the past. Whereas twenty years ago the Environmental Assessment (EA) for a prospective hydro project would occupy perhaps one chapter in the Feasibility Report, it is now invariably a separate report, often with detailed supporting annexes and usually undertaken by an independent party. In general most, but not all, countries would require the studies to be undertaken to World Bank or similar guidelines, and most international consultants in the sector would expect to work to these standards. This does not avoid contentious issues, but it ensures that they are identified and thoroughly investigated in advance of any final commitment to the project. As a result the more recent projects have generally been subjected to much thorougher environmental screening process than previously.

Despite this the international lenders and guarantee agencies have come under a lot of pressure from groups who appear to be lobbying against hydropower in general, often without regard to the specific characteristics of individual projects or the environmental cost of alternatives. For this reason there has been reluctance on the part of some multilateral financing and guarantee agencies to get involved with hydro, particularly with storage projects, on the grounds that they might prove contentious.

[1] World Bank Paper, Financing of Private Hydropower Projects

These trends in changing financing patterns and increasing environmental concern give rise to a number of interrelated issues which are explored in this section of the report.

Character of Hydropower Plants

A central feature of the issues to be explored here is the uniqueness of each hydropower site, and the importance of developing that site for the optimal national benefit (i.e. for utility purposes) consistent with acceptability amongst local stakeholder groups. These objectives are encapsulated in the emerging criteria for hydropower projects in a number of countries, including Canada, which require that they should be:

- economically viable (optimal?)
- environmentally sustainable
- acceptable to the local community.

To appreciate the first point it is necessary to understand the differences between basic types of hydro project, and the quality of electricity that they can produce. They are:

- Run-of-river projects.
- Storage (or reservoir) projects

i) Run-of-river projects have no reservoir and generate only on the natural, unregulated river flow. These projects have relatively minor environmental impact, other than the depletion of river flows between the intake and powerhouse on tunnel schemes. However due to the lack of storage they produce relatively low value base load energy, and offer few of the ancillary benefits inherent in a storage project (e.g. load following, spinning reserve, energy standby).

ii) Storage projects have the flexibility to adjust output to meet system requirements. They are used to store energy and service the high-value peak of the load curve. Most importantly they are more responsive in terms of load following frequency control and emergency standby than any other form of generation. In summary storage projects produce higher quality electricity, but at the cost of generally raising more environmental concerns over such issues as loss of land, population displacement and changed flow patterns.

The distinction between these two types of scheme is not absolute. Some run-of-river schemes can have very limited storage (e.g. hourly) and reservoirs for storage schemes can provide everything from daily to seasonal regulation. For example in Southern Africa it is

not unusual to find reservoirs which can hold three times the mean annual flow (MAF) whereas in South-East Asia, with its more regular rainfall pattern, typical storages might be the equivalent of three to six months' MAF.

Consequences of Current Trends

The current trend away from public financing and towards the private development of fossil fuel-burning thermal plant is resulting in about 40 MW of thermal plant being developed for every megawatt of hydro under private financing. This obviously has serious implications in terms of sustainable development for the following reasons:

i) Countries are failing to develop indigenous renewable resources.

ii) They are often committing themselves to an ongoing foreign exchange outflow for the purchase of fuel.

iii) Even the cleanest of thermal fuels (gas) emits greenhouse gases, and all thermal power stations are aggravating the global warming problem.

Whilst these issues are well recognised in general terms at government level in many countries, it will be difficult to correct the downward trend in hydro until solutions are found to the twin problems of the financing and environmental acceptability. Central to these will be the regulatory framework under which future hydro projects are developed.

3.1.2 Trends in the Regulatory Environment

Traditionally hydropower projects have been developed by public sector utilities, and the question of regulation has not arisen. However with the move towards the private ownership of power projects the regulatory environment becomes very important. This is particularly true in the context of hydro where each project involves the "once-only" exploitation of a unique national asset (the site) with the associated land and water rights.

Experience has shown that hydro requires a totally different regulatory environment from thermal power because the issues are more complex, they affect more stakeholders and a greater level of public support is needed to make projects viable in the private sector. The special regulatory problems posed by hydro include:

- Ownership of the site, water rights and the regulation of natural flows.
- The allocation of risk between the public and private partners.

