

## PPPs in the renewable sources energy sector: the Greek experience of a medium-scale hydropower plant

V.Kanakoudis<sup>1</sup>, M. Podimata<sup>2</sup>, A. Papotis<sup>3</sup>

<sup>1</sup> University of Thessaly, Civil Engineering Dept., Pedion Areos, 38334, Volos, bkanakoud@civ.uth.gr

<sup>2</sup> Environmentalist

<sup>3</sup> Production & Management Engineer

**Abstract:** The growth of investments related to the renewable energy sources sector rendered them profitable and competitive towards respective conventional ones, making imperative the need of examining their economic viability as investment drawings. The present study checks the feasibility of a small hydropower plant located in a small highland village, Vatsounia, Greece, utilizing the waters of a local river. The water used to produce electricity returns to the river in order to be used to irrigate cultivated land. The whole project combines high profitability while being environmental friendly. The special characteristic of this project is that a Public Base Company was established to run it. Regarding its partnership scheme, the Community itself holds 35% of the stocks, and the rest 65% has been given to the local residents (treated as individuals) with an upper limit of 2% per stockholder. This stock distribution practice is typical for a Public Base Community Company. The electricity produced is being sold directly to the Public Power Corporation according to the national law. The resulting revenues of this investment provide an important income for the local community and its shareholders. The case study presented proves that a medium-scale hydropower plant can be financially viable while being compatible to the sustainable development of the environment

**Key words:** Public Private Partnerships (PPP), renewable energy, medium-scale hydropower plants

### 1. INTRODUCTION

Public Private Partnerships (PPP) are types of cooperation between the public and the private sector, to finance, manufacture, renovate, maintenance and manage public infrastructure and provide services, in those sectors of national economy, where the market liberation is either impossible or undesirable. The participation of the private sector is being held either by the form of a partner cooperating with the public body within a joint implementation scheme, or by the form of a services' Provider to the public sector. Although this form of making business is widely used across the EU27, there are major differences regarding the actual practices between the western and eastern European countries. The main difference is that in the Western Europe, everything can be done unless there is a law that forbids it. On the other hand, in the Eastern Europe nothing can be done unless there is a law that permits it. Today PPP projects are mostly Large-scale infrastructure projects or services. The challenge is to expand this practice to medium-scale projects. A Large-scale project is defined as having a very high construction cost and a very long construction period.

### 2. WHY THE PUBLIC SECTOR IS TURNING TO PPPs? – BENEFITS vs. RISKS

The main reason forcing the Public Sector to turn to PPP projects is the (as stated) fact that the State (central government, regional/local authorities) usually has no or limited money to spend or has other priorities that need to be fulfilled first. On the other hand, the private sector can 'produce' better work with the same budget or the same, in terms of quality, work cheaper. Additionally, is a better manager and can handle the undertaken by him part of the risks more effectively. Also through PPP projects the Private Sector Participation & Private Finance Initiative are being better utilized. Additionally, public sector risk is reduced by transferring to the private partner those risks

that can better manage, provided services are improved and the assets are being better utilized. Finally, by taking advantage of private sector's innovation, experience and flexibility, PPP projects can often deliver services more cost-effectively than other traditional approaches. The resulting savings can then be used to fund other needed public services of higher priority. Finally, the public sector should examine the possibility of implementing a PPP project when:

- the provided service or project is new and cannot be implemented using the existing public funds and/or the public sector's know-how;
- the private sector can reduce the cost;
- the private sector can improve the quality of the service provided;
- the private sector can deliver the service or the project faster.

### ***2.1. The main driving force and objectives***

The ulterior motives for implementing PPP projects are based on the need to secure the state budget allocations; the quality improvement of public infrastructure and provided services; the mobilization of private sector's know-how in project planning and implementation (know-how pooling); the significant limitation of the life cost of a project or a service; and finally the sharing of financial risks (risk transfer from the public to the private sector).

The main objectives of PPP projects are the better exploitation of existing public funds; the differentiation of the way public infrastructure projects and services are being implemented, in order to advance innovation; the increased competition and know-how transfer from the private to the public sector; and the need to guarantee the desirable level of projects social benefit and the quality of provided services on constant basis.

