Identification and Discussion of Various Nuclear Power Project Finance Models

IFNEC Steering Group Meeting and Finance Panel
May 9, 2014
Bucharest, Romania

By
Dr. Nadira Barkatullah
Director of Economic Regulation, Regulation and Supervision Bureau

Disclaimer: The views presented are those of the presenter and not reflective of the Regulation and Supervision Bureau.
Overview

- Investor Finance Model
- Phased Financing
Investor Finance Model

Where investors form a group to invest in a project

- Debt
  - Banks
  - Export credit agencies
  - Capital markets (Bonds)

- Equity
  - As Shareholders
  - Capital markets (IPOs)

Examples can be:

- 'Mankala' Model

Very popular in the Finland electricity sector
Investor Finance Model

What is Mankala Model?

Regulator

Technical and safety licensing and regulation

Lenders

Debt

Debt Service

Construction contract

Completion risk

EPC Contractor

Mankala Company

Equity

Rights to Electricity produced

Operational cost and debt service

Completion risk mitigation

Shareholders

Large industrial customers

Price regulation
Investor Finance Model

- Built by TVO (Teollisuuden Voima Oyj)
- Type: EPR 1600MW (FOAK)
- Original cost: Fixed Price Turnkey Contract, with Areva-Siemens of €3.2 bn in Dec 2003
- Construction started in 2005
- Expected commercial operation in the first half of 2009
- Delay: 7 years
- Operational: 2016
- Expected cost € 8 bn
- Arbitration claim by Areva-Siemens against TVO of more than € 2 bn

Who are sharing the risks and increased costs?
Characteristics of hybrid financing (corporate/project finance):

- The project financed on the balance sheet of TVO
- Part of equity and loan is provided by the large customers
- A long-term PPA with large customers ensuring future stable revenue stream from the project
- Leverage characteristics similar to project finance
- Export credit guarantee by the French and Swedish Governments

Very good example of multiple investors to diversify risk
Investor Finance Model

Fennovoima's

The third nuclear company in Finland is a Mankala company. Shareholders E.ON (34%) and consortium of Finnish power and industrial companies (66%) with 69 shareholders in total, mostly small regional and municipal utilities, but also industry (trade, mining, steel manufacturing).

Hanhikivi project

Some other countries in Europe also want to adopt this model as it promotes risk diversification.
Financing Models Trend

Risk transferability from public to private

Ownership transferability from public to private

Government Financing

Corporate Finance

Co-operative Models

Project Finance
Investor Finance Model

Phased Financing

concept that could apply to any of the financing models discussed
Phased Financing

Nuclear Phases

Initial Financing Phase

Development

Construction

Operation

Decommissioning

Refinancing Finance Phase

Lower risk premium...why?
Nuclear has High Capital Cost Component

![Bar chart showing the cost components of nuclear, coal, and natural gas energy sources.](chart.png)

- **Nuclear**: High capital cost component.
- **Coal** and **Natural gas**: Lower capital costs compared to nuclear.
Total Construction Cost

- Overnight Cost
- Escalation Cost
- Financing Cost

Total Construction Cost = Overnight Cost + Escalation Cost + Financing Cost

If a NPP is to cost $5-8bn

Up to 80%
Phased Financing
NPPs Construction Risk

- The most significant risk

- High risk implies high premium

- But why do we worry about construction risk?
Phased Financing

Construction Risk: Longer construction duration
Average Estimated and Realized Overnight Cost
(1982 US dollars/kW)

A long history of construction delays and cost overruns still haunt the industry with average cost overruns for 75 nuclear plants built in the US between 1966-1977 was on average 200% (CBO 2008)

Source of data: US DOE/EIA-0485
Phased Financing
Investment Cost Uncertainty

Overnight Investment Cost Change over time by Site ($/kW)

The variation in the overnight capital cost is daunting for newcomers and adds to the risk premium.

Source: World Nuclear News, Nucleonics and Other publications, 2008-2013
Phased Financing

NPPs Construction Risk: Longer construction and IDC

IDC % of overnight capital cost

<table>
<thead>
<tr>
<th>Construction Duration</th>
<th>Interest Share (5%)</th>
<th>Interest Share (10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Upto 75% of overnight cost
Phased Financing
Construction risk premium

High risk premium during construction phase: why?

- Turkey's first nuclear plant facing further delays (Reuters February 7, 2014)
- Vietnamese delay confirmed (World Nuclear News, 28 January 2014)
- Finnish nuclear plant delayed again... (Reuters, February 28, 2014)
- S.C. Supreme Court hears arguments for V.C. Summer nuclear plant cost increase (Power Engineering, 22 April, 2014)
- Hinkley plant construction delay (BBC 25 April, 2013)
Phased Financing

NPP project: Construction/Operational Phase

Risks

Planning/Construction

- Credit risk
- Construction delay
- Foreign exchange rate fluctuation
- Interest rate increase
- Technology changes to design
- Supply chain backlog
- Lack of skilled staff

Operations

- Despatch
- Fuel supply
- Electricity price
- Fuel supply
- Spent fuel disposal

Time
Phased Financing
Construction Phase and Project Cashflow

Cash flow cycle

Positive

Negative

Project Cash Flow

Cost

Licensing/Construction duration

Operations

Refinance the project

Revenue

Debt repayment
Concluding Comments

- Governments have a critical role with explicit long-term commitment
- Investment cost uncertainty is challenging for newcomers
- Financing and construction duration key influencing factors to impact total investment cost
- Government financing still dominate the industry
- ECA support is vital and ensures bankability of the project
- Private financing – Investor models, JV among utilities with robust balance sheets and hybrid financing are being explored
- Risk diversification and meticulous Financial Risk Management Strategy imminent
- Strict financial industry regulation, like Basel III to impact liquidity and more vigilance of large scale risky projects
- Financing NPP is challenging but viable with new financing trends emerging to support nuclear new built
Thank you

www.rsb.gov.ae