What works and what doesn't with BOT contracts?

The case of thermal and hydraulic plants

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Abstract

Private financing and operations of public infrastructures – often also called Public-Private Partnerships or PPPs – are becoming increasingly important, especially in the case of developing countries. Different types of PPP instruments – among which in particular BOT (Build-Operate-Transfer) and BTO (Build-Transfer-Operate) instruments – have been tried and will be used in major infrastructure projects, ranging from dams, power plants, roads, and railways to telecommunications infrastructures and others more. Little however is known about critical success factors.

In this paper, the authors will focus on BOTs for both thermal and hydraulic plants. Empirically the paper will be grounded on selected cases in Africa, as well as on World Bank data. More precisely, the authors will compare such BOTs and seek to identify the relevant success factors. It is generally admitted that BOTs work better in the case of thermal plants than in the case of hydraulic plants. It is assumed that this is mainly because, in the case of thermal plants, more limited initial investment is needed and therefore less financial and other risks (e.g., climate, geology) are being incurred. However, there is generally more uncertainty about fuel price evolution in the case of thermal plants.

The paper will seek to determine which are the relevant criteria that influence the choice for BOTs in either thermal and hydraulic plants. We anticipate that such criteria pertain to the amount of kWh needed, the type of energy needed (e.g., continuous vs peak-load), oil price, regulatory factors (e.g., CO2 tax), and others more. Overall, it will appear that risk management is the key to successful BOTs. Therefore, in conclusion, the paper will make related recommendations.

Key words: PPP, BOT, thermal and hydraulic plants, risk management

Introduction

Infrastructures were mainly financed by the public sector in the past. But now, the public can't find money anymore to continue the build up of infrastructures. In their budget, they cancel first new investment before they cut off current costs. In addition, a lot of public sector failures didn't improve the reputation of the public sector.

At the time, for many countries, sector reforms, including public-private partnerships (PPP) in infrastructure, were seen as a way out of an apparently inescapable downward spiral. In the energy sector, PPP was expected for example to reduce power outages. PPP then seemed as a good alternative to a long history of public sector failures [1]. Public sector monopolies tended to be plagued by inefficiency and failed to expand services to meet rapidly growing demand. Many were strapped for resources because governments succumbed to populist pressures to hold prices below costs, notwithstanding that the beneficiaries of these subsidies were usually not the poor. Overstaffing and mismanagement, including the diversion of revenues by employees of these utilities, were common, and indeed still remains so under public provision. Consumers were often in the position of having to cope with shortages and lack of access by self-provision or buying expensive inferior substitutes to network access. The inability of public utilities to meet demand created black markets for connections. [2]

Until the early 1990s or so, infrastructure industries – energy, ports, railways, roads, telecommunications and water & sewerage – were generally almost exclusively a public sector responsibility. This has changed. Private corporations – often not local – are now an actor in roughly 40-50% of the countries of the world in some key dimension of large-scale service delivery – the average is somewhat higher for developed countries than for developing countries and for some sectors than for others.

For developing and transition economies, there were at least three main drivers behind this transformation. The first was a change in ideology. The high profile of the, then, very atypical 1970s British and Chilean experiences with market oriented privatization, were the results of political reversals in these two countries. These real life laboratories of the competition cum privatization

[1] World Bank, Antonio Estache: PPI partnerships versus PPI divorces in LDCs, p. 2, January 2005
[2] World Bank, Clive Harris: Private Participation in Infrastructure in Developing Countries, p. 3, April 2003

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experiments eased the large-scale replications of the 1990s. British and Chilean experts traveled the world during the 1980s "selling" their experiences to curious audiences from Africa, Latin America, Asia and later Eastern Europe. At this point, it has to be said that 90% of future plants will be in Asia, Africa and South America [3].

The second change engine was technological. The telecommunication revolution is well known and has been internalized in the most remote areas of the world. Not quite as spectacular as in telecoms, technological changes have however also reached almost all other sectors in poor countries. From more cost effective small water systems to spectacularly performing low cost small-scale solar generators, technological progress is slowly but surely changing the market structure in energy service delivery in developing countries.

The third engine of reform is the fiscal crisis of the 1980s to the mid-1990s in most developing and transition economies. Governments could no longer afford the high costs of the historically high inefficiency levels and of the resulting subsidy demands of the sector. Moreover, governments had long stopped significant investment in the sector. [4]

There are four principal roles for the private sector in PPP schemes [5]:

- to provide additional capital;
- to provide alternative management and implementation skills;
- to provide value added to the consumer and the public at large;
- to provide better identification of needs and optimal use of resources.

The advantages of PPP are [6, 7]:

- enhance government's capacity to develop integrated solutions
- facilitate creative and innovative approaches
- reduce the cost to implement the project
- reduce the time to implement the project
- transfer certain risks to the private project partner and better risk allocation

[3] The dams newsletter, No. 2, May 2004
[4] World Bank, ~~Antonio Estache, Sergio Perelman and Lourdes Trujillo: Infrastructure Performance and Reform in Developing and~~ Transition Economies: Evidence from a Survey of Productivity Measures, p. 1, February 2005
[5] European Commission: Guidelines for successful public-private-partnerships, p. 4, March 2003
[6] European Commission: Guidelines for successful public-private-partnerships, p. 15, March 2003
[7] Public-private partnerships, Managing risks and opportunities, Akintola Akintoye, Matthias Beck, Cliff Hardcastle, Blackwell Science Ltd., p. 7-9, 2003

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- Acceleration of infrastructure provision
- Reduced whole life costs
- Better incentives to perform
- Generation of additional revenues
- Enhanced public management

However, while PPPs can present a number of advantages, it must be remembered that these schemes are also complex to design, implement and manage. They are by no means the only or the preferred option and should only be considered if it can be demonstrated that they will achieve additional value compared with other approaches, if there is an effective implementation structure and if the objectives of all parties can be met within the partnership. [8]

A few guidelines to help [9]:

- A multitude of PPP structures exist and must be selected according to project type, needs and sector. There is no single perfect model.
- Each type of PPP has inherent strengths and weaknesses which need to be recognized and integrated into project design.
- Each partner to a PPP has responsibilities. The Public sector must transform its role from a service provider to manager / monitor of private contractors.

