

**U.S. Department of Commerce  
Civil Nuclear Trade Advisory Committee (CINTAC) Meeting  
Fifth Charter, 2016-2018**

Thursday, July 19, 2018, 9:00am - 4:00pm  
Herbert. C. Hoover Building, Commerce Research Library  
1401 Constitution Ave. NW  
Washington, DC 20230

MINUTES

**8:30 – 9:00                      Arrival, Coffee, and Networking**

**9:00 – 9:45am                Welcome & Briefing on China’s Civil Nuclear Market**

- CINTAC Chair Gary Wolski opening remarks.
- CINTAC Co-DFO Devin Horne opening remarks.
  
- Briefing on China’s Civil Nuclear Market – David Fishman and J.P. Stovall, Nicobar Group (see PowerPoint presentation).
  - Many new reactors coming online and being approved – 2018 is a key year – AP1000s at Sanmen and Haiyang to come online late 2018 or Q1/Q2 2019 – will lead to more new reactors being approved.
  - Inland plants not expected to be included in National Plan until 2020 (14<sup>th</sup> 5-year plan) – draft versions of plan to be out 2018/2019.
  - Mergers/restructuring – utilities being combined, SOEs with complementary product lines being combined (e.g. SPIC creation).
  - Hualong One – 4 demonstration reactors under construction now – startup by 2021; Gen IV HTGR loading fuel – to be online late 2018.
  - CAP1400 demo plant under construction.
  - Opportunities for U.S. Suppliers
    - Operating Reactor Fleet
      - Services as primary growth market; many gaps where U.S. technology firms can gain foothold in market; spare parts for previously imported equipment.
    - New CAP1000 builds
      - Opportunities for U.S. equipment suppliers willing to explore localization; U.S. suppliers should have a plan for how to approach localization/tech transfer.
    - Hualong One
      - China wants as much Chinese content as possible, but opportunities for sub-component suppliers for Chinese suppliers.
    - Advanced Reactors - limited opportunities due to sensitive technology.
    - China Export Builds - opportunities for U.S. companies willing to explore partnerships Chinese firms.
  - CS Shanghai Update (Christian Koschil)

- Discussion/Q&A
  - Hash Hashemian asked for recommendations for key China civil nuclear trade shows for U.S. companies to focus on
    - David Fishman noted that there are two large shows: (1) Nuclear Industry China (NIC) – every 2 years – last met April 2018; (2) China International Exposition Nuclear Power Industry (off years of NIC show).
    - For intergovernmental cooperation (Asia Nuclear Business Platform)
  - Seth Grae asked about creating and enforcing an IP protection plan, what does a successful enforcement plan look like?
    - David Fishman noted keys to success: plan ahead, consult with a law firm, designate location for arbitration in China, contract written in Chinese and English, contract interpreted by Chinese law, hire Chinese lawyer or China knowledgeable lawyer.
    - China enforces IP infringement strongly.
  - Donald Hoffman noted that Excel Services Corp. works with three organizations in China and that each operates differently. Noted need for an entity that U.S. firms can share best practices with (Excel has started putting together a product re this).
  - Gary Wolski noted that the U.S.-China Energy Cooperation Working Group is a good forum for sharing best practices.

### **9:45 – 10:30 TeamUSA Update**

- Representatives from the Departments of Commerce, Energy, State, and EXIM Bank will provide an update on recent activities and answer questions
- Participants: Devin Horne/Jonathan Chesebro/Robert Little (DOC), Alex Burkart (State), Gary Langlie (NRC), Katie Strangis (NNSA), Art Kron (DOD).
- DOE Update (Michelle Scott)
  - Noted that Saudi Arabia, India, UK, and Poland as TeamUSA markets of focus.
  - DOE Office of Nuclear Energy (NE) Activities:
    - Upcoming Bilats: U.S.-India CN WG – delegations of Indians to Idaho National Lab July 31-Aug 2;
    - DOE Deputy Secretary and Under Secretary Mark Menzes to participate in U.S.-Japan Bilateral Commission August 8 in Tokyo;
    - U.S.-Argentina Joint Standing Commission (Aug 21-24)
    - University engagement: NE opening up applications for undergrad /graduate student scholarships; 3<sup>rd</sup> round of advanced nuclear technology Funding Opportunity Announcements (FOA) closes July 31.
      - July 9 – first Nuclear Energy Advisory Committee (NEAC) meeting of new charter held – 25 committee members (13 new members).
    - IAEA
      - Bilats being developed for DOE principals.

- U.S. Government (USG) requested three side events (all were approved) - Peaceful Uses side event, Industry focused side event, and CSC side event. USG supporting other IAEA side events.
  - Seth Grae asked if the schedule of side events will be circulated so U.S. companies can determine which events they can participate in,
    - Michelle Scott noted that the side event list will be posted online soon.
  - David Blee noted importance of Czech Republic and Jordan as export markets. Noted importance of DOE FOAs - \$80 million given out so far (out of \$110 million allowance) - \$30 million left to allocate in Round 4.
- State Department Update (Alex Burkart)
  - International Nuclear Institute (INI) – professional development program (2 weeks in Czech Republic, 2 weeks in U.S.) – opportunities for participants to be exposed to U.S. and Russian technology – (funded by DOE/State Peaceful Uses Initiative (PUI) funds.
    - Candidates for program generally junior people – noted desire for U.S. participants; application process through IAEA.
  - China – USG working hard to conclude civil nuclear policy review.
  - Myron Kaczmarek asked if the USG worked with Millennial Nuclear Caucus Events (Holtec sponsoring event on August 2). Alex noted that he will promote this event more.
  - Bob Kalantari noted that he has worked with INI and Umass Lowell – he presented on nuclear safety at recent event – said 7-8 countries participated (mostly students); good forum for meeting international players.
- Cameron Dorsey (DOC/ITA Advocacy Center) Update
  - Asked companies to submit advocacy questionnaires sooner rather than later – takes about a month to approve.
- Gary Langlie (NRC Office of International Programs) Update
  - Senate confirmed three NRC commissioners in late May - NRC has all commissioners in place now.
  - Margie Doane (NRC General Counsel) appointed by commissioners as new Executive Director of Operations.
  - NRC Federal Register Notice (FRN) published June 25 re “Fee Recovery for FY2018” – NRC amending its fees starting late August – NRC will no longer be charging fees for export and import licensing applications for the next year – this may change in future.
- DOE/NNSA (Katie Strangis) Update

