

Evolution of the Global Nuclear Supply Chain

Chris Savage

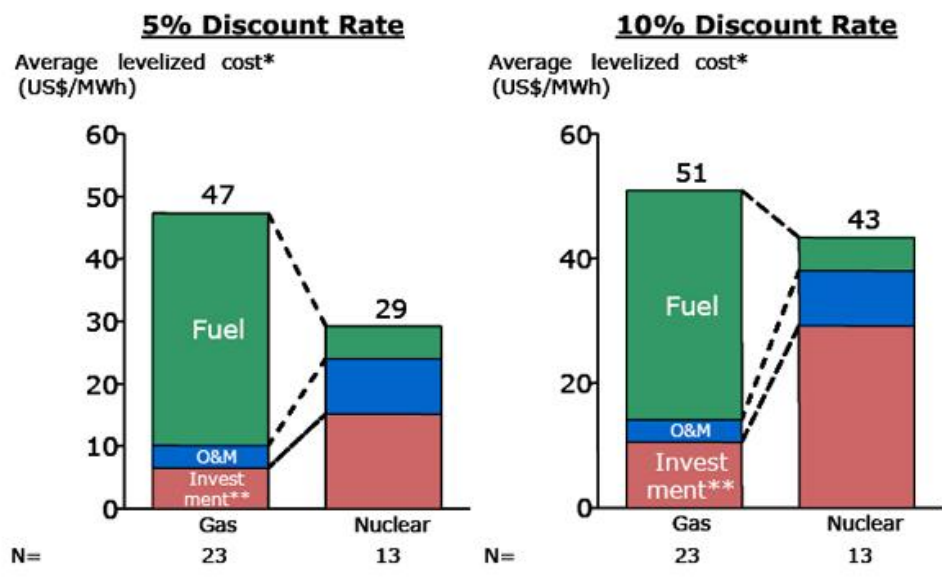
OECD Nuclear Energy Agency Workshop

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Scope

- Economic context
 - Why supply chain matters
- Industry adaptation
- Options for the future
- Issues to be addressed