- Responsibility for feasibility studies and project definition.
- Responsibility for the EIA and any environmental mitigation measures and resettlement.
- The level of public support needed to achieve bankability under a private sector scenario.
- The method of awarding the concession.

Early attempts by some governments to attract private investment to the hydro sector on the basis of an ill-formulated regulatory framework and unclear risk allocation proved a failure. The private sector response to such overtures was poor because of concerns over:

i) Perceived high commercial risks, particularly in terms of uncertain energy production and high exposure to completion risk due to the nature of the works.

ii) Delays and heavy costs involved in feasibility studies and obtaining the necessary permits.

iii) Possible late interference and unforeseen costs or delays arising from environmental issues, and problems with land and water rights.

iv) Difficulty in financing projects with a large local civil works content and long pay-back periods.

It became evident that if the private investor is to be attracted to fund hydro projects the public sector has to be prepared to assume some of the risks, and to play a much larger role in the project than for thermal IPPs. Furthermore there are key issues to be resolved regarding the interface between the public and private partners if the project is to be developed and operated in a way that realises the full potential of the site. In general private hydro schemes are on a BOT basis (build, operate, transfer) with the scheme eventually reverting to the utility at the end of the concession period. Under such arrangements it is natural that the private concessionaire will take a shorter-term, narrower perspective which may be in conflict with the broader interests of the host government and the utility.

For example, most private hydro projects are being promoted as run-of-river schemes because financiers and guarantee agencies are reluctant to become involved with storage projects due to concerns over environmental problems and negative publicity. In consequence there is a tendency to develop run-of-river schemes irrespective of whether the

site might be better developed as storage project yielding higher quality electricity and possible multipurpose benefits. Other problems can arise when it comes to the operation of existing storage schemes, where a private operator will naturally try to adopt a reservoir release policy to maximise the returns from the sale of electricity. Under a power pool system there will be a tendency for all hydro schemes with storage to bid into the peak of the load curve where the higher price is obtained, but this can result in an unacceptable pattern of river flows downstream and may be in conflict with other requirements.

The regulatory framework therefore has to address, on the one hand, the need to induce the private sector to participate in an area in which it is not particularly comfortable, and on the other hand provide the necessary checks and balances to ensure that the wider and longer-term national and local interest is being preserved.

A key issue with which many governments are struggling is the method of awarding hydro concessions in a manner that meets certain basic obligations, namely that:

i) The site is developed in an optimal manner, not only for the power system but also for multi-purpose use where appropriate;

ii) The selection of the concessionaire, and the setting of tariff levels, meet adequate standards of public accountability;

iii) A sensible balance is achieved between the benefits that the state receives and the support that it provides.

iv) The project meets adequate environmental criteria, and is acceptable to the local population.

v) The engineering, operation and maintenance of the project are consistent with public safety requirements and maximising the project life.

The World Bank study already mentioned, examined trends in the regulatory environment for in about seven countries at various stages of development. All have been trying to promote privately financed hydro with varying degrees of success, and tuning their regulatory approach accordingly. The current position can be briefly summarised as follows:

Lao PDR. Legislative reform has been focussed on encouraging foreign investment for the development of export projects as Lao's hydro resources are far in excess of its domestic

demand. Two projects have reached the construction stage and a third (Nam Theun II) is still under planning following a delay of about 2 years while the environmental impact was reviewed. There is no BOT legislation as such. Each project has been directly negotiated on a tripartite basis between the developer, GoL and EGAT the Thai utility. GoL benefits as a shareholder using concessionary ILA lending to purchase its shares, and from royalty payments and tax revenues. Potential export revenues will form a significant part of GNP.

Nepal. Nepal also has hydropower resources far in excess of its domestic requirements. Like Lao it has been traditionally dependent on concessional financing, but the New Industrial Policy of 1992 opened the door to private financing. To date there have been two privately funded hydro projects (36 MW and 60 MW) aimed at the domestic market. Both have been directly negotiated and depend heavily on ILA support. The trend is now towards encouraging competitive bidding for the next generation of domestic projects, and reviewing the way forward on larger export projects.