- E810 trainings being scheduled regularly – interested companies should contact NNSA if want to take training.
- NNSA working with Hill on proposed legislation to delegate Part 810 approval down from Secretary of Energy.
- NNSA working diligently to review Part 810 applications.
- DOC (Devin Horne) Update
  - IAEA U.S. Industry Program Update – application period extended until August 3 – 45 individuals from 26 companies registered.
  - Japan Decommissioning Forum on Aug 7 in Tokyo – DOE Deputy Secretary leading delegation – 25 companies registered, 60 U.S. participants expected.
    - U.S.-Japan Roundtable (Howard Baker Forum organizing) on Aug 9 – U.S. companies welcome to participate.
  - DOC Bureau of Industry & Security (BIS) Uranium 232 investigation
    - July 18 – Secretary Ross announced launch of DOC investigation into whether the present quantity and circumstances of uranium ore and product imports into the United States threaten to impair national security.

#### Discussion/Q&A re TeamUSA Update

- Omer Brown noted support for CSC side event at IAEA General Conference; noted his CSC visit to Peru and Brazil recently.
- Vijay Sazawal noted that USEC requested last Uranium 232 investigation due to competition from Europe; now, in situation where U.S. utilities purchase almost all foreign uranium; noted that current 232 case could adversely impact US companies.

#### **10:45 – 11:15 Update from the White House**

- Mike Goff, Office of Science and Technology Policy
  - Noted that this is an important and exciting time for civil nuclear policy in U.S.
  - Noted challenges facing U.S. fleet - mainly tied to energy market structure (not to reactors themselves); noted importance of innovation in U.S. nuclear industry – many different reactors under development.
  - Noted that current Administration recognizes challenges and opportunities facing U.S. industry. Administration supportive of industry –June 2017 “Unleashing American Energy” speech re Civil Nuclear Review.
  - Civil nuclear energy plays key role in U.S. National Security Strategy – calls on U.S. to lead in research, technology, and innovation.
  - Strong bipartisan support for civil nuclear energy – demonstrated by budget and current bills.
  - Recent release of Report re “Science and Technology Highlights in First Year of Administration” – civil nuclear highlighted – TREAT reactor re-started earlier this year – part of critical infrastructure for testing advanced fuel and reactor concepts – will help U.S. industry.
  - President’s Civil Nuclear Review

- Review is ongoing – details cannot be discussed.
- Revitalizing and expanding U.S. civil nuclear industry is a key goal of the Administration.
- Discussion/Q&A
  - David Blee asked if the Presidential Directive to ensure resiliency in electricity markets is part of the Civil Nuclear Review (Mike noted that it is part of the Review).
  - Hash Hashemian asked what the USG is doing to save the existing fleet.
    - Mike noted the recent Notice of Proposed Rulemaking (NPR) designed to reward benefits that nuclear fleet provides re resiliency; FERC has agreed to continue to address this issue.
  - Hash Hashemian asked for an update on accident tolerant fuel for TREAT
    - Mike noted that a lead test assembly to be loaded in late 2020 (goal); TREAT operational to do fuel qualification tests.
  - Bob Kalantari noted that consumers pay different amounts for nuclear generated electricity in different states (deregulated vs regulated markets distort market).
    - Mike agreed that there are challenges to current market structure – don't want to lose U.S. nuclear assets.

**11:15 – 11:30            Review Letter Regarding 110 Minor/Major Nuclear Component Category**

- Myron Kaczmarek
- Noted purpose of letter is to expedite review of license applications to China and other countries and opened floor to comments/questions.
  - Michelle Scott asked about purpose of letter - Myron noted purpose is not China specific – want to expedite Part 110 approvals to other countries. Michelle noted that if policy change is broader than China, than letter should note this specifically
  - Stephen Burdick noted his support for the letter and that letter should focus on China
  - Gary Wolski motion to approve letter – CINTAC approved letter.
- Gary Langlie (NRC) noted that interagency would have to review CINTAC's recommendation re if this could be resolved and how quickly.
- Stephen Burdick noted that letter not asking for rule change/NRC policy change – asking for carve out of minor equipment from China civil nuclear review since these items are less sensitive.

**11:30 – 11:45            De-brief of June 11 Congressional Briefing on Civil Nuclear Exports**

- David Blee & John Bendo

- David Blee gave overview of briefing – noted strong industry participation, 90 attendees (15 Hill attendees), received many favorable comments from members of House Energy and Commerce Committee.
- Noted pending bill that will delegate 810 authorizations from Secretary of Energy.
- Congressman Joe Johnson sponsored the event.
- John Bendo noted that he hoped the event moved the needle somewhat for industry.
- Lee Peddicord noted that future events like this would be useful.

