

# HIGH STAKES NUCLEAR DEVELOPMENT IN THE MIDDLE EAST:

## THE ROLE OF THE U.S. AND ITS ALLIES AS COMMERCIAL COMPETITORS AND PARTNERS

***PRESENTATION FOR :  
NUCLEAR GEOPOLITICS IN AN EVOLVING ENVIRONMENT –  
GLOBAL RESPONSIBILITY, INFLUENCE, AND INNOVATION  
IN THE 21<sup>ST</sup> CENTURY***

***PARTNERSHIP FOR GLOBAL SECURITY /  
CARNEGIE ENDOWMENT FOR INTERNATIONAL PEACE  
WASHINGTON, D.C.***

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# PRESENTATION OUTLINE

- Lessons from the Barakah NPP
- The Current (& Future) State of Things
- Concluding Thoughts

*Everyone is watching what the Saudis will do, but let's first go back in time to draw some lessons before we project near-term and future developments ...*

# Going Back to 2009: KEPCO wins Barakah (UAE NPP)

# UNITED ARAB EMIRATES



- **Key Factors**

- Dedicated offtake market
- Strong government credit
- National plan
- Host Government commitment
- Need to meet growing demand for electricity with carbon free generation
- Need to preserve oil & gas for more profitable uses
- IWPP experience and success of IWPP model
- Motivated exporter
- 4 unit deal

- **Key Challenges**

- Lack of national experience
- Geopolitics of an NPP in the Middle East

- **Key Deal Points**

- Competitively bid
- Vertically and horizontally integrated deal
- Government-to-Government deal
- Sovereign guarantee of debt
- Contractor equity (minority stake)
- ECA participation, esp. by “third” country to validate the deal (original structure)
- Power Purchase Agreement for full plant output

# UAE NUCLEAR PROGRAM

- **Final bidding teams:**
  - APR-1400 (KEPCO, etc.) 
  - ABWR (Hitachi, etc.) 
  - EPR (AREVA, etc.) 
  - Did not make the final cut:\*
    - Westinghouse's AP1000 
    - AECL's Candu 6 
    - GE's ESBWR 
    - Atomstroyexport's VVER 
- **Bids were submitted on:** July 3, 2009
- **Final award was scheduled for:** September 16, 2009

# UAE NUCLEAR PROGRAM (AS OF DEC 2009)

- **Contract awarded to the APR-1400 consortium in late December 2009 (three months late)**
  - Contract was for four units ( $5820 \text{ MW} = 1455\text{MW}^* \times 4 \text{ units}$ )
  - Reported cost of the units = US\$20 billion (US\$3436/KW)
  - Reported cost of fuel and operating services over 60 years = US\$20 billion
  - Total award to APR-1400 group: US\$40 billion
  - Unit 1 COD: May 2017 (with the remaining three units coming online in one-year cycles)

\* Source: <http://www.apr1400.com/system/system02.jsp> (KHNP website)

# **UAE 2009: What is the broader impact on the international nuclear marketplace?**

# DEAL POINT #1: A “PACKAGE DEAL”

- The UAE wanted a “package” deal:
  - NSSS technology
  - EPC scope
  - Operations
  - Fuel
  - Equity
  - In effect, “one stop shopping”
- Customarily, these disparate services were provided through separate sources
- These services traditionally involve different business sectors, with different business models and time horizons
- Yet, the UAE wanted to go to one counter-party (whether one company or new corporate entity) to provide everything
- ***Updated Point: US companies aren’t vertically and horizontally integrated; we don’t have a “package deal” concept, where one entity can “front” the risk***
  - *Risk allocation is a challenge for our companies*



# DEAL POINT #1: A “PACKAGE DEAL”

- **“Korea Inc.” was comprised of:**
  - KEPCO, as consortium leader (full scope of works and services)
  - Doosan Heavy Industry & Construction, as equipment maker
  - Hyundai, as plant builder
  - Samsung, as plant builder
  - Korea Nuclear Fuel, as fuel fabricator
  - Korea Plant Services & Engineering, as service vendor
  - Korea Power Engineering Co., as architect-engineer
  - Korea Hydro & Nuclear Power Co., as EPC role and operator

# DEAL POINT #1: A “PACKAGE DEAL”

- **How & Why did this happen?**
  - Competitive pressure
  - Realization by the UAE that this effort, on the desired time scale (Unit 1 COD = May 2017), was an enormous undertaking
    - Human resource challenges; inability to integrate all aspects of the nuclear package (NSSS, EPC, fuel, operations)
- **Query:**
  - Did the Dubai financial situation put unexpected pressure on the UAE, thereby making price a bigger issue?
  - Did the Emiratis get “sticker shock”?
  - Did exchange rates hurt the French bid?

