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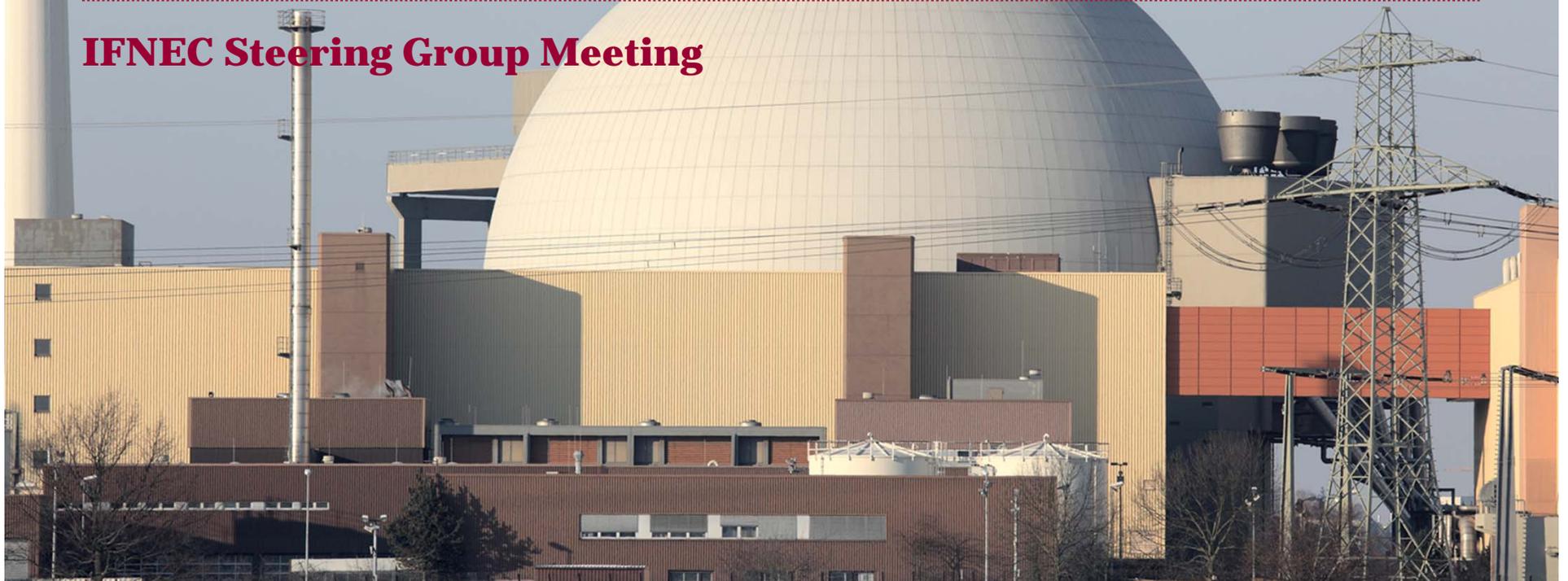
9 May 2014

Bucharest, Romania

# **Financing an NPP: Foundation Knowledge**

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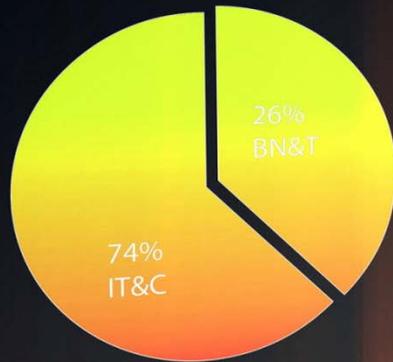
**IFNEC Steering Group Meeting**



# Overview of Presentation

- **Market Conditions and Challenges**
- **Key Terms**
- **Current Trends**
- **Project Development & Procurement**
- **Contracting Structures**
- **Concluding Thoughts**





Distribution of market share among the major industry players: IT & C and BN & T was 74% and 26% percent respectively. A further change in the economic situation in the market will be characterized by a more equal distribution of market share major players



# Market Conditions and Challenges



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# Financing – Current Market Conditions

- **We are in a period of financial conservatism:**
  - Continuing effects of the Global Financial Crisis of 2008
  - Eurozone troubles
  - Basel III requirements
  - Fukushima places renewed focus on project risk
- **Result: Money is tight**
  - Combined with traditional challenges for the financing of nuclear power plants, there are limited options
    - Classic Models: Utility Balance Sheet; Government-Funded/Sovereign Model; Regulated Markets
    - Export Credit Agencies
    - Host Government Programs (US EPAct 2005 and CWIP financing structures; UK CfD and loan guarantees)
    - Russian approaches (India, Vietnam, Turkey, Bangladesh, Belarus, Hungary, Finland, etc.); BOO as an option
    - China for China (and moving beyond ... Hinkley Point in UK)
    - Oil Economies (UAE, Saudi Arabia)
    - Vendor equity models (Horizon, NuGen, Visaginas [?])
    - Foreign utility as developer (EDF in UK)
    - High end-users (TVO/OL3, Exeltium, Blue Sky)

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# We're also seeing ...