#### IAEA U.S. Industry Program (USIP) Update (Hash Hashemian)

- Noted U.S. industry comments to DOC to improve event for U.S. companies.
- U.S.-centric side event with industry speakers to be held.
- More industry engagement at U.S. Pavilion
- Noted industry plans to organize Tuesday evening U.S. industry reception.
- USIP Program extended to 3 days

#### Industry Conference Update

- Mimi Limbach gave overview of Pacific Basin Nuclear Conference
- Vijay Sazawal noted conference in Mumbai October 9-10.

#### **12:15 – 1:15      Review CINTAC Scorecard**

- CINTAC members reviewed CINTAC Scorecard to determine which recommendations were implemented and which were not. Members discussed why specific recommendations may not have been implemented.

#### **1:15 – 2:00      Identify Lessons Learned & Best Practices from other DOC Advisory Committees**

- Vickie Gunderson, DFO, Renewable Energy & Energy Efficiency Advisory Committee (REEEAC)
- Cora Dickson, DFO, International Trade Advisory Committee on Energy and Energy Services (ITAC-6)
- Amy Kreps, DFO, Environmental Technologies Trade Advisory Committee (ETTAC)
- REEEAC Best Practices (Vickie Gunderson)
  - Challenge to get consensus advice from diverse group of companies.
  - REEEAC recommendations not unique to sectors covered in Committee – have applicability to other sectors.
  - Committee work does not always result in recommendations to Secretary – often their work informs USG actions in real time.
  - 60% of last REEEAC charter members were new (learning curve for committee).
- ETTAC Best Practices (Amy Kreps)
  - Gave overview of committee charter and activities - committee contains companies from emerging trends subsectors.
  - “Interagency boot camp” for new committee done at start of charter to make committee aware of the USG agencies involved in the sector.

- Committee developed 20 recommendations, has been around since 1994, track recommendations via tracking matrix.
- ITAC 6 (Energy & Energy Services) Best Practices (Cora Dickson)
  - 8 member committee – small – difficult to find balance across energy sectors.
  - ITACs handle sensitive information – members undergo background check.
  - Have closed meetings usually since receive USTR briefings with sensitive information on trade negotiations. Advisors can access proposed trade negotiation text. Committee recommendations are not public.
- Discussion/Q&A
  - Neil Numark asked how to deal with continuity between Administrations that have different views on issues.
    - Vickie Gunderson noted differences between what is portrayed in the media and reality - staff level work does not change significantly.
  - Gary Wolski asked if Committees ever provide combined recommendations to Secretary Ross.
    - Vickie, Amy and Cora noted that Committee recommendations are typically provided separately and that there could be better communication among DFOs to ensure coordination.
  - Devin Horne asked what worked and didn't work in each committee.
    - Amy noted that recommendation development process worked well – going through subcommittee process to draft recommendations for review by full committee. Worked to streamline process over last several charters. Noted that ad hoc working groups on specific sectors did not always work well.
    - Cora noted the challenge in writing letters that had consensus of all members.
    - Vickie noted challenge of DOC staff implementing recommendations when received en mass. REEAC did recommendations in real time - easier for DOC and interagency to implement them and get USG feedback. Challenges: losing members mid charter, not being able to bring designees from a representative's organization, DFOs not being able to draft letters or make substantive changes.
  - Devin Horne asked if subcommittees have received USG briefings or if briefings have been at full committee level. Vickie noted that they have done briefings for both full committee and subcommittees. Depends on the topic and level of interest by members.

**2:00 – 2:45**

**Identify Priorities for Future CINTAC Work**

- Gary Wolski asked members what next CINTAC should focus on. Each member noted their input.
- Omer Brown – noted importance of CSC.
- Seth Grae – get more DOC certification of trade events to increase visibility of U.S. industry at these events.
- Bob Kalantari – U.S. needs to stop China and Russia cooperation to dominate global market. U.S. needs to team with other countries to be stronger.

- Jarret Adams – U.S. needs a high-profile win to change the narrative and bring more people to U.S. cause. White Paper studies could be used more to help U.S. make arguments for specific policy actions.
- Lee Peddicord – noted well-regarded nature of U.S. universities and lack of U.S. promoting this capability (when other countries are noting their capabilities in this area). Asked DOC to review past 4 years of CINTAC activities/industry developments to see what might come up in next 4 years (in order to think ahead and have CINTAC ready to respond to future developments)
- John Bendo – suggested next CINTAC review past Committee recommendations to see status of implementation and track them.
- Brad Porlier – Saudi Arabia is deal of the decade – noted need for USG to help U.S. to win large nuclear power plant deal.
- Stephen Burdick – continued focus on export controls (get results of China policy evaluation), examine DOC export controls to see if improvements needed, financing improvements (OPIC, USAID).
- Colin Austin – maintain focus on strategic importance of nuclear, focus on DOC needs, avoid last minute asks of DOC in CINTAC recommendations, do concrete asks, maintain international subcommittee of CINTAC.
- Jeff Harper – Committee should follow up on Secretary Ross’s inquiries from March 15 meeting, bring in different guest speakers (perhaps some that are not supportive of nuclear).
- Eddie Guerra – better track how CINTAC letters had an impact (e.g. led to Executive Order, new bill), more work at subcommittee level to develop recommendations/letters (better define subcommittee responsibilities).
- Donald Hoffman – CINTAC asks need to be clear, USG implementation needs to be clear, better coordination between CINTAC and what other Administration groups are doing. Noted need to clarify value of CINTAC to suppliers. Suggested letter to Secretary to note what this charter did and what next charter should do.
- Hash Hashemian – ask USG to help U.S. industry financially (e.g. subsidies, financial support).
- Myron Kaczmarzky – suggested that DOC’s Civil Nuclear Top Markets Report include more on SMRs and isotope production. Keep Civil Nuclear 101 training for DOC/USG staff going – need to keep USG informed re latest in technologies and how U.S. can be competitive.
- Graham Cable – suggested USG make investments that will improve industry competitiveness; identify gaps in value chain and where industry should go; need to focus on Saudi Arabia and Middle East using U.S. tools in our toolkit – take Saudi Arabia lessons learned to identify what a successful U.S. model is to win deals.