Philippines. The government and utility (NPC) have modified the regulatory framework considerably following a poor response by the private sector to earlier rounds of BOT hydro bidding. Despite many attempts and a large number of projects being offered to the private sector, there are only three BOT hydro projects actually under construction. Negotiations on a number of others are being blighted by the reluctance of the utility to enter into further power purchase agreements pending full privatisation of NPC. There have been no public sector hydro projects for many years.

Turkey. The position is similar to the Philippines in that there much effort has resulted in very little action on the ground. Despite favourable risk sharing arrangements from the viewpoint of the private developer, and the "award" of about 80 BOT hydro concessions, only a handful of projects are under construction. One exception is the 600 MW Birecik project which is reported to have taken eight years to negotiate. There is growing recognition that the private hydro programme in Turkey is stalling due to bureaucracy and financing problems.

India and Pakistan. Both countries have tried, largely unsuccessfully, to attract private finance to the hydropower sector, and both have recently issued new policy guidelines which lay more emphasis on state participation in private projects, particularly in terms of project preparation, environmental permitting and support with financing. Much emphasis is being placed on the sharing of commercial risks and the provision of sovereign guarantees for the underwriting of power offtake agreements.

Brazil. Currently undergoing deregulation of the power sector, with accompanying legislation to encourage private generators. The regulatory framework is based upon a competitive bidding process which varies according to the size of project. To date most of the activity has focused on the sale of existing assets, but there are a small number of new quasi-private hydro schemes in progress, many involving the local utility company in partnership with private industries.

As will be seen from the above, the picture is unclear and changing. No standard regulatory model has emerged for hydro projects, but in general terms the trend is in the following directions:

i) In most cases utilities are assuming production risk (i.e. payments are not dependent on river flows) and sharing some of the construction risks.

ii) The public sector is increasingly recognising that the feasibility study and project definition are public responsibilities, and that it is anyway advantageous to retain them in the public sector.

iii) Similarly EA studies and the resulting mitigation/resettlement plans have to be carried out by the public sector before the private sector becomes involved.

iv) The host government has to be prepared to back the utility's payment obligations with sovereign guarantees.

v) Political risk cover and funding support mechanisms are needed from the ILAs whose role is central to the success of most privately financed hydro projects.

In conclusion the public sector in the form of the host government, the utility and the ILAs will continue to have a strong influence on any new hydro projects irrespective of whether they are developed in the private or the public sector.

3.1.3 Trends in Project Financing

The cost breakdown of a typical hydro project (as a percentage of the total cost) is as follows:

Civil Works	60 - 70%
Equipment	25 - 35%
Engineering	5 - 10%

As the civil works are largely local costs, a significant proportion of the total project funding could be sourced in local currency if it was available, and would return immediate benefits to the local economy. In contrast most thermal power stations have a very high percentage of equipment, which is usually imported, and the foreign exchange component can reach over 80%. In the past it has been difficult to exploit this advantage in the developing world, because of limitations on local capital resources and the fact that the scale of the works is usually beyond the capability of local firms. In practice hydro projects have therefore also had a large foreign exchange component, generally financed through the ILAs under concessional terms with long grace periods and low interest rates.

Twenty years ago the typical public sector hydro project in the developing world was financed in its entirety under concessional terms, but in more recent years there has been a tendency for this type of financing to be restricted to the civil works leaving the remainder to be funded through export credits. In addition to providing finance, most export credit agencies (like the US Eximbank, ECGD, Hermes and Coface) offer insurance cover for certain types of risk in support of their own exporters. ECA funding is more readily available than straight commercial lending, and at somewhat easier terms which sit part-way between commercial credits and the concessionary finance provided by the international development banks like IBRD and ADB.

The move towards privatisation has had two marked effects on the financing of hydropower projects:

i) The swing away from corporate to project financing has greatly increased the difficulty of raising funds; and

ii) The move away from public sector concessional funding towards ECAs and commercial lending has increased the cost of financing and therefore the overall cost of individual projects.