Levelised Costs of Nuclear

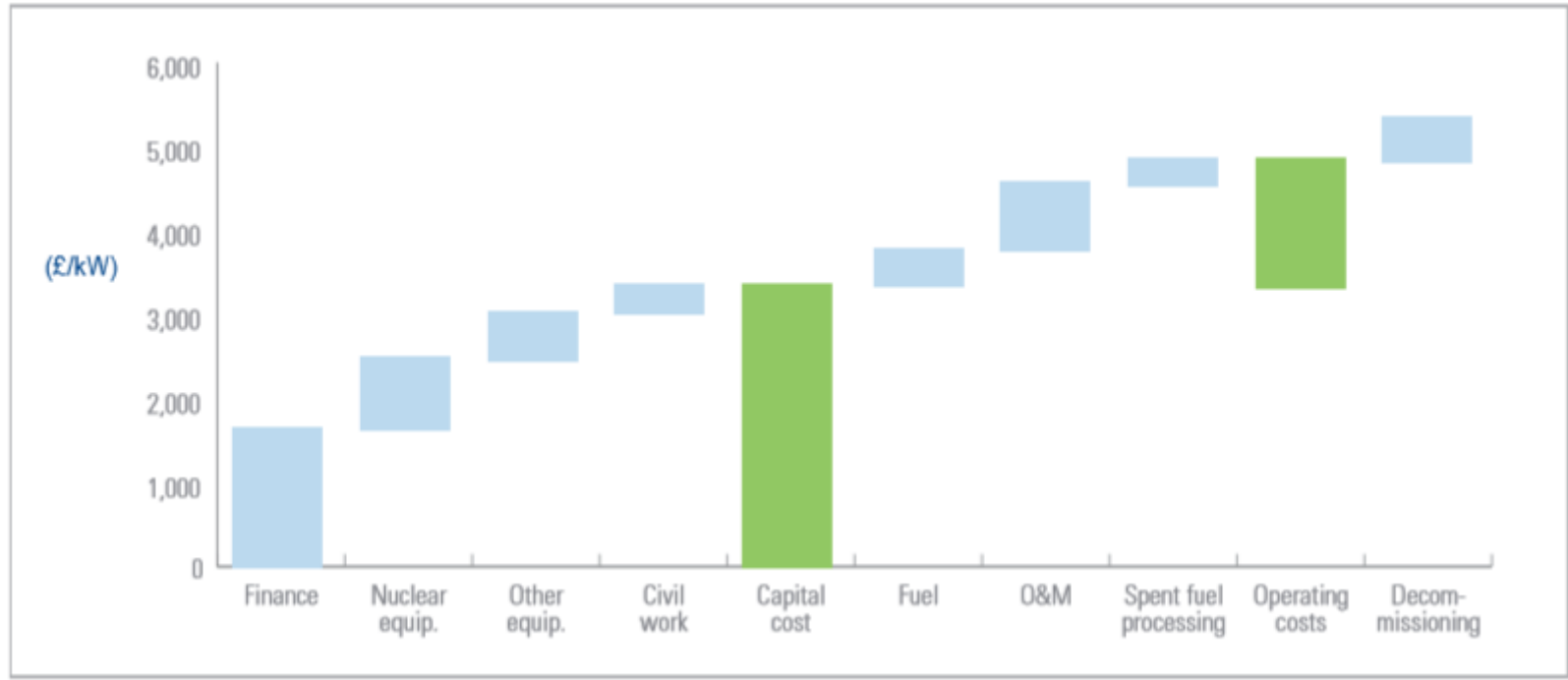


Nuclear is highly capital intensive

Notes and sources: *Average of data from survey of new facilities in 21 countries, mostly OECD but also include 4 developing countries. Levelized generation cost include initial investment cost, Operation and Maintenance cost, Fuel cost, and in the case of nuclear; main assumptions – 85% capacity factor for plants, 40 year lifetime for coal and nuclear plants, for other plants lifetime come from country level responses, fuel price projection based on each country’s models. **Investment cost for nuclear power includes decommission cost Source: “Projected Cost of Generating Electricity 2005 Update” – Nuclear Energy Agency / International Energy Agency