The overall aim of PPPs is therefore to structure the relationship between the parties, so that risks are borne by those best able to control them and increased value is achieved through the exploitation of private sector skills and competencies.

[8] European Commission: Guidelines for successful public-private-partnerships, p. 4, March 2003
[9] European Commission: Guidelines for successful public-private-partnerships, p. 13 + 17, March 2003

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Different types of contracts

There are a lot of different contracts in the PPP. The following figure shows the relationship between ownership and management in the different contracts:

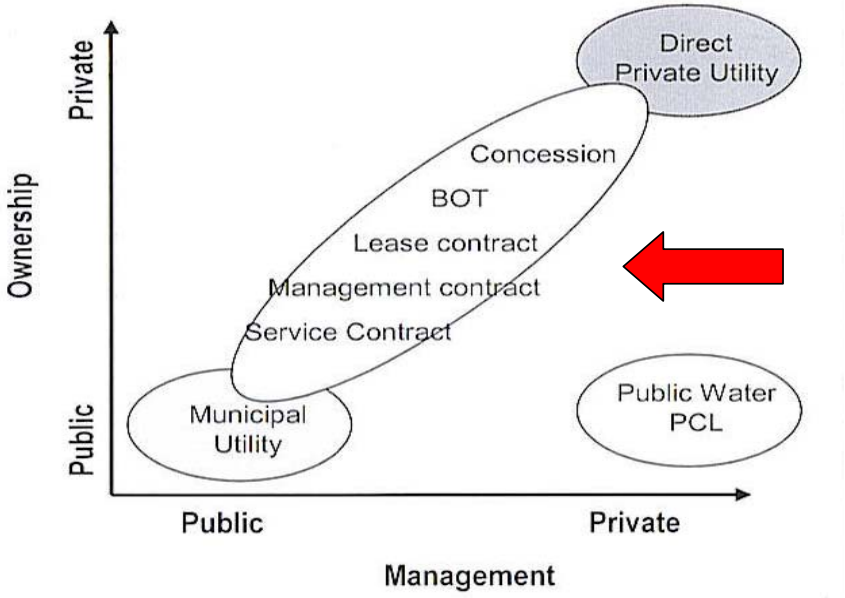

Fig. 1: The different contracts – ownership and management aspects [10]

A few explanations to the different types of contracts [11]:

- The Service Contract is an institutional arrangement whereby a private company is contracted to provide a clearly defined technical task (i.e. a mains rehabilitation exercise, design engineering) or administrative task (i.e. payment collection) for the public sector.
- The Management Contract is an institutional arrangement whereby a private company is contracted to take over core operations and maintenance responsibilities within a production unit. The customers remain legally clients of the public sector. This contract is to boost senior capability and introduce new concepts.
- The Lease contract is an institutional arrangement whereby, as in the case of the management contract, the private company is awarded a contract to undertake the core operations and maintenance responsibilities of a public entity. But unlike in the case of management contract, the leaseholder assumes the legal responsibility for operating the service in exchange for

[10] EPFL, MIR, Interview with Patricia Manso, April 2005
[11] Andrew Nickson and Richard Franceys: Tapping the Market, The Challenge of Institutional Reform in the Urban Water Sector, p.56-67

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payments for the use of the fixes assets. Customers become clients of the private company. The company does not have responsibility for debt servicing and financing new investment.

- The Concession contract is an institutional arrangement that has all the characteristics of the lease contract, but with the significant addition that the concessionaire also finances a detailed investment program for expansion and/or rehabilitation of the system. This contract transfer full commercial and technical responsibility to the private sector and, in addition, transfers responsibility for obtaining capital funds.

Capital funds for infrastructure components such as plants can also be obtained under arrangements such as:

- The Build Operate and Transfer (BOT) contract is an increasingly common institutional arrangement used to finance infrastructure projects. Under this arrangement the private promoter is required to design and finance the investment project, to construct and commission the asset, to operate and maintain it to an agreed standard for the concession period (typically 25-30 years), and then to hand over the asset to the provider in good working order at the end of the concession term. Where the legislative framework permits, an alternative Build Own Operate Transfer (BOOT) contract may be used.

  BOT-based developments have been realized in several developing countries as an intermediary scheme between public sector development and pure power generation business of the private sector. The BOT scheme is considered to be coordination of the roles between public and private sectors form the standpoint of risk sharing and attribution of assets. [12]

For the last type of contract, there are many variation of it, not only the BOOT. The following table gives the whole terminology:

BOT	Build, operate, transfer
BOOT	Build, own, operate, transfer
BOTT	Build, operate, train, transfer
MFO	Maintain, finance, operate
ROT	Rehabilitate, operate, transfer
BROT	Build, rehabilitate, operate, transfer
DFBO	Design, finance, build, operate
Reverse BOT	Gov. declining finance of BOT

Tab. 1: Terminology

[12] International Commission on Large Dams, Yoshiki Onoi, Nobuaki Kawata, Takayuki Niimura, volume 1, report 6, p. 85, June 2003

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To have a brief overview of the importance of the different contracts, table 2 shows in percent the number of each type of contract in MLIC).

Type of contract	**%**
Service Contract	35 %
Management Contract	12 %
Lease Contract	4 %
ROT	2 %
BOT	22 %
Concession	19 %
Other (mainly divestiture)	6 %

Tab. 2: Type of contract in Middle and Low-Income Countries (MLIC) [13]

A main difference between the different contracts is the duration time of the contract. Here a short overview:

Service Contract: 1-2 years

Management Contract: 3-5 years

Lease Contract: 10-12 years

BOT Contract: 20-30 years (operating period, one has to add the 10-20 years for the construction)

Concession Contract: 25-30 years

Besides these types of contract, there are still other possibilities. One is outsourcing and the other a total privatization. Or the government doesn't make contract with private, but instead liberalize the industry sector.