- **Distorted power markets in Europe and the United States**
  - Europe: coal plants running / nuclear plants shutting down / gas plants shutting down
  - US: nuclear plant closures
  - Europe / US: heavy subsidies for renewable energy
  - Large scale baseload power generation isn't necessarily a good business in a lot of places right now
  - *Query: Does deregulation make sense, when considering emissions, energy security, and energy diversity? Does the market get it right?*
- **Concerns about carbon emissions**
  - Favoring renewables
  - Nuclear power not considered
- **Government budgets under pressure**
  - Therefore, looking for external solutions to internal problems
- **Energy security and industrial needs**
  - Japanese industry post-Fukushima
  - German industry under *Energiewende*
  - European dependence on natural gas from Russia
  - *Consider this from an historical perspective: France's long term bet on nuclear in the 1970s and 1980s*

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# Classic Nuclear Financing Concerns & Types of Risk

- **Primary Concerns for Financiers**

- **Long development / construction periods**
- **High capital costs**
- **Regulatory uncertainty**
- **Reputational Risk**
  - Safety culture
  - Environmental responsibility
  - Commitment to International Regimes and Standards
- First-of-a-kind risk
- Operational Success
- Human Resources and Supply Chain
- Sustainability of government commitment
- Fuel cycle concerns

- **Key Risks in an NPP**

- **Completion**
- Political
- Country
- Regulatory / Licensing
- Technology
- Labor & Materials
- Electricity Market
- Operational
- Environmental
- Nuclear Incident
- **Reputational**

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# Cost and Completion Risk: Why have projects stumbled?

1. Regulatory changes
2. Estimating errors (both generally and due to overall length of construction period)
3. Lack of / Lost execution experience
4. NSSS knowledge vs. project delivery experience
5. Supply chain failures
6. Inexperienced subcontractors (and the dangers of localization)
7. Lack of in-country experience
8. Site specific changes (vs. reference plant)
9. First-of-a-kind issues
10. Changes in public / government support
11. Political / country risk factors
12. Lack of an “informed customer” (note the importance of a competent Owner’s Engineer)
13. Labor availability (esp. specialty crafts)
14. Commodity price fluctuations
15. Lack of a project management “A Team” (either due to inexperience or capacity challenges)

# Key Terms



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## Key Terms (1 of 5)

- Debt
  - Borrowed money
  - Ideally the larger portion of the financing structure
  - Cheaper than equity
  - Higher priority than equity
- Equity
  - Invested money; ownership
  - More expensive than debt
  - Lower priority than debt

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## Key Terms (2 of 5)

- **Offtake**
  - Utilization of the electricity
- **Power Purchase Agreement**
  - Offtake agreement
  - Capacity / availability and utilization elements
  - Key source of revenue in a financed structure
  - Must be with a credit-worthy entity
  - Longer is better
- **Market Structure**
  - Regulated vs. Deregulated
  - Deregulated markets are a challenge for nuclear because nuclear is a price taker, not a price setter

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## Key Terms (3 of 5)

- **Vendor Equity**
  - NSSS supplier (reactor supplier) puts money in the deal
  - Might be temporary equity
  - Growing trend in recent years
- **Project Finance**
  - Non-recourse / limited-recourse
  - Debt and equity are serviced by the revenue generated from the asset
  - Never been used for an NPP
  - Technical diligence is a key aspect of deal formation
  - Lender controls / lender rights are critical

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## Key Terms (4 of 5)

- **Export Credit Agency (ECA) Financing**
  - Financing from sovereign / quasi-sovereign entities
  - Classically tied to national content
- **Refinancing**
  - Revision to financing structure after a certain point in time (usually after commercial operation)
  - Goal is to lower the cost of capital
  - Particularly important for NPP financing, given market appetite

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## Key Terms (5 of 5)