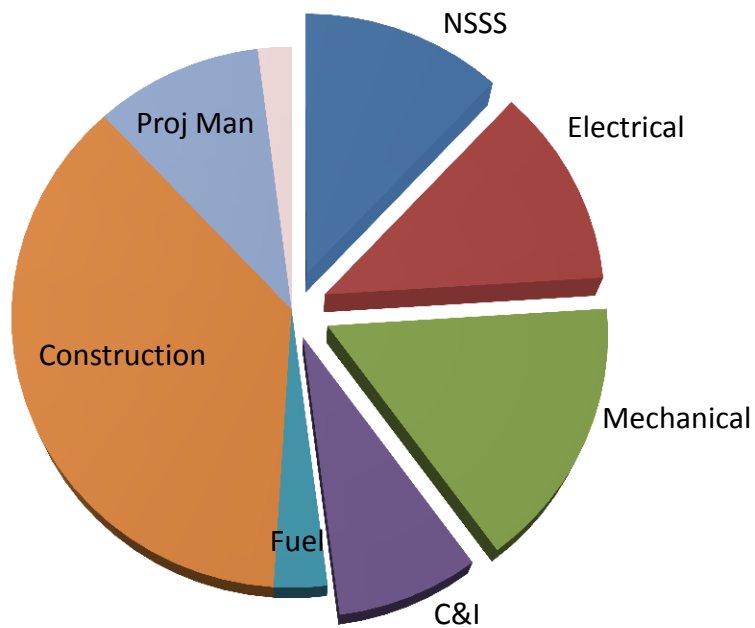
Levelised Costs of Nuclear

Estimated value of differing cost elements per kW over 40 year life



Source KPMG 2010

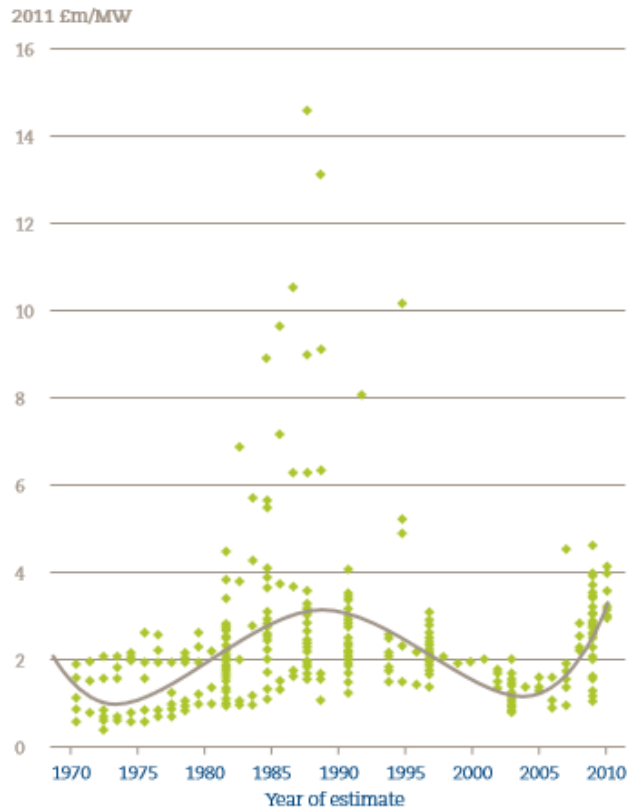
Value Breakdown of a New Nuclear Plant



Equipment = 48% of value

- Nuclear Island