**2:45 – 3:15                      Update on Jordan’s Civil Nuclear Power Development Plans**

- Dr. Kamal J. Araj, Vice Chairman, Commissioner for Nuclear Power Reactors, Jordan Atomic Energy Commission  
(PowerPoint Presentation given)



- Jordan is landlocked so not much room to site nuclear power plant (NPP), even at Aqabah. Jordan working to identify inland sites for a NPP.
- Jordan has serious energy problem – growing demand for energy, high dependency on imported fuels, lack of indigenous conventional fuel options.
- 450MW of oil shale under construction (Chinese finance, Estonian technology).
- Since 2009, Jordan has been discussing introduction of nuclear energy.
- 5MW research reactor in Jordan (from Korea’s KAERI).
- Since 2007, Jordan has had an independent nuclear regulator.
- \$300 million in grid investment needed to install 2,000MW of power.
- Jordan pursuing 2 parallel tracks: SMR and large NPP.
- Jordan doing lots of feasibility studies re where to site a SMR.
- Jordan has signed 14 nuclear cooperation agreements with other countries (no U.S.-Jordan 123 Agreement).
- Jordan has identified viable sites – Amra region for large NPP (have to pump water 60km to site) – use Palo Verde NPP in Arizona as model (inland NPP site) – wastewater for cooling.
- Discussion/Q&A
  - Russell Neely asked what lessons Jordan learned from building small research reactor that Jordan will apply to SMR building.
    - Dr. Araj noted that Jordan working to develop industrial policy re localization so there is more localization; will train staff in advance of building/operating SMR; operator needs to be ready and participate in commissioning stage; Jordan wants to participate in design review phase (regulator to regulator cooperation).
  - Seth Grae asked about the attitude of the population towards nuclear and if UAE developments have influenced public opinion
    - Dr. Araj noted that 67% of decision makers are supportive of nuclear; majority of population supportive of nuclear.
  - Lee Peddicord asked about grid connections in area
    - Dr. Araj noted that UAE not connected to Jordan, but that Jordan is connected to other nearby countries.
  - Bob Kalantari asked about Jordan’s financing needs.
    - Dr. Araj noted that EXIM Bank financing would be useful and that a financing package is needed.
  - Chris Colbert asked about the competitive price of electricity generation in Jordan
    - Dr. Araj noted that it is 8-9 cents per kw hour. LNG not a long term solution.
  - Eddie Guerra asked about the status on siting.
    - Dr. Araj noted that 3 sites have been identified.
- Bart Meroney, Senior Advisor in DOC/ITA’s Office of the Deputy Assistant Secretary for Manufacturing, thanked CINTAC for their service and the valuable recommendations they have provided to DOC.

**3:15 – 3:30**

**Public Comment Period**

- Jeff Merrifield (Pillsbury) comments
  - Suggested priorities for next CINTAC charter :
    - Look at international conferences and where U.S. industry can be engaged – do analysis of conferences to determine which ones are most useful.
    - Educate USG staff abroad on civil nuclear commerce.
    - Hill Briefing – get larger space next year, companies pay for food at event, video tape session for future dissemination, get CSPAN to cover.
    - U.S. companies should be more involved in Canada - \$20 billion worth of work underway in Ontario at Bruce and Darlington sites
    - Uranium 232 Investigation – 200 miners in U.S. impacted by uranium trade – tariffs on imported uranium could cause premature shutdown of U.S. NPPs and loss of hundreds of U.S. jobs.
    - “Introductory Bootcamp” for next CINTAC could be useful; subcommittees need to be established quickly.
    - DOE NEAC should meet with CINTAC to discuss areas of collaboration.
    - REEEAC White Paper format as model for CINTAC White Papers.
- Jay Cramer Comments
  - Noted that issues industry is dealing with now are the same ones that have existed for decades.
  - Noted importance of the Committee’s work.

**3:30 – 3:45                    Closing remarks from CINTAC Chair and Vice Chair**

- Devin Horne thanked members for their service
- Gary Wolski and Chris Colbert thanked everyone for their work.