### ***2.2. The benefits and the risks involved***

The potential benefits of PPP projects are the reduction cost (either construction or/and operation); the effective risk management and danger confrontation; the improvement of provided services; and the incoming support & other financial benefits (employment growth, economic development reinforcement, etc.).

The potential risks of PPP projects are the loss of control by the public sector; the increased loading of provided services use; the political risks; the responsibility matters; the unreliable services; and finally the lack of competition and the blurriness in the partners selection procedure.

## **3. PPP TYPES, CATEGORIES AND FORMS**

The common contents of PPP projects are the long-term legitimate (bidirectional) relationship; the full or partial private financing (usually in complex patterns); the presupposition that the main role of the private sector is to assure the project's financial parameters while the main role of the public sector is to assure the public interest determining quality standards and the pricing policy; and finally the risk transfer from the public to the private sector, combining their best capabilities for mutual benefit ('making the best out of'). The PPP project types vary according to the size of the risk included and its distribution pattern among the partners; the required degree of each partner's specialization (or experience) regarding the formulation of the contract and the negotiation of its terms; the potential consequences to the taxpayers and finally the financing details.

### ***3.1. PPP types***

There are three basic PPP Types, Concession; Joint Venture; and Hybrid. In Concession PPP projects the private partner is (during the concession period) in charge of the project utilization/

maintenance/management; is responsible for every construction/renovation/expansion; is self-financed; is responsible for the provided services; determines the pricing policy (respecting the restrictions set by the public partner); directly collects the money from the users of the services provided; and finally may initially or progressively pay an amount of money (or in kind) to the public partner. On the other hand the public partner is responsible for the configuration of the performance criteria; reassures that the above criteria are respected by the private partner; sets the prices' limits and the quality standard regarding the services provided; and finally retains the ownership of the assets utilized by the private sector. The concession period (which usually lasts more than 25 years) is based on the contract requirements. Concession is the most common PPP type/category in everyday life. Regarding the Joint Venture projects, both partners (Public and Private) are equally responsible and co-owners of the provided services or projects. Joint Venture represents an alternative to the pure privatisation, as the private partner covers less than 100% of the total project budget. Both partners (Public and Private) form a new company or they are co-owners of an existing one that is independent from the public sector. The public sector represents the final regulator & an active shareholder of the company, can participate in the profits distribution of the project, and reassures the greater political efforts acceptance, while the private sector often takes the responsibility to deal with everyday project management. As far as the Hybrid PPP forms (B.O.T., O.M., O.M.M) are related, they will be presented in the next paragraph.

### **3.2. PPP forms**

During the last twenty five years of PPP projects implementation history on international level, various PPP forms have been developed. Their differences mainly derive from the “who is doing what” between the public and the private partner, the distribution of the risks among them and who finally owns the property of the assets-service. The most common PPP Forms are:

- B.O.T. (Build-Operate-Transfer)
- B.O.O.T. (Build-Own-Operate-Transfer)
- D.B.F.O. (Design-Build-Finance-Operate)
- B.T.O. (Build-Transfer-Operate)
- B.O.O. (Build-Own-Operate)
- B.B.O. (Buy-Build-Operate)
- L.R.O. (Lease-Rehabilitate-Operate)
- B.O.L.T. (Build-Own-Lease-Transfer)
- O.M. (Operation/Maintenance Private Services Contract)
- O.M.M. (Operation/Maintenance/Management Private Services Contract)

In a B.O.T. or B.O.O.T. project (belongs to the public or the private partner respectively), the private partner partially or fully finances, builds, operates and maintains it during a predefined contracting period. When this period ends, the private partner transfers the operation of the project (and its ownership in case of a B.O.O.T. project) to the state.

In a D.B.F.O. project, the private partner designs, builds, finances, operates and maintains it. There is a predefined contracting period during which the public partner pays the private one for the services provided. Finally, the private partner transfers the ownership of the project to the public partner (D.B.F.O. is the most commonly used contracting model for infrastructure and public assets development, when the commercial exploitation potentials are initially unknown or/and limited).

In a B.T.O. project the private partner finances, designs and builds it (he may also undertake the project's operation and maintenance). After the completion of the project, its ownership is being transferred to the public partner, including a predefined leasing period.

A B.O.O. project has a social character and belongs to public entities. The private partner fully finances, designs, builds, maintains and operates it for a predefined long period of time.