- Conventional Island
- Balance of Plant

Nuclear construction costs



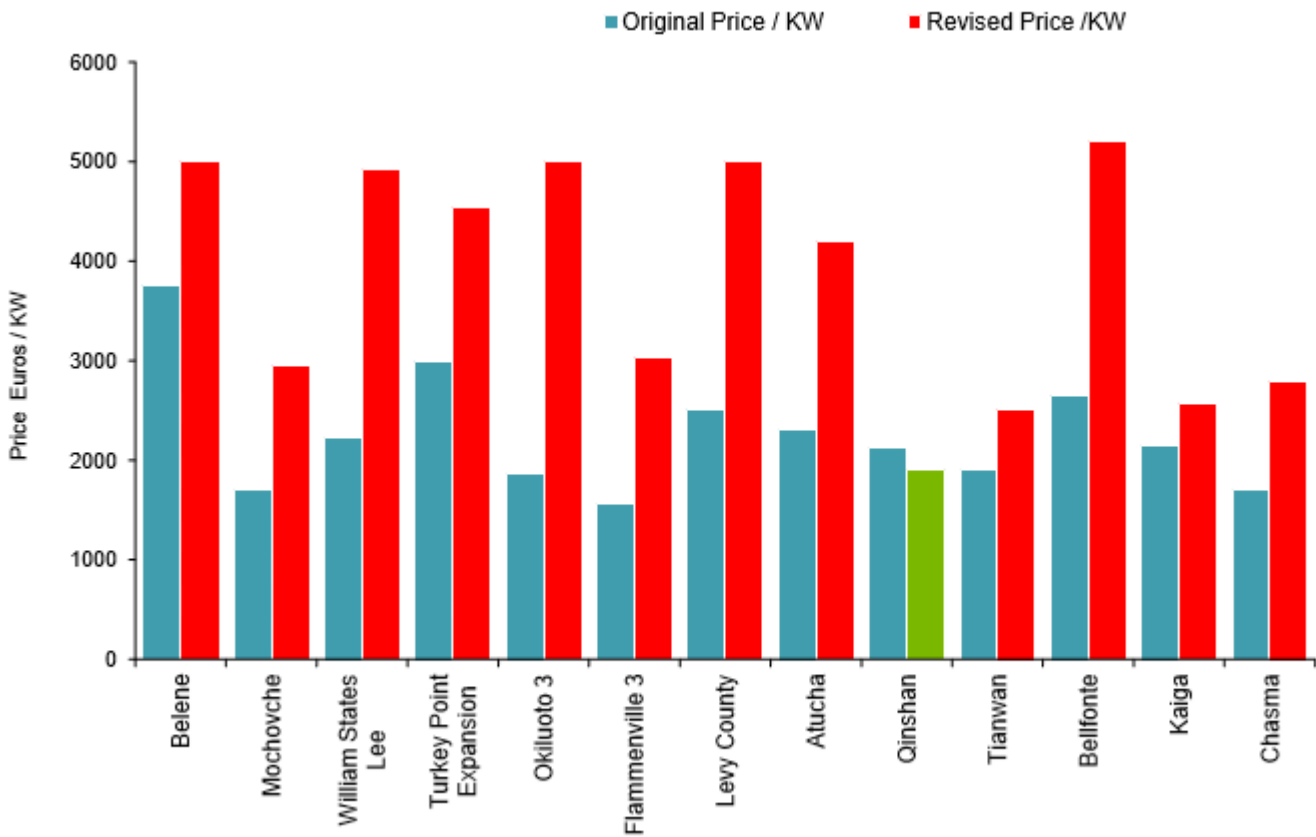
Falling costs during 90s

- Regulatory certainty
- Construction periods

Rising after 2005

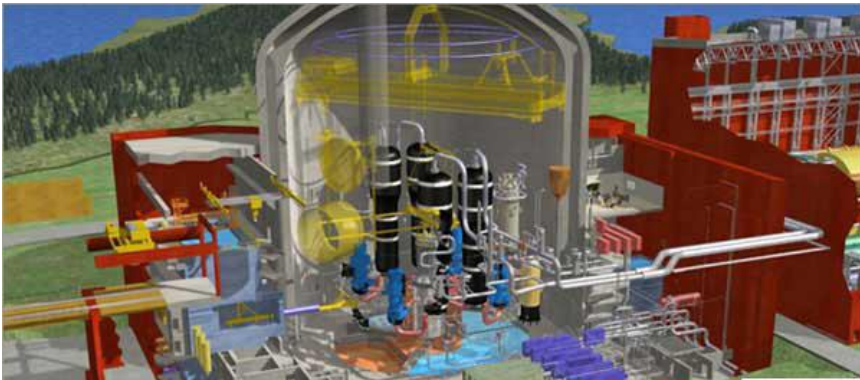
- Resource costs
- Manufacturing capacity