- **Entity Structuring: Separating Ownership from Operation**
  - Facilitates passive equity investment into Project Company
  - Allows operational experience to be separate from ownership
    - Useful where Owner does not have operational capability
    - For newcomers: need to locate foreign operators into host country operator organization
  - Allows lenders to separate debt from nuclear liability
    - In theory, separate nuclear liability exposure (licensed operator) from main equity investment (owner)
  - Enables sovereign to maintain national ownership (either directly or indirectly)
    - Addresses “strategic national asset” concerns
  - Can be implemented, regardless of contracting structure
  - Can be done for tax reasons

A photograph of a business meeting in a modern office. Two men in suits are silhouetted against a large window in the background. In the foreground, a desk holds a laptop, a pen, and a document with a colorful bar chart. A red banner with the text 'Current Trends' is overlaid on the image.

# Current Trends

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# Trending in the Nuclear Sector

- **“Newcomer” countries**
  - Lack of a track record
  - Human resource challenges
- **ECA Financing**
  - Key source of financing
  - Driven by national content of exporter country
  - Confidence-building measure
- **Government - to - Government Model**
  - The nuclear procurement is done at a government-to-government level
  - Financing can be through an intergovernmental loan
  - Currently being used by Russia in a number of locations (India, Vietnam, Bangladesh, Belarus, Nigeria, etc.)
  - Pros: Makes financing easier
  - Cons: Limits technology choice
  - Key Consideration: Strength of bilateral relationship
  - Realization: Government is a key factor in a nuclear development program
- **Vendor Equity**
  - Not a “Western” model
  - Foreign Investment / Ownership
  - Source of equity
  - Source of alignment (?)
  - How much capacity is there (?)
- **Localization**
  - En vogue, esp. with larger programs
  - Part of a national development strategy
  - Note the tradeoffs with ECA financing
  - What is feasible?
- **Technology Transfer**
  - En vogue, esp. with larger programs
  - Part of a national development strategy
  - Intellectual property, competition, and export control issues
  - Note: Distinguish “technology” transfer from “knowledge” transfer

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# Financing / Structuring Models

- Project Finance
- Sovereign model (People's Republic of China, France, India, S. Korea)
  - Often via ownership by a government-owned utility (EDF, NPCIL)
- Utility Balance Sheet model
  - Consider market structure (regulated vs. deregulated)
- “Tied Equity Investor” / Vendor Equity model
- Finland & Exeltium / Blue Sky models (heavy end users)
- Multiple-utility model (multiple off-takers)
- Build Own Operate (“BOO”) & Build Own Operate Transfer (“BOOT”)
- Government-to-Government model
- Regional Arrangements (Baltic efforts)

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## Project Finance – Nuclear

- No history of project finance for nuclear power – Why?
  - Remember, “project finance” is a term of art
    - Limited / Non-Recourse structure
    - Debt / Equity structure
    - Financing Entities look to revenue stream of the asset
    - Repayment is a function of achievement of Commercial Operation
    - Financing Entities can “take” the asset

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# Financing a Nuclear Power Project

- No history of project finance for nuclear power – Why?
  - Classic nuclear risks
    - Regulatory risk
    - Political risk (a “moment of insanity”; the joys of democracy)
    - Schedule issues
    - Budget issues
  - Project Finance remedies don’t readily suit a nuclear asset
    - Financing Entities can’t “take” the asset
    - Need for a “licensed operator”
    - Strategic asset within many countries
    - Inability to replace the NSSS vendor during construction

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# Additional Commercial and Financing Considerations

- Vendor Equity

- Rationale:

- Provides foreign source of equity
    - Reduces burden on host owner
    - Facilitates export of technology; it is often not a traditional “equity play”
    - Provides further human resources development of “country of origin” utilities (as well as source of expertise in cases like the UAE and Turkey)

- Possibly, a long term commitment

- Barakah: KEPCO in for long term
    - Akkuyu & Sinop: Long term commitment by Rosatom and by MHI (and GDF Suez/ITOCHU)
    - UK (Horizon and NuGen developers): Long term commitment

- Looking for additional equity:

- EDF in UK (Chinese equity; sovereign wealth funds)
    - Russia in Turkey (sell down of 100% ownership)

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## Vendor / Foreign Equity

- Trend over the last 5-6 years
- Source of equity (along with ECA-provided debt)
  - But, perhaps, limited replicability for (most) vendors
- Alignment of Interests
- An opportunity to move profitability from EPC Contract to equity return on investment
- Integrate foreign knowledge (and personnel) into long-term project operating plan and operating organization
- However, the Contractor can't overrun the Equity
  - Contractor / vendor is now on both sides of the deal
  - Results in a need for conflict-of-interest management