In a B.B.O. project, the public partner sells existing public utilities to the private partner, aiming at further investments (renovation, expanding). The private partner fully finances the project and operates it through the form of a state supervised profit-making public utility.

In a L.R.O. project, the public partner owns it. The private partner rents existing utilities, fully finances the project and is responsible for its operation gaining from it. Finally, there is a predefined leasing period.

In B.O.L.T. the private partner fully finances the project and rents it from the public partner. The latter pays (through a leasing contract) the private partner in order the ownership of the project to be gradually transferred to him. So, at the end of the contracting period the public partner owns the project or it buys it in a predefined (based on the leasing contract) price. Finally, during the leasing period the public or the private partner is in charge of the project operation.

In a O.M. project (called “Service Contract”) the public partner owns it and hires a private service provider to operate and maintain it, while retaining its ownership and management.

In a O.M.M. project (also called “Service Contract”) the public partner owns it and hires a private service provider to operate, maintain and manage it while retaining its ownership.

## 5. PPPS LEGISLATION PROGRESS IN EU

Reviewing the progress of setting up a legislative framework that will rule the PPPs in the EU, Table 1 outlines some of the major initiatives that EU has taken regarding PPPs.

*Table 1. EU Activities / Actions concerning PPPs*

Date	Action	Source*
1993	White Paper on Growth, competitiveness and employment	COM(1993) 700
1997	High Level Group on PPP Financing of TEN-T projects (Kinnock Report)	COM(1997) 453
2000	Commission’s Interpretative Communication on Concessions under Community Law	COM(2000/C121/02)
2000	Proposal for a Regulation of the Council and Parliament concerning the granting of aid for the coordination of the transport by rail, road and inland waterways	COM(2000) 5
2001	White Paper on European Transport Policy for 2010: time to decide	COM(2001) 0370
2002	Building a Valuable Approach to PPPs Working session on the draft guidelines	COM(2001) 0370
2003	Guidelines for successful Public Private Partnerships – DG Regio and dissemination at a series of international conferences	DG Regional Policy
2003	A European Initiative for Growth – Investing in Networks and Knowledge for Growth and Jobs	COM(2003) 690
2003	Proposal for a Decision of the EU Parliament & of the Council amending Decision No 1692/96/EC on Community guidelines for the development of the trans-European transport network	COM(2003) 564 Adopted 21/04/2004
2003	Regulation amending Council Regulation (EC) No 2236/95 laying down general rules for the granting of Community financial aid in the field of trans-European networks	COM(2003) 561
2003	Communication from the Commission: Developing the trans-European transport network (Innovative funding solutions & Proposal for a Directive on the widespread introduction and Interoperability of electronic toll collection systems)	COM (2003) 132
2003	High level Group Report on the TEN-T network (Van Miert Report)	DG Transport
2003	Communication from the Commission to the Council and the European Parliament - Public finances in EMU	COM(2003) 0283 SEC (2003) 571
2004	Eurostat proposals on accounting treatment of PPPs	CMFB & Eurostat news release (STAT/ 04/ 18) Feb 2004
2004	White Paper on services of general interest	COM (2004) 374
2004	New Procurement Directives – including introduction of Competitive Dialogue	COM (2004) 134
2004	Green Paper – EU consultative paper on PPPs and Community Law on Public Contracts and Concessions	COM (2004) 327
2005	Report on the Public Consultation on the Green Paper on Public-Private Partnerships and Community Law on Public Contracts and Concessions	SEC(2005) 629

\*Published in the Official Journal of the European Union (also known as OJEC)

## 6. IMPLEMENTATION AREAS OF PPP PROJECTS ACROSS THE EU

The main PPP implementation areas in the EU are:

- Oil mining and exploitation;
- Natural Gas;

- Electric Power Production & Distribution;
- Water Recourses Management and Distribution;
- Telecommunications, Road Infrastructure;
- Rail Infrastructure;
- Subway Networks infrastructure.