Outturn costs escalate



Source: KPMG 2012

Generation III designs



Very large components

Pressure vessels require 14000 tonnes+ press

Steam generators

- EPR: 4 x 25m
- AP1000: 2 x 23m

Single turbine

Olkiluoto



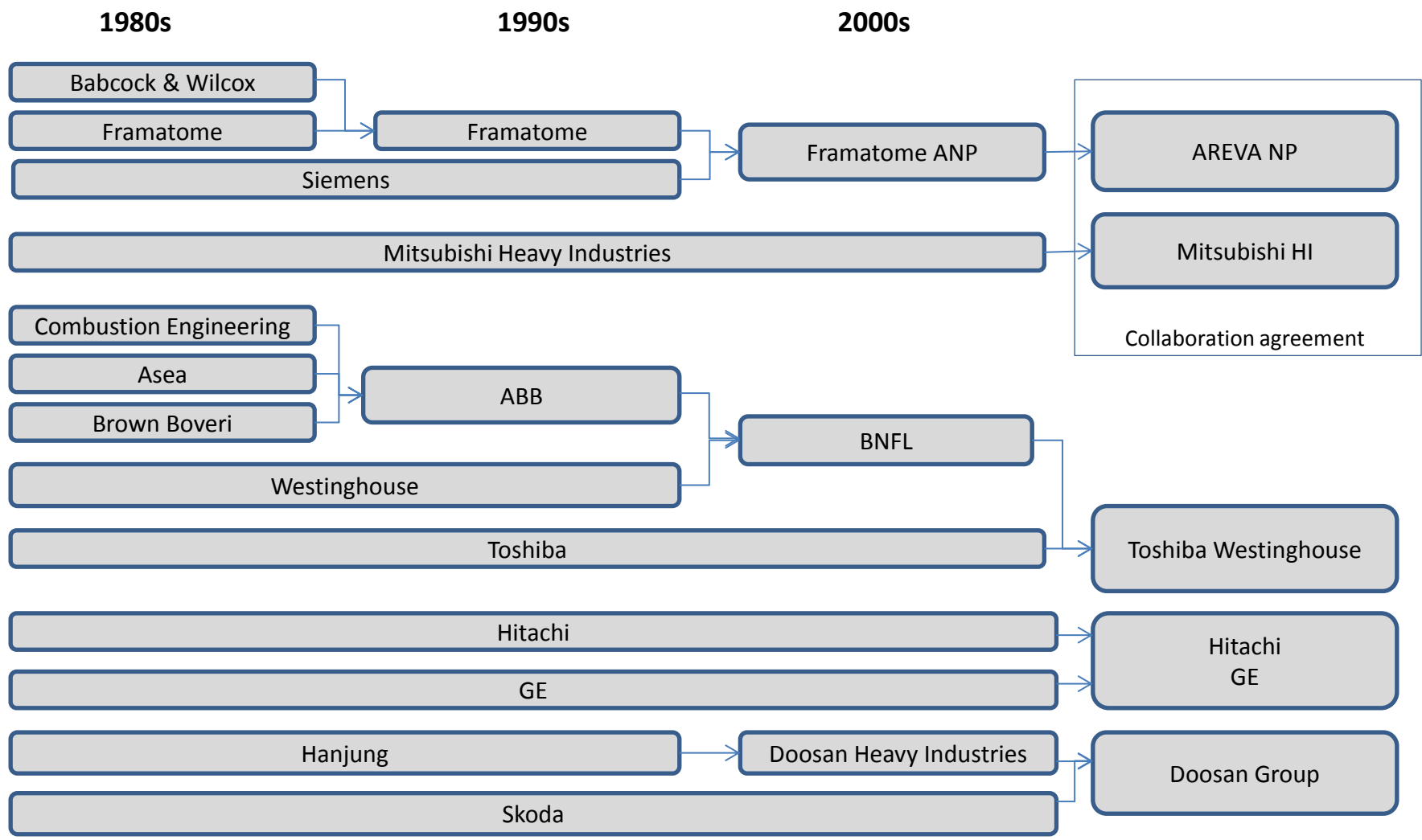
Luc Oursel Areva NP

not *“100 percent assured to have a good quality of supply”*

STUK

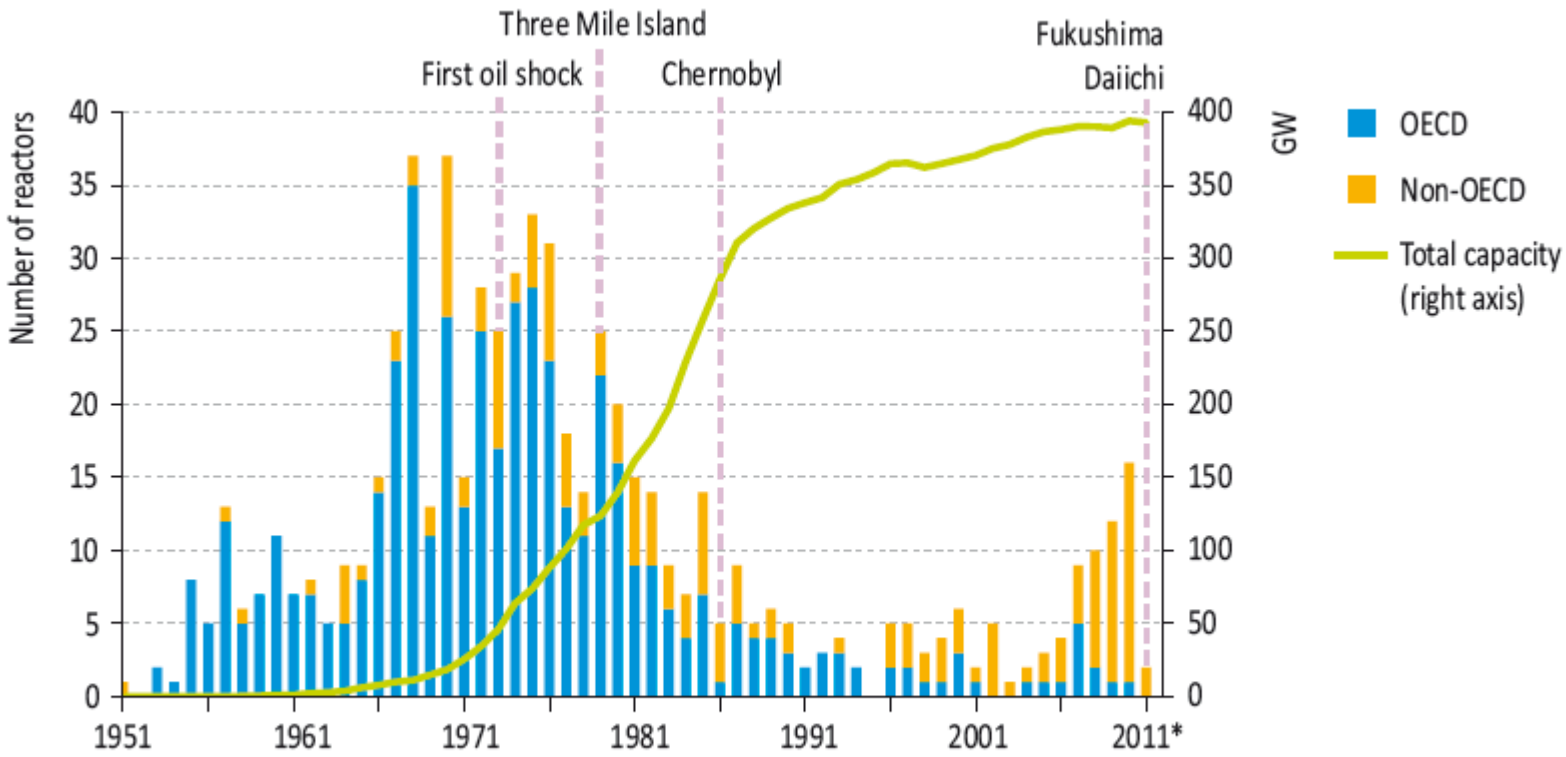
Supply chain *“not used to working to the exacting standards required on nuclear construction sites since so few new reactors have been built in recent years”*