Whilst these features are common to other infrastructure developments, they are particularly exacerbated in the case of hydro because of its capital-intensive nature. Whereas the cost of energy from thermal stations has a major fuel component which is common to both public and private sector projects, the cost of energy from a hydro plant is totally dominated by the overall cost of the works including finance.

The ways in which a hydropower project can be financed depends on its size and whether it rests in the public or private sector. Broadly speaking the options are as follows:

i) **Public Sector**

Public sector projects are typically financed from either central government funds or by the utility on the strength of its balance sheet, which normally implies corporate borrowing. Depending on the country concerned there may still be concessional debt available from one or other of the ILAs, although this is a diminishing source of funds. More creditworthy borrowers in the developed world will often raise money on the bond markets.

Public sector financing will undoubtably remain an option in a number of countries with command economies, and in those areas of the world where the necessary legislative framework and credit rating is insufficient for private investment. However it has to be recognised that the global trend in the financing of infrastructure projects, including power, is inexorably towards increasing dependence on private investment.

Although a project may initially be publicly funded, it is possible to introduce private finance at a later stage by selling or leasing a completed project. In general an existing hydro asset is an attractive investment provided the power offtake position can be secured. In countries like China the public sector is either borrowing on the strength of existing hydro assets or selling equity in them. However this approach is clearly only viable if there is sufficient public sector funding available in the first place to implement the project.

ii) **Private Sector**

Private sector projects are generally financed as stand-alone entities through special purpose companies called Independent Power Producers (IPPs) created specifically for the purpose of developing, owning and operating the project. Whereas thermal power projects are generally BOO (Build, Own and Operate) most hydropower schemes are eventually transferred back to the state or the utility, and the concession is therefore granted on a BOT (Build, Own, Transfer) arrangement.

The financing of private power projects is generally through sponsor's equity and debt raised on a non-recourse basis on the strength of the revenue stream and securities provided by the project itself. Lenders have little or no recourse to the underlying balance sheet on the project promoter if things go wrong. Under such arrangements financiers naturally take a close interest in the robustness of the

project, particularly when (like hydro) it involves uncertain output and high construction risks. Typical debt/equity ratios for hydro projects are in the region 70%/30%.

For thermal power projects with their high export content, the traditional source of debt has been the export credit agencies. However for the typical hydro project ECA credits are unlikely to account for more than 30% of total project cost. With equity accounting for perhaps another 30%, this leaves 40% of the overall project cost including financing to be sourced from elsewhere as follows:

	%
Sponsor's equity	30
ECA credits	30
Commercial loans? ILAs?	40
	100

In practice this gap is usually too large to be filled by commercial loans and experience has shown that for the larger projects ILA support is usually needed. Amongst the projects examined in the recent World Bank study the ILAs were seen to have acted in a number of roles, including:

- surrogate lenders (i.e. through the host government)
- direct lenders
- equity holders
- provider of technical assistance
- guarantors.

In general private financing is only sustainable with support from the host government and within a security package which often requires full sovereign guarantees.

iii) **Public-Private Partnerships**

Many types of hydro project are proving to be difficult to finance entirely in the private sector, and yet traditional sources of public funding are no longer available. The solution to this problem may well be a combination of public and private funding, with the public sector providing in effect the minimum needed to bring the private financiers to the table. This can be achieved in a number of ways, by either:

- Hybrid Projects where the project is effectively divided into separately financed public and private elements. An example of this is the San Roque project in the Philippines where the dam is being publicly financed under concessional terms and the powerhouse is being financed by the private concessionaire. Another example is the retrofitting of a powerhouse by the private sector, to an existing publicly owned dam.

- Lease-Purchase Arrangements under which public money in injected into the project in the form of lease-purchase payments during the construction phase to reduce the amount of private funding required. This has the effect of reducing the amount of private finance needed (and overall cost of the project) making it more affordable and bankable.

Under both of these arrangements ownership and effective control of the project remains in the hands of the (public sector) utility. To date there is little actual experience of implementing projects under these arrangements.