Current evolution

There are different zones of maturity for PPP in the world, related under others to different organizational framework. A high maturity is found in North America, Europe and in the South of Latin America. A medium maturity is found in Central America, Turkey and India. Especially in Africa, the maturity has yet to be developed. There are still many regions in the world where the physical, social, environmental and economic conditions are favorable for hydropower projects. [14]

[13] 2nd WORLD WATER FORUM: "Water and Public-Private Partnerships", Keynotes, p. 9, The Hague 17-22 March 2000

[14] International Commission on Large Dams, Jean Biquet, Daniel Devely, Bernard Tardieu: Typology and special features of some BOT Hydropower Projects, volume 1, report 5, p. 59, June 2003

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On average, a smaller proportion of the developing countries are sharing the responsibility for service delivery in the network industries than in developed countries. In general also, it seems that among developing countries, the richest countries have been more systematic at engaging in reforms to attract the corporate private sector. [15]

	Electricity Distribution	Water & Sewerage	Railways	Telecoms
Developing Countries	36%	35%	37%	48%
Developed countries	43%	80%	65%	83%
Sub-Saharan Africa	28%	20%	47%	41%
East Asia	20%	64%	43%	38%
Eastern Europe	48%	62%	20%	58%
Latin America	61%	41%	56%	67%
Middle East	6%	18%	20%	23%
South Asia	13%	13%	17%	50%

Source: Estache and Goicoechea (2004)

Tab. 3: How present is the private sector in network industries? (Share of countries in tot. nbr. of countries. [15])

The overall message is usually quite positive for electricity, telecoms and most transport privatizations. There are more doubts on water privatization with a wide variety of experiences (for instance, see Estache and Rossi (2002)). Most of these papers however tend to focus on the ownership question. A few papers have now started to look at the impact of regulation on these efficiency measures. For developing countries, Estache and Rossi (2004a) show how the choice between price caps and rate of return matters as expected for efficiency and much more so than ownership in electricity distribution. [16]

The main overall conclusion is that the record is quite mixed. While in general, the efficiency levels, quality and access rates have benefited from the reforms, these gains have been achieved at significantly higher fiscal costs and distributional costs than expected.

Indeed, the PPP relationship meets the expectations of the sector specialists concern with efficiency but probably not the standards of macroeconomists concern with the fiscal costs of the sector and with the interest groups committed to ensure that the interests of the poor are at the top of the short run agenda and not just on the long run agenda. [17]

But in the case of Africa, and presumably in all LDC's, there are more problems, which are the corruption, a worse quality because one has to slow down the prize for these poor regions, and the

[15] World Bank, Antonio Estache: PPI partnerships versus PPI divorces in LDCs, p. 4, January 2005

[16] World Bank, Antonio Estache: PPI partnerships versus PPI divorces in LDCs, p. 9, January 2005

[17] World Bank, Antonio Estache: PPI partnerships versus PPI divorces in LDCs, p. 12, January 2005

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non-payment risk. There are organizational problems, too, like if in the electricity sector only the generation is privatized, but not the transport and distribution, the transport monopole can buy the produced electricity “for free”, because there is no other transport possibility. And it would be to expensive and ecological non-sense to duplicate the whole transport and distribution network.

For the non-payment problem, there is the solution to work only with prepay like in the cell phone sector, which works in Africa. But for electricity, people always find ways to bypass the installed counters.

It’s important to note that before the PPP, the public had the monopoly for the service in electricity (generation, transport and distribution). The state had a social goal to fulfill. With the change to PPP and the participation of private, the privates have an economic goal (maximize the profits). To avoid private monopoly which would bring a lot of social problems (to high prices of a service for example), the World Bank gives only loans if there is a competition. Mainly, the competition is for the market and not in the market.

Because of economies of scale and scope and, in many developing countries because of the high commercial risks faced by private operators, limits to the achievable degree of competition in the market continued to prevail in some cases. In small countries, monopolies are indeed hard to avoid in water and energy distribution and in bigger countries, national monopolies are replaced by regional or local monopolies, but monopolies nonetheless. This is why competition for the market has become so popular during the 1990s.

One of the assumptions implicit in this promise was that the number of potential providers in the sector would be large enough to allow competition for the market to be effective. This did not happen for all sectors. In Latin America for example, during the 1990s, 92% of the water and sanitation auctions, 76% of the transport auctions and 57% of the energy auctions awarded had 3 or fewer bidders (Estache (2003)).

The experience showed up that in the countries in which the energetic expansion has been based by economic principles “on the short term”, developed the capacities in the thermal power sector (on gas and coal) which have initial costs of capital lower and reduce terms of achievement than in the case of hydraulic. The developing on the short-term doesn’t take in consideration that after the period of the

retrieval of the loan (12-15 years) the generated power in the hydraulic plants returns to 4-5 times lower price than of any comparable capacity from thermal. [18]

Any private investor analyses on a short-term looking for an investments recovery as quick as possible, the developing of new capacities in hydraulic becomes possible only if exist the Power Purchase Agreement (PPA) and so, the private investor is isolated from the commercial risks. [18]

Financing

The real value in a project financed this way (PPP) is not in the ownership of its assets, but in the right to receive cash flows from the project. The structure of financing power project largely can be categorized as follows [19]:

- equity
- debt- loans, bonds, debentures, etc.
- net internal resources: retained profits plus depreciation less funds utilized for debt servicing and catering to the needs of additional working capital
- others sources like leasing, hire purchase, deferred payments, etc.

Private-sector project finance debt is provided from two main sources – commercial banks (82% of it in 2001) and bond investors (insurance companies and pension funds) [20]. Public-sector project finance debt as subsidies. The local funds largely coming from Pension Funs, Insurance, Military Funds, etc. [21] Foreign loans are mainly bilateral and multilateral loans, grants and mixed credit, export credit and commercial borrowings.

Lenders with to have Promoters with experience in the industry concerned and the ability to provide any technical or operating support required by to project; a reasonable amount of equity invested in the

[18] International Commission on Large Dams, Eugen Pena, Mihai Telenau: Hydropower projects financing through the public private partnership – a future powered by hydro, Montréal, volume 1, report 2, p. 18-19, June 2003

[19] International Commission on Large Dams, D.K. Dhar: Financing hydraulic projects including dams, Montréal, volume 1, report 13, p. 190-191, June 2003

[20] E.R. Yescombe, Principles of project finance, p. 22, 2002

[21] International Commission on Large Dams, D.K. Dhar: Financing hydraulic projects including dams, Montréal, volume 1, report 13, p. 192, June 2003

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project; and interest in the long-term success of the project.