While there is an interest in PPP projects across the EU, there is limited experience regarding effective procurement procedures related. UK stands out as having the longest and most substantial experience of PPP projects. The progress of PPP projects implementation in a country usually is based on the willingness of the politicians to promote them rather than on any other factor. Some countries have been reviewing the use of PPP projects and developing pilot procurements for some time, but with limited results in terms of projects procured and financed. Others, which have only recently adopted the practice of PPP projects implementation as a valid method of procuring public services, have moved rapidly and have procured pilot projects within relatively short time period.

Table 2 summarizes two elements of institutional development, which are often associated with the progression of PPP projects, the setting up, of one, or more PPP units at a central government level and the promotion of generic PPP legislation. Of course, there are limitations to such an approach. However, this analysis gives some insight into the efforts made by European governments to develop the 'institutional capacity' and 'enabling environment' for PPPs. Table 3 provides a high level summary of PPP activity in Europe by country and sector.

Table 2. Summary of PPP Institutional Development

Country	PPP Unit	PPP Law
Austria	***	—
Belgium	*	■
Cyprus	—	—
Czech Republic	**	■■
Denmark	**	—
Estonia	*	—
Finland	—	■
France	*	■■
Germany	**	■■
<b>Greece</b>	*	■■
Hungary	**	■
Ireland	***	■■■
Italy	**	■
Latvia	**	■
Lithuania	—	—
Luxemburg	—	—
Malta	*	—
Netherlands	***	—
Poland	**	■■
Portugal	**	■■
Slovakia	—	—
Slovenia	—	—
Spain	—	■■
Sweden	—	—
UK	***	—
Bulgaria (not EU)	*	■
Romania (not EU)	*	■■
Turkey (not EU)	—	■■■
Norway (not EU)	*	—

*Legend*

PPP unit	*	Need for PPP unit identified & some action taken, or only a regional unit exists
	**	PPP unit in progress (or existing but in a purely consultative capacity)
	***	PPP unit existing (actively involved in PPP promotion)
PPP law	■	Legislation being proposed
	■■	Comprehensive legislation being drafted / some sector specific legislation in place
	■■■	Comprehensive legislation in place

Table 3. Summary of PPP Activity in Europe by COUNTRY and by SECTOR

Country	Main PPP Sectors					Secondary PPP Sectors					
	Roads & Bridges	Urban (Light) Railway	Intercity (Heavy) Railway	Schools	Health & Hospitals	Central Accommodation	Airports	Housing	Ports	Prisons	Water Supply & Sewage
Austria	▲		▲	◆	▲	◆	◆			◆	◆
Belgium	▲	◆	◆	◆	▲		▲	▲			▲
Cyprus	▲						•		▲		▲
Czech Rep.	▲	◆	◆	◆	◆		◆	◆			•
Denmark	▲		▲	▲		◆			▲	◆	
Estonia	◆			◆	◆						
Finland	▲	◆	◆	▲	◆	◆					◆
France	▶	▶	▲	◆	▲	▲	▲		▲	▲	▶
Germany	•	•	•	•	◆	▲	◆			▲	••
Greece	•					◆	▶				
Hungary	•	◆		•	▲			◆		▲	•
Ireland	••	▲		•	▲	◆		▲			••
Italy	••	•			•	◆	▲	◆	▲	◆	▲
Latvia	◆										
Lithuania		◆									
Luxemburg							◆				
Malta					▲			◆			
Netherlands	•		•	▲	◆	◆		◆	◆	◆	•
Poland	▲	◆	◆			◆	◆	◆	◆	◆	▲
Portugal	▶	•	◆	◆	▲		◆	◆	◆	◆	•
Slovakia	◆						◆				◆
Slovenia											•
Spain	▶	•	◆	◆	▲	◆	◆		▶		•
Sweden	◆	◆	◆		◆						
U.K.	▶	▶		▶	▶	▶	▶	▶		▶	▶
Bulgaria	◆						◆				•
Romania	•				▲			◆			•
Turkey	◆	◆	◆				•				•
Norway	•		◆	▲	▲	◆				◆	

Source: European Investment Bank

#### Legend

- ◆ Discussions ongoing
- ▲ Projects in procurement
- Many procured projects, some projects closed
- Substantial number of closed projects
- ▶ Substantial number of closed projects, most of them in operation

While the recent PPP projects in Greece are the International Airport of Athens, the Rion-Antirion Bridge, the Athens Subway, the Athens Ring Road, the Construction & Operation of Local Natural Gas Utilities and finally the Exploitation & Operation of State-owned Tourist Installations, the first steps go quite back to the early 50's. It was the time when two major large-scale and of strategic importance PPP projects were implemented:

- ULEN concerning the construction of Athens (capital of Greece) water distribution network (nowadays, Athens Water and Sewage Utility “runs” the network); and
- POWER concerning the construction of the national electric power distribution network (before the establishment of the Public Power Corporation).

