Financing Nuclear Projects. Case Study: Unit 2 Cernavoda NPP

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ABSTRACT

The implementation of a Nuclear Power Plant (NPP) in a country is a major undertaking for all entities involved, due to the necessity of planning work and co-ordination of the implementation process of the different fields of interest, starting with the governmental authorities and ending with the people.

Having in view the specific investment cost (relatively high) for a NPP, to find an adequate financing structure is possible through an iterative process that involves first an assessment of the technical performances of the project and second, the mathematical modelling of the financing structure effects on the project.

In this respect, the paper proposed will be focused on the main steps needed in order to promote an investment project in nuclear field, starting with the decision phase, providing the documentations requested by the local and international authorities to promote the project and ending with the negotiation of the contracts (commercial contract, financing contract, power purchase contract, etc.)

The case study will be focused on the phases achieved in order to promote the Unit 2 Cernavoda NPP completion works project.

1 GENERAL ASPECTS

Nuclear sector – referred to power production based on nuclear fuel – is a very specific one, due to the big volume of investments, the complexity of works and the long periods for carrying them out. Investments in nuclear power plants rise at hundreds thousands of million dollars and they are achieved over 5-15 years. These aspects, determining the financial risk of the nuclear projects, request the approach of financing assurance in a certain manner which, on the one hand, could assure the economic and financial feasibility of the nuclear project and, on the other hand, could provide the investors (or the creditors, by case) both for the safety of the invested funds and for their project profitability. In order to start attracting finances for a nuclear project, a range of well-stated elements are necessary, such as:
- substantiate the necessity, the opportunity and priority of the nuclear project for the power system based on some global, technical-economic analyses;
- demonstrate the technical and managing capability for achieving similar projects;
- substantiate the project value;
- demonstrate the project feasibility, its financial sustainability, based on the project configuration economic analysis, respectively, in terms of the market electricity prices
- secure, on long term, the basic fuel and raw materials (D₂O, etc.) providing, and accept the power quantity supply;
- really commit to the project performance;
- the client, the project promoter must have the technical and financial capability to attract finances, run and carry out the project, under good conditions and sustain its operation, under optimal circumstances, for assuring the pay back of all debts engaged in the project performance; the client financial capability should be demonstrated by overlapping cash-flow, projection afferent to the project itself, over the existing cash flow, to emphasize and avoid payments overlapping and financial collapse;
- opportunity of co-financing from own sources, or attracted sources (budget allotments, developing funds, client available own sources) from the previous financial balance profit. Co-financing is necessary, besides the fact it proves the client seriousness and wish to get involved in the project performance, for usually covering the:
  - local costs, mainly related to construction mounting works execution, adding a part of the local supply to them;
  - 15-20 % ratio paid in advance (down payment), for any credited financing, by the financing assuring institution (bank);
  - financial costs occurring during construction-mounting works (according to the financing institutions requests), such as; interests, fees, commissions, insurances.
- opportunity to guarantee the engaged loans both by long-term selling contracts and at a pre-fixed price (substantiated and approved) of the power sold, and by bank guarantees and/or state guarantees, against the background of transition economies (the case of our country, at present), it is difficult to constitute bank guarantees based on the financial solvency of the company running the project, one should know, from the very beginning, before starting to attract capital, the types of guarantees that can be assured (and for which values).

There must be a local, legal package that should assure, both the attractiveness for such complex, high risky projects and the contracting and granting mechanisms of the contractual clauses. Most of the times, in Romania, the limited access to local finances (credits granted by local banks, sources from bonds, issued on the local market, budgetary sources, developing funds, etc.) determined by the shortage of local capital for investments, resulted in financing scheme proposals in which the client of the project financed only a part of the project, from his own sources, budgetary sources, or sources attracted from the local market of capital. This resulted in promoting some financing schemes in which the external financing sources where prevailing.

A nuclear project financing is complex and difficult not only for the high cost of such project and the long period of execution, but an important factor in financing a nuclear project is the client financial credibility, the project degree of risk and the risk degree estimated by different institutions with respect to the country that implements the project.

The economic-financial analysis of the project, based upon the classical financing structures, has to emphasize the advantages and disadvantages of approaching them, both from the client point of view (demonstrating the project reliability criteria and limits) and from the investor point of view (determining the efficiency of the invested money on the selected project).