The differences between bank loans and bonds are various, only a few are given here:

Bank loans:	**Bonds:**
- can be provided to any credit-worthy market	- only available in certain market
- inflation-linked loans generally not available	- some markets can offer bonds with the inters rate linked to inflation
- Project Contracts kept confidential to a restricted number of banks	- the terms of Project Contracts may have to be published in listing particulars prospectus
- Banks exercise control over all changes to Project Contracts and impose tight controls on the Project Company	- Bond investors only control matters that significantly affect their cash flow cover or security
- Banks tightly control the addition of any new debt and unlikely to agree the basis for this in advance	- It is generally easier to add a limited amount of new debt to bond financing as bond investors will agree the terms for this in advance
- It is easier to negotiate with banks if the project gets into difficulty.	- Bonds may be less flexible if major changes in terms are required
- If a project gets into difficulty, negotiations with banks should remain private	- Negotiations with bond holders may be publicized
- Low penalties for prepayment	- High penalties for prepayment

Tab. 4: Bank loans vs. Bonds [22]

The "PPP-World" is a fast changing world. Financial institutions should develop policies to make available soft loans and cheaper credits and should come out with innovative schemes for leasing, refinancing, Quasi debt instrument etc [23]. To keep the sustainable development view, more hydropower projects should be developed (the Bonn Renewables Ministerial Conference recognized hydropower as a renewable source of energy, regardless of the size of the power plant [24]). One way could be to allow hydraulic companies to issue lower inters rate bonds, giving guarantees to subscribe; to direct the government owned banks and financial institutions to allocate resources and lend liberally to hydropower sector by treating it as a priority sector; and to offer higher return on equity to hydropower projects as compared to thermal power [25].

Additional, it could be that in a near future a global carbon tax could be introduced because of the political bargaining on charging CO2-emissions at the national level to reach Kyoto Protocol [26]. This would have a major impact on the thermal and puts the hydraulic in an advantage position.

[22] E.R. Yescombe, Principles of project finance, p. 64, 2002
[23] International Commission on Large Dams, D.K. Dhar: Financing hydraulic projects including dams, Montréal, volume 1, report 13, p. 198, June 2003
[24] International Commission on Large Dams, Cassio Baumgratzu Viotti, Newsletter, May 2004
[25] International Commission on Large Dams, D.K. Dhar: Financing hydraulic projects including dams, Montréal, volume 1, report 13, p. 199, June 2003
[26] Swiss Agency for Development and Cooperation (SDC), SDC paper: New sources of development financing: an SDC working paper, p.5, Berne, 2005

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Cases

Three cases from Africa are given in Tab. 5. For each one figures the main technical and financial characteristics, as well as information about the type of contract and organisational issues. Because these are recent cases from which not all information can be publicised, there are no names and countries named. Three more cases on hydraulic plants are given in the annex, because there are less recent than the others.

	Case 1 (Thermal, diesel)	**Case 2 (Hydraulic)** (run-of-river)	**Case 3 (Hydraulic)** (run-of-river, with dam creating an reservoir of about 400ha when full)
Capacity (MW)	65 MW	60 MW	300 MW
Production a year (GWh)	420 GWh	190 GWh	2520 GWh
Construction period	16 months	30 months	44 months
Investment costs	68 Mio US$	122 Mio US$	513 Mio US$
Equity-debt distribution	30% Equity, 70% loan agreement	20 % Equity, 80% loan debt with planned 5% interest rate; pay back period of 15 years; IRR of investment of 9.75% and IRR of equity anticipated dividend insuring a 13% return on shareholder's equity	25 % Equity, 75% debt financing (25% equity required by the government); IRR of equity of 10.75 %
Investment costs per MW installed	1.05 Mio US$/MW	2.03 Mio US$/MW	1.71 Mio US$/MW
OM costs a year	6.6 Mio US$ costs/year (plus contingencies, margins and taxes. The variable O&M costs would cover spare parts (39%), lubricating oil (32%), other non-fuel consumables (23%) and maintenance fuel (6%))	2.3 Mio US$/year	4.5 Mio US$/year
OM costs per kWh produced a year	0.016 US$/kWh	0.012 US$/kWh	0.002 US$/kWh
Sold price	0.16 US$/kWh (average)	0.094 US$/kWh first 15 years, then 0.090	Sold 27.55 US$/kW/month, evaluated at 0.0280 US$/kWh
Energy buyer	The energy is sold to national electricity distribution company through a PPA	The energy is sold to "Energy of Country B" with a PPA and directly to large consumers such as gold mines, currently supplied by diesel generators.	The energy is sold to State utility with a PPA

Type of contract	BOT: The new IPP will be privately owned and operated and equipped with large Diesel motors burning heavy fuel oil (HFO), a low-cost process residue from the nearby oil refinery	BOOT	BOOT
Duration of concession	15 years	30 years (included the construction time)	30 years
Additional comments	Environmental Impact Study of 130 pages + annex. (noise, emissions, waste water, …)	For each % equity more/less the price is 0.0014 US$ more/less. 0.0098 US$ more for each year delay. Investors will be exempted from the income tax during the first 8 years and is allowed to re-export their benefits.	The client pays the installed capacity and not the kWh. At the end of the PPA, the company will sell and convey all of its right, title and interest in the Power Station to the Government for the sum of 1 US$ plus any overdue Capacity Payments, in accordance with the procedures set forth in the Implementation Agreement. Environmental impact study of over 200 pages.

Tab. 5: Cases [27]

These cases show a clearly longer construction period for the hydraulic plants for a given capacity (Case 1 and 2). The investment costs are much higher for the hydraulic plants than for the thermal ones, too. It keeps the proportion of about 1:2. The interesting characteristic of investment costs per MW installed points really out that fact that the initial investment for hydraulic plants is more significant. On the other hand, the OM costs per kWh are much more deeper for the hydraulic.

In all three cases, the energy is sold through a PPA (Power Purchase Agreement). Without it it isn't possible for the promoter to handle the financial risk of non-payment.