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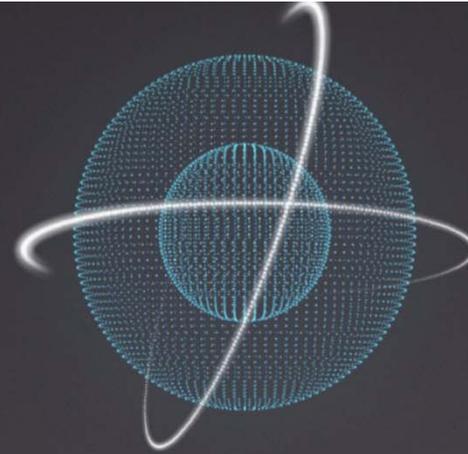
# Localization and Technology Transfer

- **Localization**

- Desire for local industry and people to participate
- Desire for local industry and people to develop
- Naturally occurs at some level
- Capacity of local market must be analyzed
- Sophistication in the nuclear sector takes time
- Forced localization can compromise project execution (both cost and schedule)
- Often a political / public relations goal
- Tradeoff with content-based ECA financing

- **Technology Transfer**

- Desire for local industry and people to develop
- Can be expensive
- Technology providers do not want to be put out of business
- Level of technology transfer can be a function of the number of NPPs being offered to the technology provider
- How do you measure success?
- Is the goal technology transfer or knowledge transfer?
- Is this distinct from human resources development?

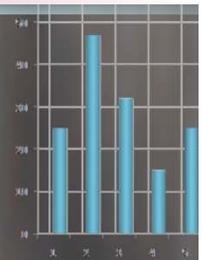


GLOBAL MARKET

TIME

# Project Development & Procurement

041	321567+94354965467
075	654964313210303467
010	973210313.10325420
004	654687603216763065
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746	132165498732106570
210	3874249732 16549248
856	754197319754812389



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## Prior to issuing the Bid Invitation Specification (“BIS”)

- Owner/Operator needs to have addressed the following issues:
    - Size or size range of NPP
    - Feasible NPP designs commercially available (generation, type)
    - Supplier candidate experiences
    - Overall schedule of the NPP project
    - Site and its characteristics (incl. security)
    - Environmental impact
    - Regulatory requirements and licensing procedure; national legal framework
    - International commitments and legal regimes
    - General technical requirements; operability considerations; codes & standards
    - Contractual approach and plant implementation model
    - National participation (local content & technology transfer)
    - Nuclear fuel cycle options
    - Nuclear waste / spent fuel management
    - Safeguards
    - Economics
    - Financing options
    - Grid capacity
- ❖ **Note that these considerations apply even if the NPP is not being competitively bid**

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# Judging Criteria

- What are your Key Buying Factors?
  - Output
  - Price (consider levelized / lifecycle cost issues)
  - Schedule
  - Reference Plant
  - Experience (to include Key Personnel)
  - Technology Transfer
  - Local Content
  - Prior in-country experience
  - **Remember: Price is only one component**

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# Nuclear-Specific Procurement Issues

- Export Control
  - Understand limitations that might exist from sourcing countries
    - Potential need for bilateral agreements
  - Put in place clear guidelines for further transfer of nuclear-controlled materials
    - Nuclear technology
    - Dual Use Items

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# Nuclear-Specific Procurement Issues

- Nuclear Qualification: *NPP construction requires nuclear certified items for nuclear safety systems*
  - Q List
    - Q List is "Qualified Suppliers List". Those suppliers that have a 10CFR50 Appendix B QA Program and that have audited and accepted as suppliers to the prime contractor. They are audited for conformance against their program and adjustments to meet our requirements.
  - N Stamp
    - ASME Section III N-Stamp: Provides the holder with the authority to design, specify, and work on nuclear equipment and pressure vessels.