3.1.4 Continuing Public Sector Role

Irrespective of the actual source or arrangements for financing, it is evident that in the future the public sector must continue to play an important role in the development of all but the smallest hydropower projects. Although the arrangements will vary from country to country, and from project to project, it can be anticipated that the support of the host government and its utility, and often one of the ILAs, will continue to have a strong influence on most future hydro projects, notwithstanding the trend to increased private sector participation. In summary:

- The host government will establish the necessary legal and regulatory framework, and overview the terms under which any private concessions are awarded. It will levy any taxes and other charges (e.g. water), and in most cases will be required to guarantee the obligation of the utility, particularly in respect of payment.

- The utility should prepare the projects in sufficient detail and assume responsibility for environmental permitting and any mitigation measures. It will generally conduct the solicitation process and be the contracting party in any power offtake agreement.

  Although traditionally such agreements have been long-term, for concession periods of 20 years or more, in totally deregulated markets this may not be tenable and IPP owners

will then have to find their own buyers or sell on short-term "spot" market as merchant plant. Although one or two small IPP hydro plants are being developed as merchant plant, it is doubtful whether medium to large schemes can be financed on this basis.

- The ILAs will continue to play a central role in the provision of finance which can either be on quasi-commercial terms direct to the IPP company, or, where appropriate, on concessional terms to the host government which can then on-lend to the IPP company at commercial terms or use the loan to purchase equity in the project.

  An increasingly important role of the ILAs is to facilitate the flow of foreign investment by the provision of political risk guarantees through organisations like MIGA (Multilateral Investment Guarantee Agency, a member of the World Bank Group) and the provision of credit enhancement mechanisms such as the World Bank Partial Credit Guarantees which can be used to extend the maturity of debt financing.

3.1.5 Influence of Financing on Project Selection

It has already been noted that the current trend towards the private financing of power projects has resulted in a marked downturn in new-start hydro, with a commensurate increase in new thermal stations. However it is also influencing the type of hydro schemes being developed, in the following ways:

i) There is a swing away from storage schemes to run-of-river projects, because private developers and financiers are reluctant to expose themselves to the risk of delays, cost increases and cancellations arising from opposition to reservoir projects. The fact that most hydropower purchase agreements fail to place a value on peaking energy or the ancillary benefits associated with storage further reinforces this trend.

ii) Limitation on funding and the time it takes to construct large projects, has tended to restrict the size of privately-financed hydro schemes to under 300 MW. Although larger schemes are in contemplation, the evidence to date suggests that it will be very difficult to privately finance the larger hydro projects that could make a significant contribution to regional energy balances in South America, Africa and parts of Asia.

iii) The configuration of all hydro projects is unique to the site, but for privately financed hydro it tends to be driven by the need to eliminate risk, reduce

construction time and maximise returns in the short-term in line with the power offtake agreement. Such considerations are not necessarily in conflict with the longer-term and wider interests of the state in achieving the optimum development of the site, but such conflicts can exist.

iv) There is a tendency on the part of private developers to avoid multi-purpose projects because of the perceived complications of dealing with a number of government departments representing the different water-user interests, and because most multi-purpose projects involve storage.

v) Projects on international rivers are relatively rare because of the reluctance of international organisations like the World Bank to become involved unless there are water sharing agreements endorsed by the affected riparian states.

In terms of environmental impact assessment, and the subsequent mitigation measures, the outcome is not significantly influenced by the approach to project financing, because the international banking community, ECAs and the major commercial lenders are all tending to follow a similar approach which is to require studies to internationally acceptable guidelines before they will even consider a project for financing.

3.1.6 Constraints and Opportunities

For about one hundred years hydropower has been used as a renewable energy resource. It is, indeed, the only renewable resource which is available in a sufficiently concentrated form to be commercially exploitable on a large scale in a way that can impact on world energy balances.

Hydro also has great longevity. Many of the projects that were developed in the early part of the century are still operating perfectly satisfactorily today. On a well-designed plant the civil works should last indefinitely, and the electro-mechanical equipment may well last for 40 years or longer.

Traditionally hydropower has been used in certain societies as a catalyst for local and national development. This extends from the small mini-hydro schemes serving isolated communities in many parts of the world, to the mega-projects which have been used for developing large regions through the provision of employment, improved infrastructure and a cheap energy. In the days of the former Soviet Union certain of the Central Asian

republics, like Kyrgyzstan, were developed largely on the basis of their ability to supply the rest of the Soviet Union with abundant and cheap hydro energy.