The duration of the concession diverse in a proportion of 1:2 again. The reason is that in the case of hydraulic one needs more time to pay back the initial investment.

[27] these cases are confidential, that's why there aren't names and countries named.

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Decision models

Today, simple models using Excel exist to help project manager to analysis projects mainly from a financial angle. Some of them can also be used to evaluate different types of investment determined by the type of contract (BOT, lease contract, ...), the duration of the concession, the participation of the public investors, the rate of interest and other financial criteria. For example, RETScreen developed from the "Natural Resources Canada" gives a brief overview on the technical and financial data and ratios [28]. Or the World Bank developed Infrisk, a program in Excel to evaluate only the financial part of a project. An engineer office may develop an own analysis model for specific project, helping them to decide which type of investment should be chosen and evaluate the own financial risk on the equity invested. One could also develop models for the comparison between thermal and hydraulic plants using technical, financial and organizational data and introducing different kinds of types of investment and different scenarios for future evolution. To start, one would introduce technical requirements (capacity, continuous or peak-load energy, prize per kWh). An example of data is given in Tab. 6:

Quantitative		**Qualitatifs**
Hydraulic	Thermal	**Organisationnel**
Technical		- legal framework (corruption)
- capacity (MW)		- non-payment
- operation time		- political acceptance of PPP (expropriation, breach of contract)
- numbers of turbines		- opposition of population
- turbines efficiency		- type of contract (BOT)
- losses (parasitic, transformer, generator)		- power purchase agreement
- variation of flow	- greenhouse gas	**Environmental**
- type (reservoir, run-of-river)		- oil price
		- impact on environment
Financial		- war or civil disturbance
- Investment Costs (feasibility study, development, engineering, power system)		- inflation
- Exploitation Costs (O&M, fuel-cost, debt payments, taxes)		- economic growth
		- exchange rates

Tab 6: Criteria in an analysis model for the comparison between thermal and hydraulic plants [29]

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[28] RETScreen Models. www.retscreen.net
[29] Decision model, Nicolas Crettenand, September 2005

The analysis would be by a ponderation of the criteria and the result would be a comparison between a thermal and hydraulic plant. Recommendations would follow on type of investment, too.

With the fast development of PPP and the markets which open to such contracts, new entries and smaller corporations may use such models to compensate their lack of experience. The experience is one of the important entry barriers to the "PPP industry". It is this experience that enable actors to dominate the market and network the way to get the less risky projects.

Such models may be of a great help for the risk management, too, because they can include modules for sensitivity and risk analysis [30].

Risk management

The risk management is the key to the success in PPP. A risk is defined as any factor, event or influence that threatens the successful completion of a project in terms of time, cost or quality. A table is given in the annex. A key principle of PPPs is that risk should be allocated to the party best able to manage it. The effective allocation of risk has a direct financial impact on the project as it will result in lower overall project costs and will therefore provide enhanced value for money if compared to traditional procurement methods.

All risks will be associated with a price premium. Therefore the objective must be to achieve cost effective risk transfer not simply risk allocation for its own sake. [31]

Revenue risk is the most fundamental of all unknown factors involved in PPP projects. Revenues flows are generally determined by two factors: utilization levels and tariffs. The availability of reliable historic information documenting demand and price elasticity levels varies among different sectors. However, the cost of providing electricity may well have been subsidized in the past, making it more difficult to determine how consumers would behave in the face of unsubsidized pricing. [31]

There is some debate as to how much risk should be transferred from the public to the private sector. Generally, the more risk transferred to the private sector partner, the more financial reward the private

[30] RETScreen Models. www.retscreen.net ; Infrisk Model, World Bank
[31] European Commission: Guidelines for successful public-private-partnerships, p. 50-51+79, March 2003

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partner will demand. **Risk should be allocated to the party who can best assume it in the most cost effective manner.**

As said before, to attract private investment, the rewards must be commensurate with the risks. One measure of the potential rewards is the size of the market. Low per capita income and low or negative economic growth can make developing countries's infrastructure markets appear small and unattractive to private investors in a world where competition for private investment in infrastructure is intensifying. In many cases, a key problem is insufficient information on how a market would respond to cost-covering tariffs. There are also questions over the affordability of cost-covering infrastructure tariffs in developing countries, and of the cost implications of relying on private rather than public finance. And even if affordability is established, a long tradition of illegal connections and non-payment by government customers reduces the potential size of the market and introduces additional risks for potential investors. [32]

Many of the special risks faced by potential investors in developing countries are due to a legacy of political instability and, in many cases, the weak credibility of government commitments. Risks are particularly acute in the infrastructure sector, where investments tend to be large and immobile, and where tariffs tend to be political like in the electricity sector. Additional non-commercial risks that may be particularly sensitive to investors in some developing countries include the risk associated with war or civil strife and the risk of expropriation [33].

Two last general comments on risks: A common error in risk identification is to inadvertently duplicate risk. For example, the risk of failure to deliver a service may not be independent of other risks such as process design deficiency or of inadequate resourcing of skill levels. Risks may be inter-related and have a common result. [34]

In a BOT contract the promoter takes most of the risks. He can try to transfer certain risks to other actors. The best way to do it is to integrate other actors in the ownership of the project, mainly the government (often 10-30% of the equity), the contractor, the operator and the customer. That way the

[32] World Bank, Michel Kerf and Warrick Smith: Privatizing Africa's Infrastructure, promise and challenge, p.21, September 1996
[33] World Bank, Michel Kerf and Warrick Smith: Privatizing Africa's Infrastructure, promise and challenge, p.47, September 1996
[34] European Commission: Guidelines for successful public-private-partnerships, p. 83, March 2003

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risks are distributed upon different actors. Or he turns towards lease contract instead of contracts with a form of ownership (BOT, concession).

An important point to mitigate the risks is the experience. The more experience the promoter has in PPP, the better he can manage the different risks and allocate it to other actors. This rises up the possibility to make profit. That leads us to the opportunity to make money as a private actor.

