Contractual structures, efficient risk allocation and incentives in nuclear new build

Michel BERTHELEMY
Division of Nuclear Technology Development and Economics

NEA-IFNEC webinar series on nuclear new build financing
Nuclear power economics is dominated by the cost of capital

LCOE of a new nuclear power plant project according to the cost of capital

Cost of capital is determined by financing framework... ...which is itself strongly influenced by ownership model and procurement arrangement
Key principles for efficient risk allocation

Cost of capital reflects risk allocation and mitigation decisions through several contractual arrangements which in turn should reflect the project strategic objectives.

Risk allocation decisions have to strike a balance between several factors:

1. **Ex-ante**: Ability to influence risk
2. **Ex-post**: Ability to absorb risk
3. **BUT**... contracts are incomplete due to high transaction costs: critical importance of aligning incentives to address challenges if unexpected challenges materialize
4. **In practice**, a party does not need to be exposed to the full risk to be incentivised
Lessons-learned from recent Gen-III FAOK projects on the importance of efficient contractual arrangements

Key lesson from several FOAK projects relates to how fixed-costs contractual arrangements led to misalignment of incentives:

- **“Margin on margin effect”**: each contractor needs to take contingencies for project risk
- If risks do materialize, **limited incentives to tackle construction challenges**, often leading to litigation

The nuclear sector can learn lessons from other industries:

- Collaborative models to engage supply chain early and align incentives, in particular sharing of risks / rewards
- Eg. **extended enterprise model** in the aerospace industry, **alliance model**, other?

### Challenges with contractual arrangements as a key drivers of recent construction costs increases

Source: Univ. of Chicago, 2011

![Graph showing overnight cost (USD/kWe) with different categories: 2000, 2004, 2011.](#)

- **Commodity Prices USD 500**
- **Owners' Cost USD 350**
- **Supplier Agreements & Risk Management USD 1 360**
When should vertical integration substitute contractual relationships?

Economic theory on transaction costs identifies 3 key conditions where vertical integration should substitute contractual relationships

1. **High frequency of transactions**: rarely the case with large NPP, different for SMR?

2. **Industrial assets are “specific”**: largely applicable to the nuclear sector, but standardization can mitigate (SMR but also large NPP)

3. **Opportunities for contractual “hold-up”** due to asymmetries of information and incomplete contracts: Reduction post-FOAK, especially for fleet programs & SMR?
Contact: [email](mailto:email)