## 7. THE GREEK EXPERIENCE: A MEDIUM-SCALE HYDROPOWER PLANT

The implementation of PPPs in large-scale infrastructure projects in Greece has provided high quality and cost effective public works, with positive impacts regarding all aspects of every day's life. The future challenge is the effective promotion of PPPs in medium-scale projects that can be VIABLE. In the past a lot of efforts have been made for the promotion of PPPs in «big» projects. The challenge of tomorrow is the effective promotion of PPPs in medium-scale projects, of questionable viability. A presentation of such a project follows (a medium-scale hydropower plant), while checking its financial viability.

The hydropower plant is located in the mountainous village Vatsounia (Mouzaki Municipality in Greece), generating electrical power of 600 kW. The managing company (YDROHLEKTRIKI S.A.) is a Public-Based Company as the Community itself holds 35% of the stocks and its residents hold the rest 65% with an upper limit of 2% per stockholder. This distribution of stocks is typical characteristic for a Public-Based Company. The electricity produced is being sold directly to the Public Power Corporation according to the national law. The resulting revenues provide a significant income for the Community and its residents. There are also new job positions included.

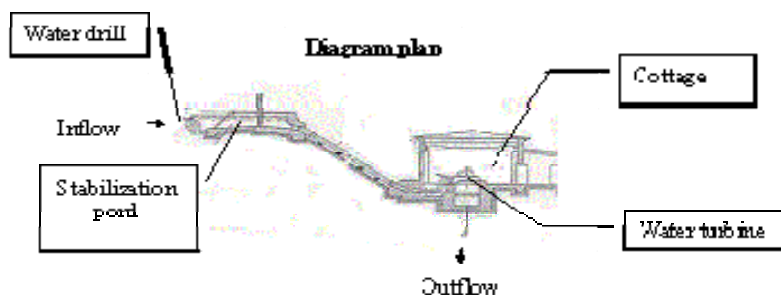


Figure 1. Hydropower plant's diagram plan.

### 7.1. The profile of the Public-Based Company and Permissions / Licenses required

Before checking the financial viability of the project is necessary to give some details regarding the Public-Based Company established to run the whole thing. It is actually a Societe Anonyme (S.A.) that aimed to build the plant, produce electric power, cooperate with other companies and offer new job positions. Its starting capital is 264.123 € divided in 9.000 stocks (each stock has a name value of 29,34 €). In order this project to be implemented there were several Permissions / Licenses required. Specifically from the:

- Ministry of Development (Department of Energy):
  - Water use permission
  - Project operation permission
  - Permit of Hydropower plant installation
- Region of Thessaly (Department of Planning & Development):
  - Hydropower plant operation license
- Regulatory Authority for Energy:
  - Electric power production license
- Prefecture of Karditsa (Department of Urban-Planning):
  - Hydropower plant environmental conditions approval

### 7.2. Feasibility study

The total investment was 0.9 million €, while the construction of the hydropower plan lasted from 1998 to 2000. The plant started to operate in 2000, annually producing 3.980.448 KWh.

The main benefit of this project is the use of a renewable source for power production. Due to this, power saving in national level is promoted as the Public Power Corporation decreases its consumption of imported fuels used. Additionally, the plant is environmentally friendly as there is no serious effect on the landscape. Finally, the existence of the hydropower plant contributes to the region's tourist growth, by combining the natural beauty with the demonstration of its operation.

Regarding the Socio-economic environment, the particular plant has many positive impacts, as it creates two new job positions; it gives a strong reason for the local population to remain in the region; it constitutes a pole of attracting population (intensification of local market, increase of population, increased land and real estates values, creation of infrastructures-services); it motivates

the agro-tourist growth of the region; it motivates the viability of the region; and finally strengthens the common feeling of the environmental protection.