The different variables to handle are:

- transfer the risks
- risk assessment of non-transferred risks
- insurances (interest rate, amount)
- provision in case of a force majeure

On the other hand, the government is in a weak position because he needs foreign capital. The bargaining power is low and that influence the risk assessment. The promoter will only sign the contract if the condition given by the government pleases him. The main risks stay at the government. The opportunity for the government is mainly to attract private capital for financing new infrastructure, renovate existing infrastructure or provide a required service. If the government hasn't the capital himself (what in developing countries is often the case), he has to get it from elsewhere. The PPP are a valid solution.

But it has to be said that the investors want today an interest rate of 20% to 30% what leads to more expensive projects. That's why the state often has to take further loans, for example at the World Bank, and encumbers with debts more and more. Or there are hidden cross-subsidies from international actors.

World Bank

It's necessary to make some comments on the World Bank because the play an important role as actors in the PPP. The World Bank takes almost no risk. They participate only with loans and would like that the private sector takes more risk. They would like to see them making concession contract and not lease contract. The lease contracts transfer commercial and technical responsibility and risks to

the private sector. The concession contracts transfer full commercial and technical responsibility and risks to the private sector and, in addition, to transfer responsibility for obtaining capital funds. The ultimate objective is to secure private investment [35].

The World Bank plays a very important role in the administration reforms and the creating and ameliorating of the regulation. They help the government for the whole regulation issue.

The main issue is not to maximize the profit, but to be able to manage the risks. One may even ask if this industry is a "risk industry", in which the services provided don't play as an important role, as how the risk management and assessment is done. Each actor will try to transfer the risks as much as possible to the other actors. But it has to be reminded, that each recognized risk has a financial value. The more risk the public transfer to the private contains, the higher the financial remunerations are. This offers new opportunities for the private sector.

As shown in Fig. 2, the identification of risks should be followed by a search for solutions than can eliminate or mitigate these risks. If the risks are successfully eliminated, then there is nothing to evaluate. If, however, solutions are derived to counter these risks, then the cost implications of the mitigating solutions should be evaluated. The outcome of the evaluation should be fed back to the identification task to re-appraise the new risk profile of the project. Sometimes the mitigation of risks gives rise to secondary risks, which must in turn be addressed through identification-mitigation-evaluation. [36]

There is always the issue of probabilities to be considered. The iteration process of risk through identification-mitigation-evaluation continues until a satisfactory position s reached. Fig. 2 shows that risks are still monitored and controlled, after they have been finally evaluated. [36]

[35] World Bank, Michel Kerf and Warrick Smith: Privatizing Africa's Infrastructure, promise and challenge, p. 18, September 1996
[36] Public-private partnerships, Managing risks and opportunities, Akintola Akintoye, Matthias Beck, Cliff Hardcastle, Blackwell Science Ltd., p. 99, 2003

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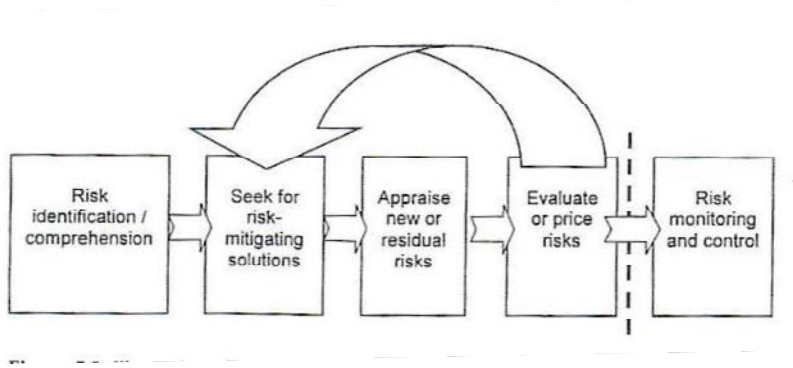

Fig. 2: Illustration of the risk management process [37]

Because PPP contract are maid on a long period time, there an additional risks in comparison to shorter in time project, like the risks related to demographic change or legislation changes.

While most forms of traditional privatisation include “transfer of risks” to on party, risk sharing between the public and the private sectors may improve the efficiency and effectiveness of privatisation [37]. But it has to be remembered that the allocation of project risks in BOT project is an art rather than a science, said Renton [38].

The involvement of a large number of parties increases risks, since each party has different objectives. But risks sharing can be done better, but on the other hand a risk of one party may have an impact on the other parties.

Most large-scale infrastructure projects are financed using non- or limited recourse project financing, a form of debt financing in which lenders rely exclusively on the revenue stream generated by an infrastructure project as the source of loan repayment. Since lenders assume most of the risk in such projects, providing 70-75% of the capital costs in the form of debt financing, lenders have developed risk allocation requirements which must be met in any international project financing. The success of privately developed infrastructure project in Asia (and especially other developing countries) is therefore highly dependent on the ability of investors to meet the risk allocation requirements of international non-recourse lenders and to assure that legal commitments made in connection with their projects are upheld once funs are invested. [39]

[37] Public-private partnerships, Managing risks and opportunities, Akintola Akintoye, Matthias Beck, Cliff Hardcastle, Blackwell Science Ltd., p. 314, 2003

[38] Public-private partnerships, Managing risks and opportunities, Akintola Akintoye, Matthias Beck, Cliff Hardcastle, Blackwell Science Ltd., p. 263, 2003

[39] Public-private partnerships, Managing risks and opportunities, Akintola Akintoye, Matthias Beck, Cliff Hardcastle, Blackwell Science Ltd., p. 225, 2003

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Risk profile of hydraulic and thermal BOT

The risks peculiar to hydraulic and thermal power project can be classified into a development risk until the financial closure (risk only for the project company / promoter), construction completion risk (risk for the project company, lenders and the contractor) and operation risks (risk for the project company, lenders and OM contractor) based on the related timeframe. As one of the development risks peculiar to hydropower, the relatively long time for the arrangement of complex financial scheme is representative. [40]