Supply Chain Consolidation



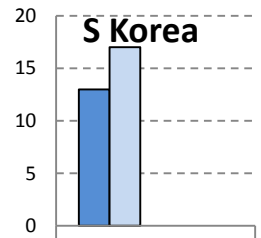
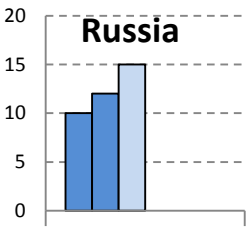
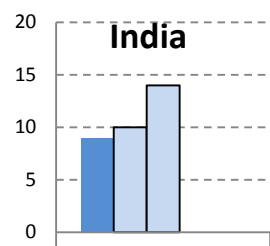
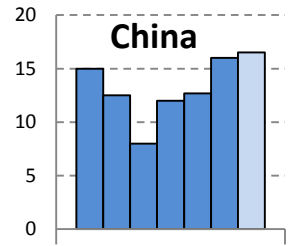
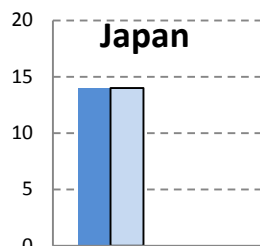
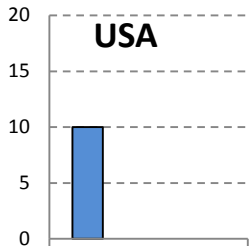
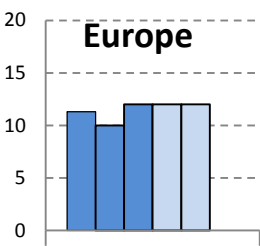
Consolidation driven by slowdown

Construction starts 1951-2011



*Data as of 31 Aug 2011.