# DEAL POINT #2: A GOVERNMENT BACKED DEAL

- **Reports indicated that the Korean bid was “guaranteed” by the Korean government**
  - Query: What is the extent of the guarantee?
    - How much of it is a legal guarantee?
    - How much of it is a reputational / relationship guarantee?
  - Effect: Such a guarantee removes (the perhaps counterintuitive) fixed price risk for the Owner
    - No matter how bad the deal gets for the KEPCO APR-1400 team, the suppliers will stay the course, in the eyes of the Owner, because of the government guarantee

# DEAL POINT #3: A GOVERNMENT-TO-GOVERNMENT DEAL

- **These deals (i.e., nuclear programs for “first unit” countries) will not just be about the procurement of a nuclear power plant**
  - Bilateral relationship that cuts across multiple industries
    - Bilateral diplomacy
    - Trade promotion
    - Military cooperation
  - Conclusion: In order to succeed, industry and government will need to work together to WIN the deal.
  - Since 2009, Russians have been particularly effective with this model, and the Chinese are now showing that they can play the same game, possibly to greater effect (Hinkley Point C & Atucha III)

# DEAL POINT #4: THE APR-1400 WAS “GOOD ENOUGH”

- **The APR-1400 doesn’t have any particularly distinguishing features, as it is not a Gen III+ technology**
  - It is “evolutionary”, not “revolutionary”, technology
  - But Gen III was deemed good enough by the UAE, as they sought to develop a model program for “first unit” countries ...
    - ... despite the UAE’s expressed desire to be the “gold standard”
- **Once all the competitors were deemed “good enough”, the competition came down to price**
  - ... even though the APR-1400 was not in operation in Korea
  - ... nor was it in construction outside of Korea
  - ... nor had the Koreans built a nuclear power plant outside of Korea

# The Current (and Future) State of Things

# WHERE ARE WE IN 2018?

- Russians are very active
- Chinese are very active
- AREVA is no more
- Japan is still dealing with Fukushima impact on nuclear industry
- Toshiba is out of the nuclear newbuild business
- Hitachi has one project (Horizon) with an uncertain future
- MHI has one project (Sinop) with an uncertain future
- Westinghouse is in bankruptcy
- GE largely appears to be inactive
- EPR projects are far worse off than where they were in 2009
- AP1000 projects have not gone well
- Korean reference plant experienced delays; Barakah now faced with significant operational readiness delays

# ASSESSMENT FOR US INDUSTRY

- **US nuclear industry is not in a good competitive position**
- **Nuclear plants in merchant US markets are under threat of shutdown**
- **Nuclear marketplace is unpredictable re. deal flow**
- **Financing is critical**
  - US-Exim still does not have quorum (therefore capped at \$10M/project)
- **Civilian nuclear power needs champions**
- **Role of Government is key (and that role takes many different forms)**
  - Russia and China have the momentum ... and soon, the LEADERSHIP
    - Russia is locking up markets
    - China is playing commercial hardball
- **Overall loss of US influence**



# WHAT HAVE WE LEARNED SINCE DECEMBER 2009 ?

- Koreans [are/were] doing well in the UAE, but they have not followed Barakah with the “next” big deal
  - Note, too, the anti-nuclear stance of Korea’s current president
- Importance of the “third flag” in the deal (for Barakah, it was the USA)
- We still cannot figure out a way to “project finance” a nuclear power project
- Western new build projects have not gone well (including the UK’s ambitious plans)
- Nuclear plants have been shut down due to Fukushima (Germany) or due to deregulated market conditions (US)
- Financing is often the determining factor
- Deals are won through either investment (see UK) or government-to-government deals (see everywhere else)
- G-to-G deals are multi-faceted and go beyond the nuclear project

# CLIMATE CHANGE & NUCLEAR POWER

- A stable grid cannot be based solely on intermittent generation
  - From a emissions perspective, baseload “clean” power options are limited to hydro and nuclear, with hydro options limited in many countries
  - Significant countries have recognized that climate goals can only be met with nuclear power as part of the solution (e.g., UK, China)
    - Contrast this with the failure of Germany’s *Energiewende* strategy (noting the net increase in emissions)
  - Environmentalists, biologists, and international organizations have recognized the critical role that nuclear power must play in climate change efforts
    - *Pandora’s Promise*
    - “Open Letter” in *Conservation Biology* from 65 noted biologists
    - “Open Letter” from James Hansen, Ken Caldeira, Kerry Emanuel, and Tom Wigley
    - International Energy Agency’s *World Energy Outlook*
    - UN’s Intergovernmental Panel on Climate Change
  - US market as an example: with recent closures of NPPs in the US (Vermont Yankee, Crystal River 3, San Onofre, Kewaunee), nuclear’s share of electricity generation is in decline, making climate goals more elusive
- ***Without significant contributions from the nuclear sector, basic math tells us that climate change goals are not achievable***

# 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, Hungary, Bangladesh, Belarus, Egypt, etc.) and by China in Pakistan and Argentina
- Pros: Makes financing easier
- Cons: Limits technology choice
- Cons: Lack of competitive pressure
- Key Consideration: Strength of bilateral relationship
- Realization: Government is a key factor in a nuclear development program

# G2G: MOTIVATIONS

- **For the Host Country:**

- Foreign experience ... a partnership of sorts
- Foreign source of funding
- Deals in other sectors

- **For the Exporting Country**

- A market for its nuclear power plant
- Bilateral relationships
- Long term linkages
- Deals in other sectors
- More focused aid with tangible results