**3:45    Meeting adjourned**

ATTENDEES

<b>CINTAC Members</b>		
<b>Name</b>	<b>Title</b>	<b>Organization</b>
Larry Sanders	President	Accelerant Technologies
H.M Hashemian	President and CEO	Analysis and Measurement Services Corporation
Craig Piercy	ANS Washington Representative	American Nuclear Society

John Bendo	Nuclear Energy Business Manager	American Society of Mechanical Engineers
Colleen Deegan	Vice President	Bechtel Corporation
Ken Camplin	Vice President and Chief Business Development Officer	BWX Technologies
Michael Whitehurst	Director, Business Development	Centrus Energy Corporation
Omer Brown, II	Attorney-at-Law and Legal Counsel	Contractors International Group on Nuclear Liability, Contractors International Group on Nuclear Liability
Gary Wolski	Vice President, Nuclear Division	Curtiss-Wright
Russell Neely	Chief Operating Officer	Edlow International Company
Colin Austin	Vice President of International Business	EnergySolutions
Robert Kalantari	President and CEO	Engineering, Planning and Management
Donald Hoffman	President & CEO	Excel Services Corporation
Ralph Hunter	VP and COO	Exelon Nuclear Partners
Woody Lawman	Director of Sales, Navy and Nuclear Products	Flowserve Limatorque
David Jonas	Partner	Fluet, Huber + Hoang
Brad Porlier	Vice President, Sales and Nuclear Power	Fluor Enterprises
Jarret Adams	CEO	Full On Communications
David Sledzik	Senior Vice President, Sales & Commercial Operations,	GE Hitachi Nuclear Energy

	Nuclear Plant Projects	
Myron Kaczmarzsky	Senior Director of Sales	Holtec International
Vijay Sazawal	Global Civil Nuclear Trade Consultant	International Atomic Energy Consulting
Seth Grae	President & CEO	Lightbridge Corporation
Stephen Burdick	Partner	Morgan, Lewis & Bockius
Dan Lipman	Vice President, Suppliers and International Programs	Nuclear Energy Institute
Lee Peddicord	Director, Nuclear Power Institute	Texas A&M University
Neil Numark	President	NUMARK Associates
Christopher Colbert	Chief Strategy Officer	NuScale Power
Scott Singer	Vice President, Chief Security and Information Officer	PAR Systems
Mimi Limbach	Managing Partner and President	Potomac Communications Group
Eddie Guerra	Senior Structural Engineer	Rizzo Associates
Eric Rasmussen	Director of Engineering and Asia Sales	RSCC Wire and Cable
David Blee	Executive Director	United States Nuclear Infrastructure Council
Thomas Dolan	Adjunct Professor	University of Illinois at Urbana-Champaign
Graham Cable	Vice President, Global Market Development, New Plants & Major Projects	Westinghouse Electric Company
Tyson Smith	Partner	Winston & Strawn LLP

Jeffrey Harper	Vice President, Strategy and Business Development	X Energy
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<b>U.S. Government</b>		
<b>Name</b>	<b>Title</b>	<b>Organization</b>
Bart Meroney	Senior Advisor, Office of the Deputy Assistant Secretary for Manufacturing	U.S. Department of Commerce
Jonathan Chesebro	Senior Nuclear Trade Specialist	U.S. Department of Commerce
Devin Horne	Civil Nuclear Trade Specialist	U.S. Department of Commerce
Cameron Dorsey	Regional Manager, Advocacy Center	U.S. Department of Commerce
Michelle Scott	Senior Advisor, Office of Nuclear Energy	U.S. Department of Energy
Mike Goff	Director	Office of Science and Technology Policy
Kirsten Cutler, Ph.D	Foreign Affairs Officer, Office of Nuclear Energy, Safety and Security	U.S. Department of State
Alex Burkart, Ph.D	Senior Level Advisor for Nuclear Energy, Bureau of International Security and Nonproliferation	U.S. Department of State
Art Kron	Negotiations and Liaison Policy	Defense Technology Security Administration, Office of the Under Secretary of Defense for Policy

\*\*\*NOTE: not all USG participants attended the entire meeting\*\*\*

<b>Members of the Public</b>		
<b>Name</b>	<b>Title</b>	<b>Organization</b>
Jeffrey Merrifield	Partner	Pillsbury
Jay Kraemer	Attorney	Fried, Frank, Harris, Shriver, & Jacobson LLP (retired)

ATTACHMENTS



# China Nuclear Briefing To CINTAC

*July 19, 2018*



# Key China Industry Themes for 2018

- Restart in FCDs, approvals expected following AP1000 commercial operation (Q4)
- Inland plants still not expected to FCD until at least 2020 (14<sup>th</sup> FYP)
- Mergers and restructuring to continue (CNCC and CNEC merger passed domestic anti-trust review last week)
- Electricity demand in Northeast China weak – future uncertain for plants in this region

# China Build Snapshot July 2018

- Operational – 41 reactors (38.5 GWe)
- Under Construction – 17 reactors (17 GWe)
- Awaiting FCD in 2018/2019– ~10 reactors
- AP1000s approaching finish line in 2018 - 4
- ‘Hualong Ones’ at Fuqing and Fangchenggang still on track for 2020-2021 start-up -4
- 4<sup>th</sup> Gen plays in various states of maturity (HTGR and SFR furthest along)

# China CAP1000 Build Forecast

- Sanmen & Haiyang (*san-mun & high-yahng*)
  - Fuel loading & grid connection thru Q3/Q4 2018
- Next wave of CAP1000 FCDs:
  - Xudapu (*shyoo-dah-poo*)
  - Lufeng (*loo-fuhng*)
  - Haixing (*high-shing*)
  - Sanmen Phase 2 (Units 3-4)
  - Haiyang Phase 2 (Units 3-4)
  - Also CAP1400s at Shidaowan