In future a number of low-income countries with abundant hydro resources and little other export potential (like Lao PDR and Nepal) have the prospect of significantly adding to their GNP through the export of hydro energy to neighbouring states. For example the Nam Theun II project in Lao will generate revenues over $250 million/year through the sale of energy to EGAT in Thailand, and the government's share over the concession period will amount to about 50% derived from a 25% equity holding in the project company, royalties and other levies. The country offers few other opportunities for creating export revenues of this magnitude.

Nam Theun II has been a controversial project on environmental grounds, but it is worth noting that a portion of the project revenues will be directed specifically for the protection of the Nakai Plateau where the scheme is located. It is argued that without such measures the existing environment would be substantially destroyed within a relatively short period of time, and that although the project submerges 450 km^2 (about 40%) of the plateau most importantly provides the means for protecting the upstream catchment area which comprises some 3,500 km2 of primary forest. The developer will contribute $1 million/year over 30 years towards the management of this forest which is of outstanding international significance in terms of its biodiversity, in addition to meeting the direct environmental mitigation costs arising from the project.

It is notable that the importance of hydro to local and national economies invariably overrides transient political differences where projects hare a common boundary. For example the Kariba project on the Zambezi continued to operate and supply power to both Zambia and Zimbabwe right through the Rhodesian war of independence when the two countries were effectively in conflict. There are similar examples elsewhere in the world.

Given the obvious benefits it may well be asked why hydro appears to be falling out of fashion. As already noted there are a number of constraints which together are continuing to stifle new hydro development. They are:

i) The withdrawal of public sector funding from infrastructure projects in general, and power in particular because it is perceived to be commercially viable in its own right.

ii) The reluctance of private investors to engage in projects which have long lead times, heavy front-end expenditure, a high risk profile and long pay-back periods.

iii) The problems of financing projects with a relatively low export content and a high proportion of local civil costs, often in countries with a low credit rating and immature capital markets.

iv) The financing problem is exacerbated by the reluctance of many ILAs and commercial bankers to become involved with projects which they think might become controversial, and for this reason some of these organisations are exercising a tacit ban on "large hydro" irrespective of the particular merits in the individual cases.

v) Developers themselves are naturally tending to opt for the easiest projects, which do not necessarily reflect the optimal development of the site or the project that the system most requires.

vi) The lack of a clear regulatory framework and a mature, proven model for the private financing of hydropower projects is also inhibiting progress.

vii) The price of projects is being increased by the risk sharing mechanisms and contract arrangements imposed by bankers, and by the cost of raising private finance. When combined with the relatively short pay-back period this often results in unacceptably high tariffs which cannot compete with the thermal alternative.

viii) The comparison with thermal plant is further distorted by the fact that hydro is required to internalise all its environmental mitigation and similar costs (e.g. resettlement) whereas in most countries there is no carbon tax or similar charge levied for the environmental impact of fossil-fuel generation.

3.1.7 Key Issues Arising from New Approaches to Project Financing

As far as the "big dams" debate is concerned, the key issues arising from the new approaches to project financing can be summarised as follows:

- There is a need for clarity in the consultation and environmental permitting processes, which should be undertaken by the host government (or its utility) before the involvement of the private sector. These are issues better handled at government level and well in advance of any moves to project implementation.

- The host government (or its utility) has to retain control over the definition of the project to ensure it returns maximum economic benefits to the state consistent with acceptability at the local level. Again this is not principally an issue for the private sector.

- A balanced approach is needed in evaluating the benefits and dis-benefits of specific hydro projects, bearing in mind that the alternative will almost certainly be to build another powerstation elsewhere.

- The ILAs and commercial lenders to review their stance on hydro where it has tended to grow increasingly negative in recent years.

In summary hydro is too valuable a potential source of generation to ignore, but care has to be taken to ensure that it is sensitively developed with more consultation and care than has perhaps sometimes been the case in the past. Host governments need to understand that private money will follow the most favourable projects, and that if hydro is to fall into this category much has to be done to build confidence in the process by which schemes are processed, permitted, financed and constructed.