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# Lifecycle Cost

- In order to do a fair evaluation of each technology, the lifecycle costs of the project must be considered
  - EPC purchase price
  - Megawatts
  - Fuel costs (and refueling cycles)
  - Operations & Maintenance costs
  - Reliability factors
  - Major equipment replacement costs
  - Useful life
  - Common facilities (if multiple units)
  - Decommissioning
  - Discount rate

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# Technical Evaluation

- Scope Equalization
  - Identification:
    - Differences in offered scope of supply and services
    - Differences in technical design features
    - Identification of necessary supporting features
    - Information required to be provided by Owner
  - Assessment:
    - Cost for differences in scope
    - Cost for differences in technical design features
    - Impact on Owner's costs
  - Judgment:
    - **Certainty of outcome**



# **Contracting & Contracting Structures**

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# Lump Sum

- Pricing: Fixed
- Cost: Most Expensive (b/c of contingency) but (theoretically) most certain
- Risk Allocation: Contractor takes greatest risk
- Profit / Fee: Contractor's profit is embedded within the fixed price, with ultimate recovery of profit based on final project cost and schedule achieved
- Open Book: Generally, no
- Financeability: Most favorable structure for financing
- Applicability:
  - When costs and risks are known; when FOAK is not present
  - When a technology provider is bringing a new product to market (debatable)
  - Least involvement by Owner; reliance on Contractor to deliver the project
  - Harder for Owner to "meddle" with localization and technology transfer requirements
- Owner Capability:
  - Important for key buying decisions
  - Need for contract oversight
  - Will Owner be licensed operator?

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# Target Price / Fee-At-Risk

- **Pricing:** Ultimately floating, but with erosion of fee relative to target price
  - Less contingency than lump sum
- **Cost:** More expensive than Cost Reimbursable, but an attempt to shift more risk on contractor
- **Risk Allocation:** Shared between Owner and Contractor
- **Profit / Fee:** Fee can be a combination of fixed (or “base”) fee and fee at risk
- **Open Book:** Yes
- **Financeability:** Will still require completion support from Owner
- **Applicability:**
  - When most costs are known but some risks (certain key commodities, labor availability, regulatory process) are unpredictable
  - When programmatic goals are involved, such as technology transfer, localization, HR development, etc.
  - When aggregate contract price is a problematic issue
- **Owner Capability:**
  - More burden on the Owner during open book process to get “certainty” as to project risks and standards of deviation from provisional sums and viability of Contractor’s execution plan
  - Will need to manage aggressively, esp. re. reimbursable vs. non-reimbursable costs

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# Cost Reimbursable

- Pricing: Floating; no contingency (Owner only pays for actual costs)
- Cost: Least expensive but most uncertain
- Risk Allocation: Contractor takes lowest risk
- Profit / Fee: Usually a markup based on costs incurred
- Open Book: Yes
- Financeability: Lease favorable for financing; will require significant completion support from Owner
- **Applicability:**
  - Desirable for a “hands on” Owner that wants control over many aspects of the project
  - FOAK situations (perhaps)
  - But hard to justify as a complete, stand-alone structure
  - Owner is wrapping the project, so either (1) it is willing to accept the uncertain aspect of cost re pricing, (2) it has the capability to manage the overall project, or (3) it has unique requirements re. technology transfer, localization, and HR development
  - Greatest risk to Owner
- **Owner Capability:**
  - More burden on the Owner to demonstrate project management capability
  - Will need to manage aggressively, esp. re. reimbursable vs. non-reimbursable costs

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# Hybrid Contracting

- **Aggregate Contract Price has combination of pricing elements**
  - Lump sum for those elements that are known
  - Target price or cost reimbursable for those elements that are uncertain
- **Results in Contractor / Vendor assuming the risk for things that they can control ...**
- **... but Owner then shares or takes risk for elements that would otherwise require heavy contingency**
  - Possible risks here include: labor, some commodities, regulatory delays

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# Phased Contracting

- Recognition of length of NPP development and construction period
  - UAE: Bids were submitted in July 2009; last unit will come on line in May 2020
- An attempt to eliminate excessive contingency in pricing
  - Price “knowns” early on
  - Price “unknowns” after detailed engineering and design are done and / or after major subcontracts are placed
- But what happens if the ultimate price is untenable?
  - Owner organization will need to be actively involved throughout in order to get confidence in overall process and ultimate price
  - Owner will need procurement and engineering capabilities

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# Split Contracting

- Separating out various work packages
  - By function (engineering, NSSS, other major equipment, commodities, etc.)
    - EDF approach
    - Applicable when Owner organization has integration capability (engineering, procurement, construction management, operations, etc.)
  - By structure (nuclear island, turbine island, balance of plant)
    - Chinese method for AP1000; Indian method on French and US plants
    - Applicable when Owner organization has integration capability (construction management) and/or ability to source large work packages locally
  - By purpose
    - Separate contracting packages for EPC, fuel, and operations
    - Owner will need procurement capabilities for all key areas
    - Less experience Owner ... more need for fully integrated package