# Shake-ups to AP1000 sites

- Xudapu 3-4 re-designated as VVERs (2018)
- Zhangzhou 1-4 re-designated as HPRs (2017)
- Taipingling 1-2 re-designated as HPRs (2017)
- Bailong 3-6 re-designated as CAP1400s (2018)
- More...?
  - Difficult to meet built targets *and* stick to demonstration plant model, so AP1000s likely to remain strongly in the FCD mix until at least the completion of HPR demo plants
  - SPIC's progress on CAP1400 demo plant also key
  - Some AP1000 builds still potentially at risk

# Opportunities for US Suppliers

- Operating Reactor Fleet
  - Services (where Chinese firms have incomplete experience coverage)
  - Spare parts for previously imported equipment
- New CAP1000 builds
  - For equipment providers willing to explore localization, yes
- Hualong One
  - As sub components for Chinese suppliers
- Advanced Reactors
  - Very limited opportunities due to sensitive tech – case specific
- China Export Builds
  - For services and equipment providers willing to explore partnerships with a Chinese company, yes

# USA Part 810 Export Control

- Chinese firms increasingly hesitant to work with American firms due to delay concerns over Part 810 Export Control
- CGN contact: *“Honestly, we are not so willing to work with American companies. Every time [we try], they start going on about ‘export control’ or ‘national security’...the USA is very strong but doesn’t have an absolute advantage...we could do it ourselves, or work with the French. Why must it be with the USA?”* (translated, excerpted)
- SPIC contact: *“We will definitely take extra considerations for timeframe and feasibility when working with American companies [due to Export Control]. This probably has a negative impact on their business...”* (translated, excerpted)

# China Nuclear Challenges & Best Practices

- IP risk and demand to localize
  - Have a “dealing with localization requirements” game plan prepared, or risk forced localization that’s *not* on your terms
  - Create and rigorously enforce an internal China IP protection plan (and use lawyers with China experience!)
- Chinese business and SOE culture
  - Get informed in advance and establish internal expectations accordingly
- Part 810 Export Control considerations
  - Talk to the DOE early and be clear on your situation in advance – inform the Chinese customer as soon as possible

# Commentary on the Role of the USG

- US nuclear firms could use more USG support to grow technology exports to fast-growing Chinese market:
  - Revisit 810 export control process for China – current process unwieldy, overly restrictive and harmful to US business interests and US worldwide leadership role in civil nuclear power
  - Increase support for China trade show and exhibition coverage
  - Increase support for trade mission/reverse trade mission efforts (can tie into trade shows)
  - Support and participate in the development of US – China nuclear energy cooperation working group
    - *Currently soliciting comments and ideas from CINTAC members*



# Inquiries

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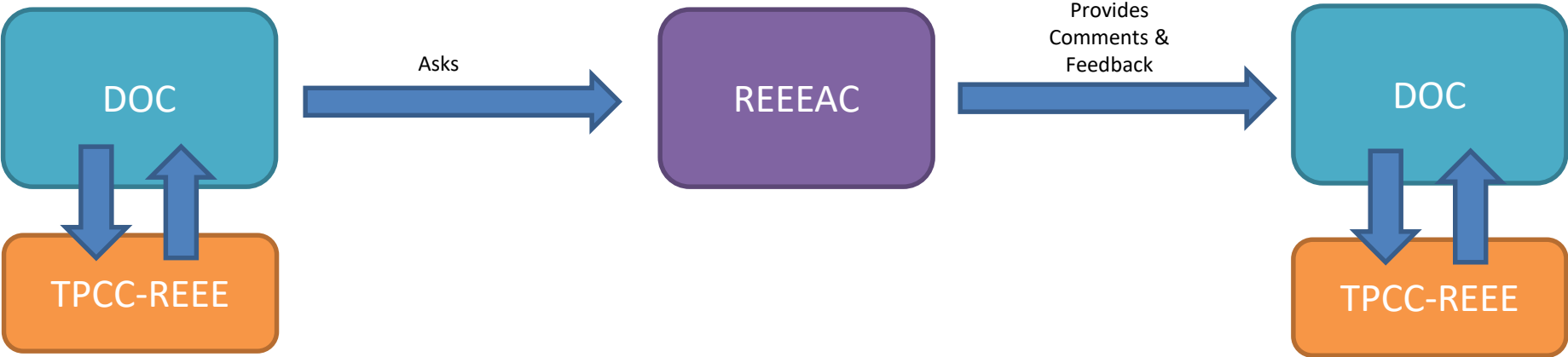
# Renewable Energy and Energy Efficiency Advisory Committee (REEEAC) Scope

		Sector Role				
		Manufacturer	Service Provider	Consulting/ Legal	Financier/ Investor	Developer
Renewable Energy	Bioenergy					
	Biofuels					
	Geothermal					
	Hydropower					
	Solar					
	Wind					
Energy Efficiency	Energy Storage					
	Power Systems EE					
	Smart Grid					