### 7.2.1. Cost-Benefit Analysis process

There are six discrete scenarios regarding the inflation rate, the maintenance and operating costs. In each scenario, the final goal was to estimate the Net Present Value (NPV), the Benefit/Cost Ratio (B/C ratio) and the Internal Rate of Return (IRR) of the investment. Finally, for each scenario, the performance time of the minimum acceptable profit of the investment is calculated (depreciation of the investment or breakeven point). Figure 2 presents the results of a typical scenario.

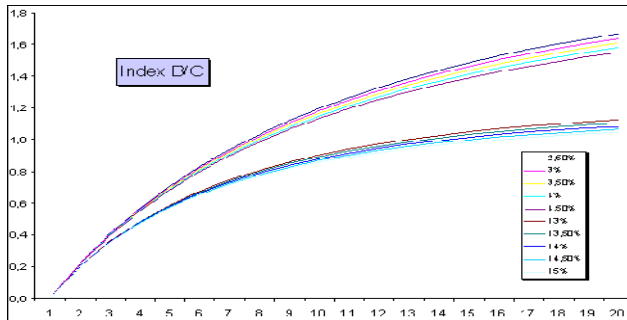


Figure 2. Benefit/Cost Index for each year

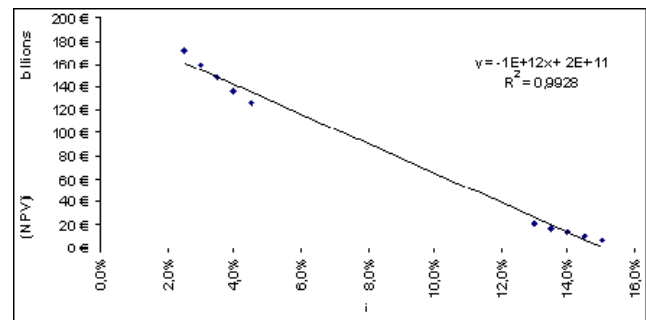


Figure 3. Net Present Value (IRR= 15%)

### 7.2.2. Results and discussion

Based on the above analysis, the project proved to be very attractive in terms of financial viability, as in all scenarios the IRR value is quite high (15%-19%) revealing also a consequent significant annual income per shareholder and a short operating period required to achieve the goal (IRR). Actually in 2000, the Greek Center of Renewable Energy Resources awarded the project as the best innovative initiative among the Greek local authorities.

As the assessment of benefits resulting from such kind of investments is very difficult (high uncertainty level) alternative benefit assessment methodologies along with various critical parameters sensitivity analysis were applied. The abovementioned evaluation indicators are actually expected to be more favorable, as significant profits arising from the plant operation were not possible to be quantified, edited and analyzed. In the present study the basic and unique (for the analysis) utility, which results immediately for the shareholders, is the annual debit of produced energy to the Public Power Corporation. That fact with the case of a Popular-Based investment, leads to the conclusion that it is a very lucrative enterprise, where its profits belong to the residents and they get those profits without actually having to work. It is important to mention that it is an environmentally friendly project that contributes to the tourist growth of the region, combining the natural beauty with the training of the visitors.

This case study proved that the electric power production on local level can be compatible with the principles of sustainable development, can be environmentally friendly and also an extremely profitable investment. This is a successful investment, a best practice actually, that can boost other similar investments.

## 8. CONCLUSIONS

The key factors for a successful PPP project are the formation of strong «partnership»; the Public acceptance; the transfer of the project management from the public to the private sector; and to ensure the meritocracy and minimize the bureaucracy during the contracting procedure. The public

sector in order to achieve the expected goals of a PPP project has to get actively involved in the planning process and in the financial, political and legislative preparation of the partnership. The public sector should also act as the coordinator that ensures the social benefits of a PPP project. The implementation of PPPs in large-scale infrastructure projects in Greece has provided high quality and cost effective public works, with positive impacts regarding all aspects of every day's life. The governments ought not to consider PPPs as «easy solutions» on difficult matters. A lot of efforts should be made to ensure a cooperation context, which will lead to success. The future challenge is the effective promotion of PPPs in medium-scale projects that can be VIABLE. In the past a lot of efforts have been made for the promotion of PPP in «big» projects. The challenge of tomorrow is the effective promotion of PPP in medium-scale projects, of questionable viability.

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