In this respect, the basic assumptions regarding the possible classical financing structures to be compared, in order to make a decision, are:

A. The assumption of covering the project value from combinations of:
   - own sources, or local sources
foreign sources, as bank loans. This assumption complies with the project carrying on, from the very beginning to the commissioning and further on, the commercial operation by the client of the project.

B. Assumption of project value covering from combinations of:
- own capitals of the investors involved in the project (equity)
- other sources (usually, loans – export credits, commercial loans).

The economically optimal combination between the two financing sources is 30% (equity) and 70% (loans), assuring both the down payment for the equipments and the loans financial costs during the construction period, from the investors own capitals (equity). This assumption complies with the project carrying on, under IPP (independent power producer) conditions, based on the implementing BOT, BOOT, BOO – type. It is important to underline that assumption B shall call for a higher efficiency of the project than Assumption A, due to the requirement for creating the attractiveness of the project. This requirement is usually ensured not only by the raise of prices for the electricity sold, but also by the severe control of terms, works quality and compliance with the initial assessment of the investment.

2 FINANCING PLAN

The financing plan contains all relevant information about the project and their running on, in time. These information mainly refer to the following:
- total project cost
- debt/equity ratio
- assessment of the potential financing sources
- costs related to nuclear fuel cycle (manufacturing, consumption, intermediate storage, final storage)
- operating & maintenance costs
- technical performances
- economic performances

The easiness to organize the financial package depends on the level of the client financial available resources for the project. These resources can be the own capital, the sources from the state budget, or from other funds managed by the state (e.g. the special fund for developing the power sector). It is stated that the minimum equity requested by the banks for a project, is correlated with the debt service ratio. According to the project risks perception, the banks request a debt redemption rate of minimum 1,3.

For a projected cash flow, this rate determines the equity value for the project. When the project financing is covered partially by the investors sources, then the share of the investors capital in the project is no more determined by the debt service ratio, but by the Internal Rate of Return (IRR). The two concepts for establishing the level of the equity in the project financing, independently applied one from the other, lead to different directions:
- the debt service ratio maximization will lead to the increase of the equity engaged in the project financing.
- IRR maximization, will lead to diminishing the equity engaged in the project financing.

Therefore, the optimal level of the own sources engaged in the project represents the result of the simultaneous implementation of the two concepts and it is very much dependent on the client or his adviser’s capacity of negotiation. Most of the times, financial institutions expect that the client of the project should take over a quota of the project risk, proving his interest in the further successful implementation of the project.

Another basic principle of a financing plan is the one on where the local costs of the project should be covered from local funds. This is a strict requirement to be met in many
countries and often its complexity is under-estimated. The experience proved that under sufficient financial resources for covering the foreign part of the project, it is quite difficult to attract sufficient sources from the local financial market, under Romania’s nowadays, circumstances, in order to finance the local part of the project. Even calling for sources from the state budget, the project local costs covering represent the main reason for delays in the project implementation.

The sources of local currency funds could be:
- Budgetary sources (allotments from the state budget or from special funds);
- Own sources resulting from the current operation;
- Bonds issues on the local financial market;
- Loans in local currency.

The difficulty in financing the local part of the project results from the limitation of the available budget resources (both the state’s and the client’s) as well as from the constraints of the local, financial market. Once the local part is covered from financing sources, there are many opportunities for the financial cover of a nuclear project foreign part. Quite a great part (60-80%) of the capital cost for such a project has to be covered in hard currency, especially in developing countries as Romania is. This is due to the fact that a part of technologies, equipment and services have to be imported.

This part of the project is financed through:
- Export Credit Agencies;
- International Developing Institutions;
- Bilateral financing sources;
- Commercial loans and bonds.

3 FINANCING SOURCES. REQUIREMENTS ASSOCIATED TO THE FINANCING OFFERS

The nuclear projects in the greatest part of the developing countries are financed through a combination of export credits, commercial credits and own sources of the beneficiary.