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## CM / EPCM Contracting

- **Methodology: hire an E&C firm to manage the project**
  - Variation on theme: Owner's Engineer
- **When an Owner organization lacks oversight capability**
  - CM: CM firm oversees EPC elements; CM contract is fee-based
  - EPCM: EPCM firm does all engineering, procurement, and CM functions
    - CM is fee-based
    - E & P can be lump sum
    - EPCM firm does not take lump sum construction risk
  - An alternative approach would be to hire a “program manager” which then provides the “Knowledgeable Customer” capability to the Owner organization (the “Owner’s Engineer” approach)

Putting it all together ...



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# Concluding Thoughts

- Ultimately, it has to be a viable project ... it must be a “good project”
  - Nuclear projects are unique
  - High visibility program of geopolitical significance
  - Sustained government support is critical
  - Classic nuclear challenges must be addressed
  - Participants need to be dependable
  - Reputational Risk factors must be considered
  - Regulatory structures need to support nuclear power generation
  - Early-stage program decisions must consider financing issues
  - Economics must work
  - If you don't have a viable structure that can be financed, you don't have a project

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# Thank you for your time and attention

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# Paul Murphy



## Paul Murphy

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Paul Murphy's practice focuses on multiple aspects of the nuclear industry – from legal and policy matters, including international regulatory and treaty frameworks and issues regarding nuclear liability, to strategies for creating viable nuclear power programs and the identification and mitigation of associated risks – representing developers/owners, investors, and contractors on nuclear projects internationally. Mr. Murphy is recognized as an expert in the development and financing of nuclear power programs by the International Atomic Energy Agency (IAEA), the OECD's Nuclear Energy Agency (NEA) and the US government. Mr. Murphy currently serves on the IAEA's Technical Cooperation Program team, which assists member states in developing civilian nuclear power programs. Mr. Murphy has served as a designated expert, chairman, and author at several special meetings and for multiple working groups of the IAEA, primarily involving the development, financing, and structuring of nuclear power projects. He continues to work with the IAEA in a number of key areas, including a current revision of the IAEA's *Handbook on Nuclear Law* and as lead author for a new report to be released in the next few months, entitled, *"Alternative Contracting and Ownership Practices for Nuclear Power Plants"*.

Mr. Murphy currently serves as a two-time appointee to the US Secretary of Commerce's Civilian Nuclear Trade Advisory Committee, and he has served as chair of its Finance subcommittee. In addition, Mr. Murphy recently served as the US Government's sole representative on an NEA working group on *"Financing of Nuclear Power Plants"*, acting as chairman for the working group. Mr. Murphy also chaired the IAEA working group that issued, *"Issues to Improve the Prospects of Financing Nuclear Power Projects."* Mr. Murphy has also worked with the Nuclear Energy Institute, the US State Department, the US Mission to the OECD, and the Export-Import Bank of the United States on revisions to the OECD's Guidelines for the financing of nuclear power projects by Export Credit Agencies.

For the last five years, Mr. Murphy served as a faculty member for the *"Training Course on Nuclear Power Infrastructure Programs and Related Projects in Emerging Nuclear States"*, held on behalf of the US State Department and the IAEA at the Argonne National Laboratory and attended by representatives of over 20 foreign governments. Mr. Murphy was the lead instructor for the segments on financing and the bidding / evaluation process for nuclear power projects.

In addition to his work in the nuclear sector, Mr. Murphy's representations have included extensive work in the engineering and construction industry, where he has been heavily involved in the nuclear and fossil power sectors, both domestically and internationally. His project experience, both domestic and international, includes nuclear (new build, steam generator replacement, nuclear operating plant services), coal (both new build and environmental retrofit), and gas-fired power projects, ranging from EPC contracting structures to technical support agreements and including major equipment purchase agreements and subcontracting. Recent projects have included work in solar power projects (CSP), IGCC and coal liquefaction plants, and pipelines.

Prior to joining Milbank, he served as Senior Counsel for Bechtel Power Corporation, supporting both the Nuclear and Fossil business lines as a transactional attorney involved in bid evaluations, business development, proposal submittals, contract negotiations, procurement, and project execution.

Mr. Murphy is a graduate of Princeton University's Woodrow Wilson School for Public and International Affairs and a graduate of Harvard Law School. Mr. Murphy is also a member of the International Nuclear Law Association.

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