# G2G: QUESTIONS

- **What does the foreign government want in return?**
- **What else accompanies the guarantee?**
- **How strong is the bilateral relationship?**

# REMEMBER

- There is no such thing as “free and open competition” in the civilian nuclear power space
- Other than the Japanese, competitors are State Owned Entities
- Nuclear procurements are not really classic competitive bid situations
- Civilian nuclear power is a unique asset class
  - *Point to Ponder: Can we learn any lessons from the Defense Industry re. how weapons systems are procured, developed, and sold internationally?*

# SO WHAT DOES THE COMPETITIVE LANDSCAPE LOOK LIKE?

- **Russia**
  - SOE core
  - Building domestically
  - Foreign projects in Finland, Belarus, Hungary, Turkey, Bangladesh, Egypt, India, Iran
  - Signed up in Nigeria, Sudan, Ghana, and a whole host of other places
  - Close in the Philippines, Kazakhstan, Indonesia
  - Possible in Brazil
- **Strategies:**
  - **Nuclear diplomacy**
  - **“We can do it all”**
  - **Financing**
  - **Hedging bets**
  - **Cornering the market; freezing others out**

# SO WHAT DOES THE COMPETITIVE LANDSCAPE LOOK LIKE?

- **China**
  - SOE core
  - Largest domestic newbuild program
  - Foreign projects in Pakistan, UK, Argentina, Saudi Arabia
  - Possible in Brazil, Kenya
- **Strategies:**
  - **Financing**
    - **But *quid pro quo***
  - **Not judgmental; commerce-driven; building networks**
    - **See also: “One Belt, One Road”, AIIB, BRICS bank, Chinese lending institutions (Ch-Exim, Sinasure, CDB)**
  - **Creating interdependencies**
    - **See also Chinese holdings of USG debt instruments**



# What Next?

# THE BROADER WORLD

- **The world still needs nuclear power**
- **But pathways for developing countries are challenged (and, probably unrealistic for most)**
- **Financing still drives the process**
  - Note, too, the importance of programmatic funding
- **Government-to-Government deals drive the process**

# THINGS TO WATCH: SAUDI ARABIA

- **Who will the Saudis pick?**
  - The geopolitical significance of nuclear power projects
  - By the way, whatever happened to things like the Monroe Doctrine? [China in Argentina]
- **If you were the Saudis, would you pick the USA?**
  - Westinghouse is still in bankruptcy
  - AP1000 projects have not gone well
  - Can Team USA put together an integrated offer?
  - US 123 Agreement (and other) challenges
  - Price Competitiveness
  - Does anyone within the OECD look any better?
- **If Westinghouse doesn't win, are there still roles for the USA?**
  - Teaming partner with ROK
  - Program Manager / Owner's Engineer
  - Operator

# THINGS TO WATCH: INTERNATIONAL MARKETS

- **What will Westinghouse look like, post-bankruptcy?**
- **Will Framatome and Westinghouse ever solve the India conundrum?**
- **Will the UK get on with “it”?**
  - And what about Euratom and Brexit?
- **Wither the Czech Republic and Poland?**
- **Will anything really ever come to fruition in Turkey?**
- **What SMR vendors will emerge? Can they compete with the Russian and Chinese offerings?**

# WHAT CAN THE US DO TO MATCH THE CHALLENGE OF RUSSIA & CHINA

- **Get US-Exim back in the game**
- **Expand tools for US-Exim and change OPIC's current anti-nuclear stance**
- **Early stage assistance**
- **Package all the things we do well in the nuclear space**
- **Structure bilateral deals across sectors**
- **Tie everything together**
- **Play hardball**
  - e.g. the India deal in 2008
- **USG and Industry together**
  - fully coordinated and aligned, with targeted countries/projects
- **What are we selling?**
- **Can US industry get its act together?**
- **Build a strategy for SMR/Advanced Reactor deployments**

# WHAT ABOUT COOPERATION WITHIN THE OECD?

- **Multi-sourced financing?**
- **But who will lead?**
- **Common design certification?**
- **Program development assistance?**

# CONCLUDING THOUGHTS

# POINTS TO PONDER

- **Four unique challenges of the asset class:**
  - Presence of safety regulator
  - Overcoming development risk
  - Shortcomings of financial modeling
  - The intangibles of nuclear power
- **Will SMRs/ARs be “game changers”? If so, when?**
  - How broad and deep is the SMR/AR market?
- **Will climate change considerations carry the day?**
- **Civilian nuclear power needs champions**
  - Note that business development is done by others at a “head of state” level
- **Role of Government is key (and that role takes many different forms)**
- ***Geopolitics: These deals are about influence and long-term, bilateral relationships across multiple sectors***



**QUESTIONS?**



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# THANK YOU!



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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 and financing viable nuclear power programs and the identification and mitigation of associated risks – representing developers/owners, technology providers, 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 the IAEA's, *"Alternative Contracting and Ownership Practices for Nuclear Power Plants"*.

Mr. Murphy has served as a four-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 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 seven 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), LNG 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.

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, and he has been appointed to ASME's Clean Energy Technology Advisory Panel.

# GLOBAL REACH



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