- **EXPORT CREDITS**

  The export credits occur in the financing of a project in the nuclear field whenever the buyer of the exported goods and services is willing to accept payment of the respective goods and services under certain conditions negotiated with the exporter. Generally, the export credits are divided in three categories:
  - short term export credits – up to 2 years
  - medium term export credits – between 2 and 5 years
  - long term export credits – over 5 years

  These credits turn into “supplier credits” when the credit is arranged and managed by the exporter, or “buyer credits”, when the exporter’s bank or other financial institution lends the buyer. Credit export agencies can provide official support for both types of credit. This official support can only be limited to insure the credit granted by the exporter or financing institution, without direct financing support, or can become a “financial support” granted as a direct credit, refinancing or subsidy of the interest.

  The official financing support can be in direct connection with the basic security or facilities granted for insurance. Currently, there are 22 countries OECD members, that have representatives in the credit export and credit guarantee group (ECG) of the OECD commerce committee. The ECG members also take part in drawing up the regulation for the official support of the export credits. This regulation has been accepted and is applied within the OECD members relations. This regulation main purpose is to provide an appropriate and
ordered institutional framework for the export credit market and prevent export credit competition. During such competition, the exporting countries would rather compete offering the most favourable financing conditions than offering the best quality and services at the smallest prices, as required for the nuclear sector.

At OECD level, there have been established some agreements regarding export credits granting for the nuclear power plants. These agreements mainly refer to:

- **Beneficiary Financial Reliability** – that represents one of the main elements taken into account by the financial institutions and various financiers when negotiating the funding conditions. The incertitude and doubt regarding financial reliability of a beneficiary of a project in the nuclear field can seriously hinder funding getting. No country with uncertain financial reliability can have access to financing for a nuclear project mainly as the investment for such a project is relatively large. Only the countries with an acceptable rating could benefit from bank loans or other credits to fund such projects. The sustainable economic development policies, good management of the external debt and risks minimization could be of help in improving the country rating. Besides creating possibilities of resorting to loans, the financial reliability also influences the interest level. Anyway keeping good reputation in this field is a requirement for a country intending to develop a nuclear program. The international rating agencies, on the basis of a specific procedure that comprises a multitude of criteria (economic, living standard, political, etc.) periodically evaluate the political risk for various countries. Agencies such as Moody’s Investor Service, IBCA and Standard & Poor’s are the most worldwide known, their evaluations in terms of political risk for various countries being paid close attention by both the Governments of the countries that are the object of the evaluation and the investors and international financing institutions.

- **The Grace Period** – The rules unanimously accepted within OECD allow awarding a grace period within a financing program for a project in the nuclear field of 6 months from the project implementation (commercial service start up).

- **The Interest** – The minimum interest accepted by OECD regulation for export credits granting equals CIRR (Commercial Interest Reference Rates) reference interest for the currency of the requested financing. CIRR reference interest for the currency of each OECD country is determined monthly and results from the long term interest rate to the treasury bonds in the respective country. In the case of the projects in the nuclear field the interest is given by SCIRR (Special Commercial Interest Reference Rate) reference interest that forms starting from CIRR to which is added 0.75% margin for all currencies, except Japanese yen, for which the margin is 0.4%.

- **Repayment Way and Period** – The export credits repayment period could be 15 years, with the installment semiannual payment, the first payment being performed post grace period.

- **Interest Payment** – The interest too can be paid semiannually, to the value of the credit to be repaid.

- **Associated Financial Expenses** - Generally, the export credit agencies levy a risk fee on the goods and services exporter or beneficiary of them as per export credit type (supplier or buyer). Still, eventually, the risk fee is entirely covered by the exported goods and services beneficiary. The value of this fee depends on the risk degree of the country to which the export is performed. Besides the risk fee, the following types of taxes and fees are also levied:
  - Management fee
  - Reservation fee
  - Other financial expenses
The bank taxes and fees differ considerably from one export credit agency to another, according to the financial reliability and political risk evaluation for the beneficiary country.

**Commercial Credits**

The commercial credits are credits granted by commercial banks, being generally, from the short and medium term credits category, with a granting period of 10 years at the most. The terms of accessing such credits depend on the financial market liquidity at the date the credit is requested and the requested bank opinion on the beneficiary financial reliability.

Generally, for the projects in the nuclear field are requested 10 year commercial credits, having the following main characteristics:

- variable interest
- grace period 2 up to 4 years
- semiannual installment repayment

The variable interest is determined in compliance with LIBOR (London Interbank Offered Rate) to which is currently added up to 4% margin. However, this margin can differ (higher or lower) from case to case.