Large forgings



- Investment requires firm orders
- New capacity coming on line
- Emerging spare capacity

Industry Structure

Consolidation v diversification

- New entrants
- Localisation
- Growth and additional capacity required



Integration v diversity

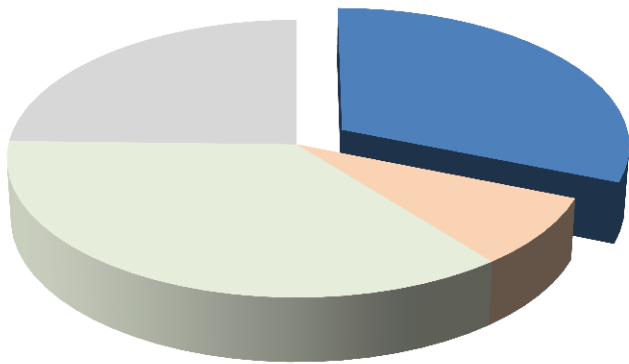
Partnerships

- Technology transfer
- Quality



Project Structuring

Number of projects



Procurement options

- EPC
- Island
- Multi-packages

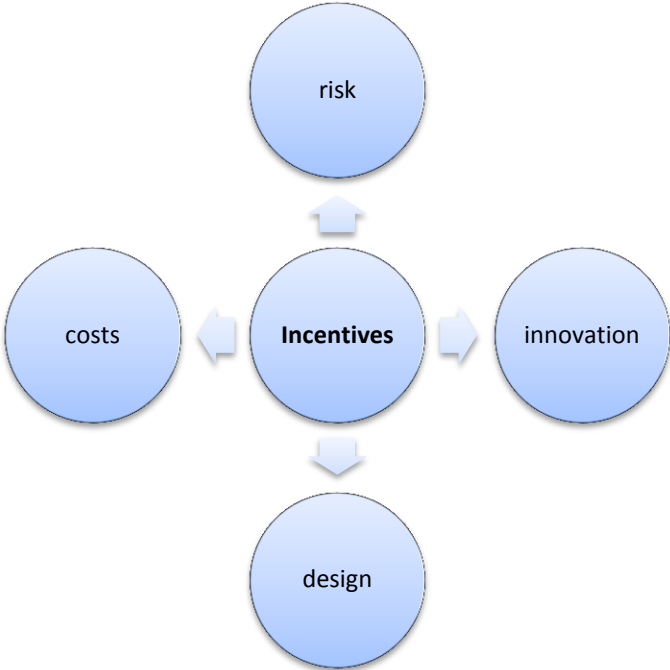
Regulatory Constraints

Principle 1: Responsibility for safety

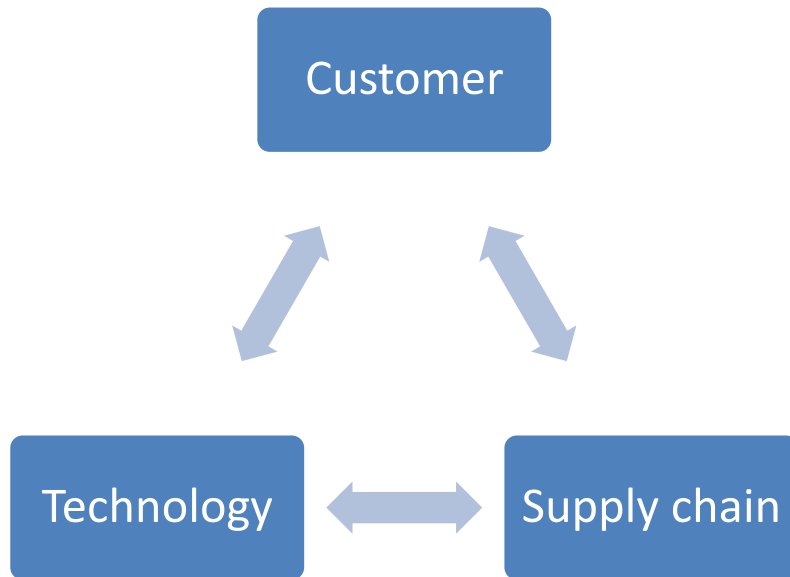
The prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks

- The licensee retains the prime responsibility for safety throughout the lifetime of facilities and activities, and this responsibility cannot be delegated.

Learning from elsewhere?



Procurement Structure



- Vendor financing
- Build-Own-Operate franchise
- Merchant utilities
- Market reform
- Structured project finance

Conclusions

No single route to change

Transition from industrial-led consortia to diverse structures

Cost as a driver

Adopting strategic supply chain relationships