Both underground conditions and water volume belong to natural risks and must be recognizes as risks peculiar to hydropower, which are different form those of a thermal power plant. For the construction risks, there are large coal thermal power plants fully utilizing advanced environmental technologies, and highly efficient plants using Combined Cycle Gas Turbines (CCGT) as a result of developments of natural gas and expansion of its supply systems. These technologies for thermal power plants have been packaged and most of the productions processes are completed at factories in developed countries, with the result that only the installation is locally done. The quality control of thermal power plants is generally more standardized than that of hydropower plants for which a large portion of civil works is locally carried out. Therefore, conditions to realize the EPC turnkey of thermal power plants are more acceptable than that of hydropower plants. [41]

During the operation period, the hydrological risk should be first point out for hydropower plants. While the supply of fuel to a thermal power plant is artificially made and fuel-suppliers are replaceable, the water inflow is under the control of nature and is not replaceable. That's especially for run-of-river plants. In the case of reservoir, it has to be large enough to carry over for two or more years, so that hydrological fluctuations have little effect on the energy generation. [42]

The market risks are for both the same. Peak-load energy can be delivered within less than a minute in the case of hydropower and in a few minutes in the case of thermal power plant. In this particularly case of peak-load energy needed very fast, the hydropower is in advantage.

[40] International Commission on Large Dams, Yoshiki Onoi, Nobuaki Kawata, Takayuki Niimura, volume 1, report 6, p. 95, June 2003
[41] International Commission on Large Dams, Yoshiki Onoi, Nobuaki Kawata, Takayuki Niimura, volume 1, report 6, p. 96, June 2003
[42] International Commission on Large Dams, Yoshiki Onoi, Nobuaki Kawata, Takayuki Niimura, volume 1, report 6, p. 98, June 2003

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Critical success factors for PPP in general

The big question is "is the investment more or less 50 Mio US$". Currently, most bancs, which are asked for loan, have this 50 Mio US$ as barrier. Is the investment above 50 Mio US$, then:

- development is expensive (big environmental impact study needed, specially for hydraulic projects)
- the promoter needs 3-5 Mio US$ from the beginning to invest from his one even he isn't sure to get the BOT-contract
- in the practice, one takes projects which aren't complicated, like a rehabilitation project, run-of-river hydraulic plants, …

The critical success factors are:

- negotiate the environmental issues, specially with the NGO
- built very fast because investment is at the beginning (for example not have to much civil engineering works to do)
- have the needed money for the whole investment and as promoter have financial resources to start promoting for the project and engaging funds even there is no certainty to get to project

In the case of a project of less than 50 US$, the critical success factors are:

- To find the fund. Most lenders don't invest in project below 50 US$, because they don't evaluate small projects. There are only few bilateral funds for project of this size.
- To have the equity and experience the way you can still find lenders
- To have guarantee on his own as promoter. For example: for a 10 Mio US$ project the promoter needs 8 Mio US$ loans, then he has to have guarantee in form of assets for example. One other possibility is to have a local banc who gave the guarantee because it knows the project and can supervise it. This local banc agrees to give a bank guarantee to a foreign bank, who gives the loan. In this case the financial risk stays at the local bank.

Critical success factors for PPP thermal

- Pos:
    - more limited initial investment

- construction time shorter (less "blocked" money in the time where there isn't a revenue) (about 10 months)
- less complexity than hydraulic (doesn't need big environmental impact study as hydraulic needs + construction time shorter => easier logistic)

- Neg:
  - is there a CO2-Tax
  - are there any contract for oil/gas (e.g. for 10 years with fixed prize) or one has to buy it on the market (volatility of the oil price)
  - fossil energy

Critical success factors for PPP hydraulic

- Pos:
  - On the long-term it's cheaper (cheap exploitation costs)
  - Long life (50 years for civil works and 25 years for the hydromechanics and electrical equipment)
  - No gas imitation
  - Fulfils far more sustainable development view
- Neg:
  - Bigger infrastructures: impact on environment
  - Very big initial investment (the highest project expenses usually occur during the construction phase)
  - Uncertainty on construction time and construction costs

Relevant criteria for the choice between thermal and hydraulic

- Amount of kWh needed (is there enough hydraulic capacity? If not, the only thermal solution)
- type of energy needed - continuous vs. peak-load (thermal: doesn't matter; hydraulic: either reservoir possible (peak-load possible, then hydraulic projects are the best choice [43]) or run-

[43] International Commission on Large Dams,D.K. Dhar: Financing hydraulic projects including dams, Montréal, volume 1, report 13, p. 189, June 2003

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of-river (continuous possible)

- cost of the carburant (hydro: one need a concession for using the water; thermal: oil price!, or one has something a similar paper as the concession for water with fixed price)
- regulatory factors (e.g., CO2 tax)
- Type of investment (long construction period possible?)
- problems with NGO / population for a hydraulic plant => chose thermal plant
- big doubts about the geology, hydrology and other sides factors => chose thermal plant
- is there a sustainable development view

Because the civil works part has the biggest weight in the hydraulic projects financing (60-80%) [44], for local economy, a hydraulic project is very important because of benefits that it assumes. Hydraulic projects may have multiple utilization (water supplies, irrigation, protection against floods, etc.), too, what represent an additional value to it.

[44] International Commission on Large Dams, Eugen Pena, Mihai Telenau: Hydropower projects financing through the public private partnership – a future powered by hydro, Montréal, volume 1, report 2, p. 20, June 2003

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Conclusion and recommandations

- The main overall conclusion about PPP is that the record is quite mixed. While in general, the efficiency levels, quality and access rates have benefited from the reforms, the price grew up.

- The state had a social goal to fulfill. With the change to PPP and the participation of private, the privates have an economic goal (maximize the profits).

- The experience showed up that in the countries in which the energetic expansion has been based by economic principles "on the short term", developed the capacities in the thermal power sector (on gas and coal) which have initial costs of capital lower and reduce terms of achievement than in the case of hydraulic. In addition, the longer the contract period time is, the more additional risks like demographic change or legislation changes come into the play. The developing on the short-term doesn't take in consideration that after the period of the retrieval of the loan (12-15 years) the generated power in the hydraulic plants returns to 4-5 times lower price than of any comparable capacity from thermal.

- The risk management is the key to success. The main issue is not to maximize the profit, but to be able to manage the risks. Risk should be allocated to the party who can best assume it in the most cost effective manner. For each party the personal network and experience with PPP bring an competitive advantages.