If the commercial credit payment starts prior to the planned date of the objective commercial start up, the bank granting the respective credit will require from the beneficiary a proof he has available sources to repay the credit granted. From this point of view, the appeal for commercial credits triggers the drawing up, at the beneficiary level, of analyses very well justified that consider all parameters that could complicate the financing process (the moment of drawings from credits, the period of granting the credit and repayment program).

Also it is worth pointing out that the financing can come from various countries and various financing sources. This is the reason an accurate management at the level of the project beneficiary is called for.

**International Development Agencies**

The International Development Agencies can be important long term financing sources. This is the reason the Development Agencies get involved actively in the financing of the far reaching projects such as the projects in the nuclear field. In most of the cases, the financing conditions offered by these agencies are specific to each of them.

**International Financing Institutions**

The most important financing institutions on the capital market are:

- The European Bank for Reconstruction and Development (EBRD);
- International Bank for Reconstruction and Development (IBRD);
- International Financing Corporation (IFC);
- Multilaterally Fund for Guarantees

**EBRD** – was specially created in 1991 to support the transition of the Eastern Europe market economy. This institution finances project both for state and private sectors by direct financing. The main form of EBRD financing are loans, capital investments and guarantees. According to its operating regulation **IBRD** has to obtain the state guarantee for any given loan. The services offered are in accordance with the Government priorities as IBRD financing is directed to the Ministries which are responsible for the projects that the financing is required.

**IFC** was created in 1956 with aim to support the private sector in the development countries and is one of the largest multilateral sources of financing for private investments in development countries. Unlike IBRD which through its operating regulation has to ask for state guarantee for each loan, IFC does not accept Government guarantees.

IFC involves in the investment project supporting by three ways:
416.7

- by participating at the project financing with long and medium terms loans, instruments of capital and risk management
- by attracting the additional financing from the international capital market
- by offering consulting and technical assistance

**Private investors** - are legal entities representative for different economic fields. Usually, a private investor invests in the same field with his own basic activity. The participation of private investor in a project is carried out mainly as part of the project.

Investment fund. The investment funds ensure an alternative at the financing offered by commercial banks and the private investors. The investment funds involve themselves in the financing of the new projects on in expanding phase. Risk assumed by the Investment Fund is higher than the commercial banks as by its own way of operation, the Fund becomes shareholder in the investment that it is involved. Generally the investment funds have as basic financing source the capital coming from Government funds or from different financial institutions (banks, private funds, international financing institutions). The advantage of financing by the investment Funds is that after a certain period of time set-up at the beginning of the project, the Fund will draw from that project.

# 4 CASE STUDY: NPP CERNAVODA UNIT 2 COMPLETION

## 4.1 Possible financing structures for NPP Cernavodă Unit 2 completion

For NPP Cernavoda – Unit 2 completion works, 3 financing structures are proposed:

**Structure A**

<table>
<thead>
<tr>
<th>Financing source</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Foreign loans, out of which:</td>
<td>65</td>
</tr>
<tr>
<td>- Commercial loans</td>
<td>17</td>
</tr>
<tr>
<td>- Long term loans</td>
<td>83</td>
</tr>
<tr>
<td>2. Budgetary sources</td>
<td>13</td>
</tr>
<tr>
<td>3. Special fund sources</td>
<td>11</td>
</tr>
<tr>
<td>4. Other sources (countertrade)</td>
<td>11</td>
</tr>
<tr>
<td><strong>Total basic investment</strong></td>
<td>100</td>
</tr>
</tbody>
</table>

**Structure B**

<table>
<thead>
<tr>
<th>Financing source</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Foreign loans, out of which:</td>
<td>76</td>
</tr>
<tr>
<td>- Commercial loans</td>
<td>0</td>
</tr>
<tr>
<td>- Long term loans</td>
<td>100</td>
</tr>
<tr>
<td>2. Budgetary sources and special fund sources</td>
<td>17</td>
</tr>
<tr>
<td>3. Other sources (countertrade)</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total basic investment</strong></td>
<td>100</td>
</tr>
</tbody>
</table>