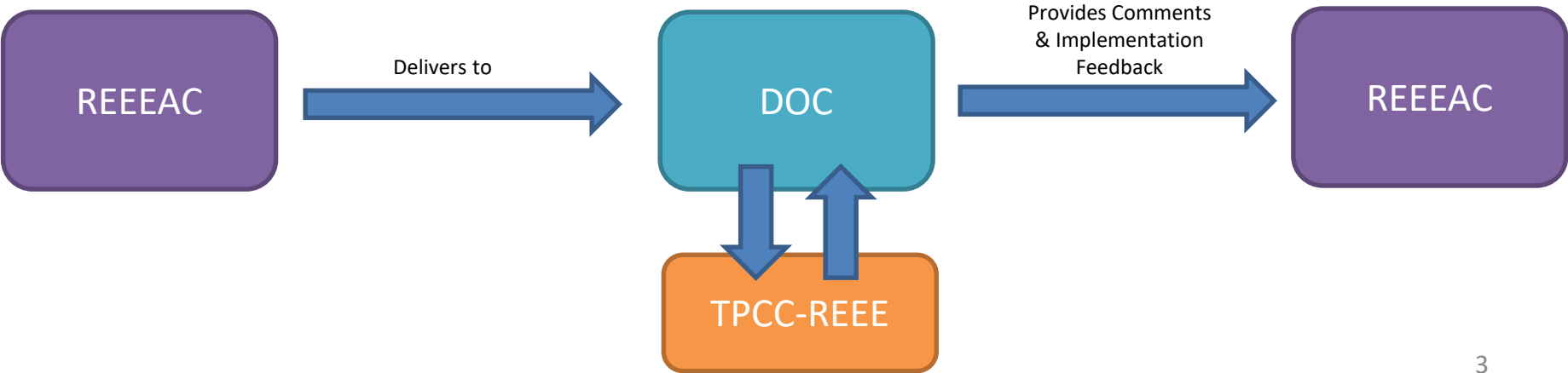
- **The primary Committee output is a series of discrete recommendations delivered to the Secretary of Commerce**
- **The REEEAC has made 44 recommendations over three charters:**
  - REEEAC I, 2010-2012: 22 Recommendations
  - REEEAC II, 2012-2014: 16 Recommendations
  - REEEAC III, 2014-2016: 6 Recommendations
  - REEEAC IV, 2016-2018: 12 Recommendations
- **Recommendations were drafted by Sub-Committees, then Presented on and Approved by Full Committee**
- **Some recommendations were supported by letters addressed to the Secretary**

# REEEAC WORKFLOWS

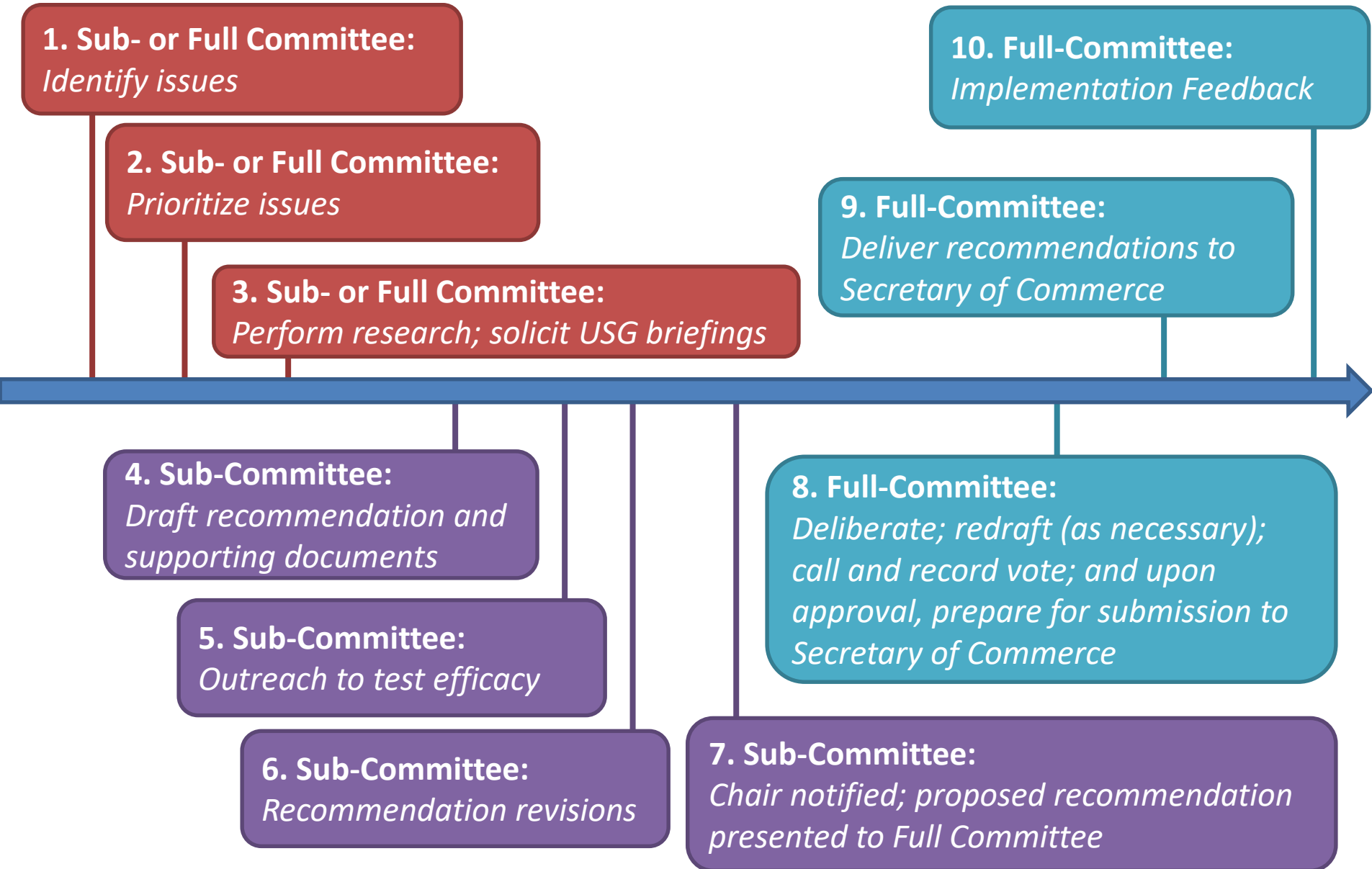
## 1. DOC Seeks Specific Policy and Programmatic Guidance