- Risk profile of hydraulic and thermal: There are more risks for the hydraulic plants (geology, hydrology), but in the case of thermal there are risks on the raise of the fuel prize and a possible legislation about CO2.

- Critical success factor for PPP in general is this 50 Mio US$ barrier.

- The advantages of thermal plants are the more limited initial investment, a shorter construction time and less complexity. But it's using fossil energy and its carburant is more under macroeconomics influence than in the case of hydraulic plants. Hydraulic plants present the advantages that in a long-term perspective, the cost per kWh is cheaper.

- The whole subject of PPP as still to be developed to find solutions for the financing of the needed infrastructures in developing countries. Especially for hydraulic projects which are longer on the time schedule and need more investment at the beginning, but fulfilled better the goal of sustainable development.
- The problem of finding investors for infrastructures project with no as high interest rates

- There is no "type contract". Each project is unique and has to be studied in its context (regulation, market, environment, …). But one constant for all PPP contract is that all identified risks have to be allocated to one party.

- For BOT today, thermal works better. For hydraulic, especially for bigger infrastructures, new types of financing will have to be developed.

Annex

Further cases:

	Dam and hydroelectric plant of Birecik, Turkey	**Dam and hydroelectric plant of Cana Brava, Brazil**	**Dam and hydroelectric plant of Potrerillos, Argentina**
Capacity (MW)	672 MW	450 MW	105 MW
Production a year (GWh)	3000 GWh	2396 GWh	750 GWh
Start of construction	April 1996		October 1996
Start of operation	October 2001 as planned	May 2002 with the first production unity (6 months in advanced)	June 2003
Investment costs	1.3 Mia US$	450 Mio US$	255 Mio US$
Equity-debt distribution	It's cover by 14.5% by the concessionary company and by 82% by senior debt and by 3.5% by the revenue of the fist production unit until all production unit are in function. The senior debt is by 75% credits of buyer and this credits have a maturity of 10 years and have a prime of 0.5-1% additional to the interbank interest rate "à 6 mois en viguer" (taux interbancaire à 6 mois en vigueur). The other 25% of the senior debt are cover by commercial credits with a maturity of 12 years and have a prime of 2-3% additional to the interbank interest rate "à 6 mois en viguer" (taux interbancaire à 6 mois en vigueur).	It's covered by 30% by the private shareholders and by each 35% by the two banks BNDES (Banco Nacional de Desenvolvomento Economico e Social) and BID (Banque Interaméricaine de Développement). Both debts have a maturity of 10 years. The BNDES credit has a prime of 1-2% additional to the interbank long-term interest rate TJLP. The BID credit has a prime of 3-4% additional to the interbank interest rate.	It's cover by 63.5% by the Province de Mendoza and by 36.5% by the concessionary company.
Investment costs per MW installed	1.9 Mio US$/MW	1 Mio US$/MW	2.4 Mio US$/MW
Energy buyer	The energy is sold to TEAS	The energy is sold to the free market: long term PPAs with several distributors + spot market (secondary energy that is hproduced upon the guarantee amount can be sold on the spot market)	The energy is sold to the market: long term PPAs with several distributors + spot market
Type of contract	BOT: Concessionary company of turkey right "Birecik Company" is owned by private national and foreign corporations	Concession	BOT: Concessionary Company of Argentinean right "CEMPPSA" is owned by two private national corporations

	(70% of the capital) and by national turkey company of electricity distribution TEAS (30% of the capital).		
Duration of concession	15 years starting from the operation time	35 years (included the construction period)	25 years starting from the operation time
Additional comments	Additional cost not includes in the Total Investment Costs like taxes, customs rights and the covering of certain risks are cover by an additional debt with was created by the turkey government to facilitate the private investment. The Concession giving Authority engages itself to help the concessionary company to get all administrative authorisations necessary for the project. All taxes for the corporations or theirs employees involved in the construction or exploitation are reduced to zero or taken by the concession giving Authority. All impacts (costs, delays, lost of revenue, etc.) coming from a force majeure event or coming from a fault of the concession giving Authority are supported by the concession giving Authority. TEAS has the buy all the produced energy even there aren't able to absorb it. The obligations of TEAS are guarantee by a guarantee of the State Tresory of Turkey (Trésor de l'Etat turc.) The tariff of the electricity is calculated the way that it assures a return on investment for the concessionary company.	-	Water for irrigation comes to from this dam. This water is free of charge. If the revenue of the sold energy during the concession period actualised by 14% is inferior to 120 Mio US$, the concessionary company has the right to obtain a concession prorogation of 5 years and maximum to 40 years in all.

Source : International Commission on Large Dams BINQUET, J. DEVELAY, D. TARDIEU, B. Typologie et spécificités de quelques projets hydroélectriques développés en BOT, volume 1, report 5, Montreal, June 2003

Table of risks:
(non exhaustive, taken from "Principles of project finance", E.R. Yescombe, 2002)

- Commercial risks (project risks):
  - Commercial viability:
    - Market (Client)
    - Price
    - Competition
    - ...
    - => market segment analysis
  - Completion risks (can the project be completed on time and on budget?):
    - Permits
    - Competence of contractor
    - ...
  - operating risks:
    - new technology
    - obsolescence
    - ...
  - revenue risks
  - input supply risks (can raw materials or other inputs be obtained at the projected costs?)
  - contract mismatch (do the project contracts fit together properly?)
  - sponsor support (is there a need for more recourse to the sponsors?)
- Macro-economic risks (financial risks): relate to external economic effect not directly related to the project:
  - Inflation
  - Interest rate risks
  - Exchange rate risks
    - Devaluation
    - ...
- Political risks (country risks):
  - Investment risks:
    - currency convertibility and transfer
    - expropriation of the project by the state
    - political violence (i.e. war und civil disturbance – also known as political force majeure)
  - Change of law risks
  - Quasi-political risks:
    - Breach of contract and court decisions
    - "sub-sovereign" risks (regional authority)
    - creeping expropriation (hidden complications such for obtaining permits, ...)
- environmental risks
  - force majeure

Comment: Risk evaluation and allocation: one needs to have the right, reliable, available, significant information

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