**Structure C**

<table>
<thead>
<tr>
<th>Financing source</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Foreign loans, out of which:</td>
<td>93</td>
</tr>
<tr>
<td>- Commercial loans</td>
<td>0</td>
</tr>
<tr>
<td>- Long term loans</td>
<td>100</td>
</tr>
<tr>
<td>2. Budgetary sources and special fund sources</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total basic investment</strong></td>
<td>100</td>
</tr>
</tbody>
</table>
4.2 Financing conditions

The financing conditions regarding the NPP Cernavodă Unit 2 completion works mainly refer to: loans amount, maturity, grace period
- bank fees level, their way and period of payment
- interest rate
- payment conditions for interest during construction
- repayment period and conditions.
These loan conditions represent the object of direct negotiations between the borrower and the lender(s).

4.3 Analysis Results

Total project cost consists of the following:
- basic investment cost:
  - equipment and local works
  - design, technical assistance and other specific costs
  - first heavy water and nuclear fuel loading cost
- financial costs associated to the loans
- interest during construction paid or capitalised

The total project cost (expressed as percents from the basic investment cost), is as follows:

<table>
<thead>
<tr>
<th>Financing structure</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Basic investment cost</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>2. Financial costs</td>
<td>17.9%</td>
<td>9.8%</td>
<td>12.8%</td>
</tr>
<tr>
<td>3. IDC paid</td>
<td>0.8%</td>
<td>0%</td>
<td>16.3%</td>
</tr>
<tr>
<td>4. IDC capitalised</td>
<td>9.9%</td>
<td>15.7%</td>
<td>0%</td>
</tr>
<tr>
<td>Total project cost</td>
<td>128.6%</td>
<td>125.5%</td>
<td>129.1%</td>
</tr>
</tbody>
</table>

The electricity tariff on the plant border was established taking into consideration the following:
- Basic investment costs financing into the analysed financing structures
- Project total cost covering using Nuclearelectrica own sources
- The same Internal Rate of Return (IRR) for all financing structures.

Assuming the least electricity tariff as a ratio basis, we can classify the studied financing structures, as follows:

<table>
<thead>
<tr>
<th>Financing structure</th>
<th>Tariff increase as against the least resulted tariff (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Financing structure B</td>
<td>0</td>
</tr>
<tr>
<td>2. Financing structure C</td>
<td>2</td>
</tr>
<tr>
<td>3. Financing structure A</td>
<td>15</td>
</tr>
</tbody>
</table>

4.4 Conclusions

The results obtained emphasize the following aspects concerned with the advantages and disadvantages of Unit 2 – NPP Cernavodă works financing, in the frame of the three studied financing structures:
<table>
<thead>
<tr>
<th>Financing structure</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| A                   | IDC capitalized | - Quite big amount of the Nuclearelectrica own sources engaged for the project (around 19 % of the basic cost)  
|                     |             | - Big budgetary sources, special fund and other sources (around 35 % of the basic investment cost)  
|                     |             | - 15 % higher tariff compared with the least tariff under the same profitability conditions |
| B                   | - IDC capitalized  
|                     | - Least amount of the Nuclearelectrica own sources engaged (10 % of the basic investment cost)  
|                     | - Least tariff under the same profitability conditions | - Budgetary sources, special fund and other sources, relatively big value (around 24 % of the basic investment cost) |
| C                   | - Small value for budgetary and special fund sources (about 7 % of the basic cost)  
|                     | - Competitive tariff (about 2 % higher than the least tariff under the same profitability conditions) | - IDC paid cash (not capitalized)  
|                     |             | - Big amount of the Nuclearelectrica own sources engaged (around 29 % of the basic cost) |

For the NPP Cernavoda Unit 2 it is important to underline the followings statements:
- Electricity price at the Unit 2 border will be competitive on the electricity market in any considered financing structures
- The electricity price includes the costs for final storage of used fuel and for Unit 2 decommissioning, which means that this problem will not be into the future generation responsibility
- The project efficiency during the Unit 2 lifetime is about 16%
- The integrated analysis of the Unit 2 project within Nuclearelectrica Company proves the financial and economic capability of this Company to sustain the project.
- Based on the previous results, which prove the Unit 2 project efficiency, the Romanian Government sustains the project development through the special laws connected with this.

REFERENCES

[2] Feasibility Study for NPP Cernavoda Unit 2 Completion Works