Management of Financial Risks in Nuclear Power Plants

OECD/NEA Workshop on “The Role of Electricity Price Stability and Long-Term Financing for Nuclear New Build”
19 September 2013
Paul Warren
Planning & Economic Studies Section
Overview

- Key FRM tool at front end of Nuclear Power Plant (NPP) is the contract
- This presentation will
  - Sketch some key contracting aims
    - Focus on Engineering, Procurement and Construction (EPC) contract
    - Two parties: ‘Owner’ and ‘Contractor’
  - Sketch a risk allocation approach from a recent procurement
  - Outline a *heuristic* approach to pricing risk in a contract framework
Key ‘fixed price’ contracting aims

• Agree clear targets:
  1. Price
  2. Quality
  3. Time

• Agree *how* to measure whether quality and time targets are met

• By default, the ‘fixed price’ Contractor bears additional cost if time or quality targets are not met, or if costs exceed those expected – *unless there are agreed extenuating circumstances*!
  • Parties must identify/define/list those circumstances!
Key ‘fixed price’ contracting aims

• Obvious extenuating circumstance – where the contractor could not control events
  • Raises problem of jointly determined outcome
    • If possible, identify tasks at a level where responsibility can be assigned to one party or the other

• Agree on remedies if Contractor fails to meet time and/or quality targets and no extenuating circumstances apply
  • What remedies should be applied for failure to meet time and quality targets (including amounts if remedies are financial – i.e. Liquidated Damages)
    • Issue of monetization
Allocating unrelieved risk: price packages

• It is possible that – even after receiving ‘relief’ in the form of compensation and/or time extensions Contractor’s costs exceed the (relief-adjusted) target price
• Example of structuring contract clauses to ‘package’ and share the risks of this kind of EPC cost-overruns
  • Example is taken from a recent procurement
# Four simple EPC cost/price ‘packages’

<table>
<thead>
<tr>
<th></th>
<th><strong>Fixed price:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fixed price submitted at time of bidding</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th><strong>Firm price:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Fixed price that is escalated to the time of invoice based on a predefined set of escalators</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th><strong>Target with ‘collar’:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Firm price defines lower threshold (‘target’) of a interval in which Owner pays for cost overruns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th><strong>Cost plus:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Contractor fee is set as a percentage of total cost. Owner pays for all costs incurred by the vendor during EPC process.</td>
</tr>
</tbody>
</table>
Summary: risk allocation mechanisms

- Compensation to Contractor
  - Events that trigger
  - Degree of compensation (0% - 100%)
- Extensions of time
  - Events that trigger
  - Degree of compensation (0% - 100%)
- Liquidated Damages
- Limits on liability
- Indexation
- Collars
Financial modelling

- Financial modelling is essential to any NPP procurement process
- A financial model consists of a set of technical and financial relationships – typically a set of equations in an Excel spreadsheet
- Model takes a set of assumptions
- Produces a set of outputs
  - Outputs are typically ‘figures of merit’ for valuing a project (e.g., LUEC, IRR on Owner’s equity)

Assumptions

Financial Model

Outputs

Financial model will include contractual terms – which can be varied in ‘sensitivity analyses’
Modelling contract financial implications

- Financial Model
  - Contractual risk allocation A
  - Contractual risk allocation B
  - IRR on Owner’s equity A
  - IRR on Owner’s equity B
Pricing risk within the contract framework

- Simple heuristic approach to bilateral engagement between Owner and Contractor over risk allocation:
  - Owner would be willing to pay up to $\mu_B - \mu_A$ to have contract arrangement B rather than contract arrangement A
  - Based purely on means (ignores higher moments)
  - Assumes non-concave “Owner’s utility function” - risk neutrality
Takeaways

• Most ‘fixed price’ contracts are not
• Even ‘fixed price’ contracts will allow various kinds of ‘relief’
• Several options for sharing unrelieved risk
• *It is possible to price the risk implicit in alternative contracts*