## 2. Committee Brings Issues to DOC Attention



## REEEAC Recommendation: Sample Process



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# Jordan's Nuclear Power Programme

*Briefing to:*

**Civil Nuclear Trade Advisory Committee  
Department of Commerce**

**Thursday, July 19, 2018**

Dr. Kamal ARAJ, Vice Chairman  
Jordan Atomic Energy Commission



# Jordan's Country Profile



- Total Area: 89,213 Km<sup>2</sup>
- Sea Port: Aqaba
- Coastline: 26 Km
- Population: 9.456 million (2016)\*  
60% (15- 64)  
35% (below 15)
- Climate: Mediterranean & Arid Desert
- GDP: \$38.65 billion (2016)\*
- Per Capita: \$4,087 (2016)\*
- GDP Growth: 2.0% (2016)\*
- GDP Growth: 2.6%<sup>f</sup> (2017-2019)\*

\* WORLD BANK

<sup>f</sup> WORLD BANK - Forecasted

# Jordan Energy Problem

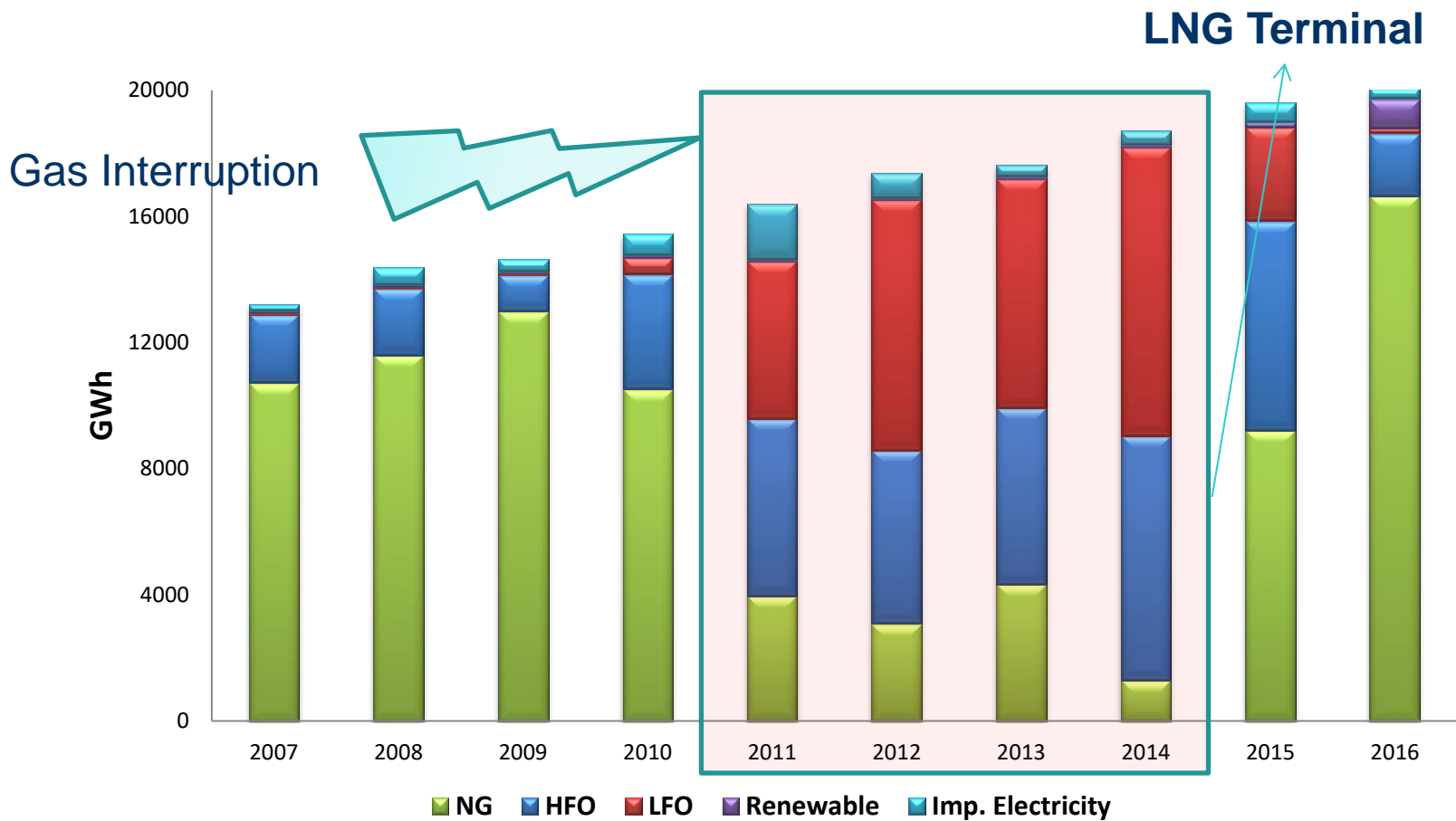
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- ❑ Growing demand for energy
  - Primary energy
  - Electricity
  - Desalination
  
- ❑ Need for reliable and affordable base load power
  
- ❑ High dependency on imported fuels
  - High and volatile prices
  - Insecurity of supply
  
- ❑ Lack of indigenous conventional fuel options



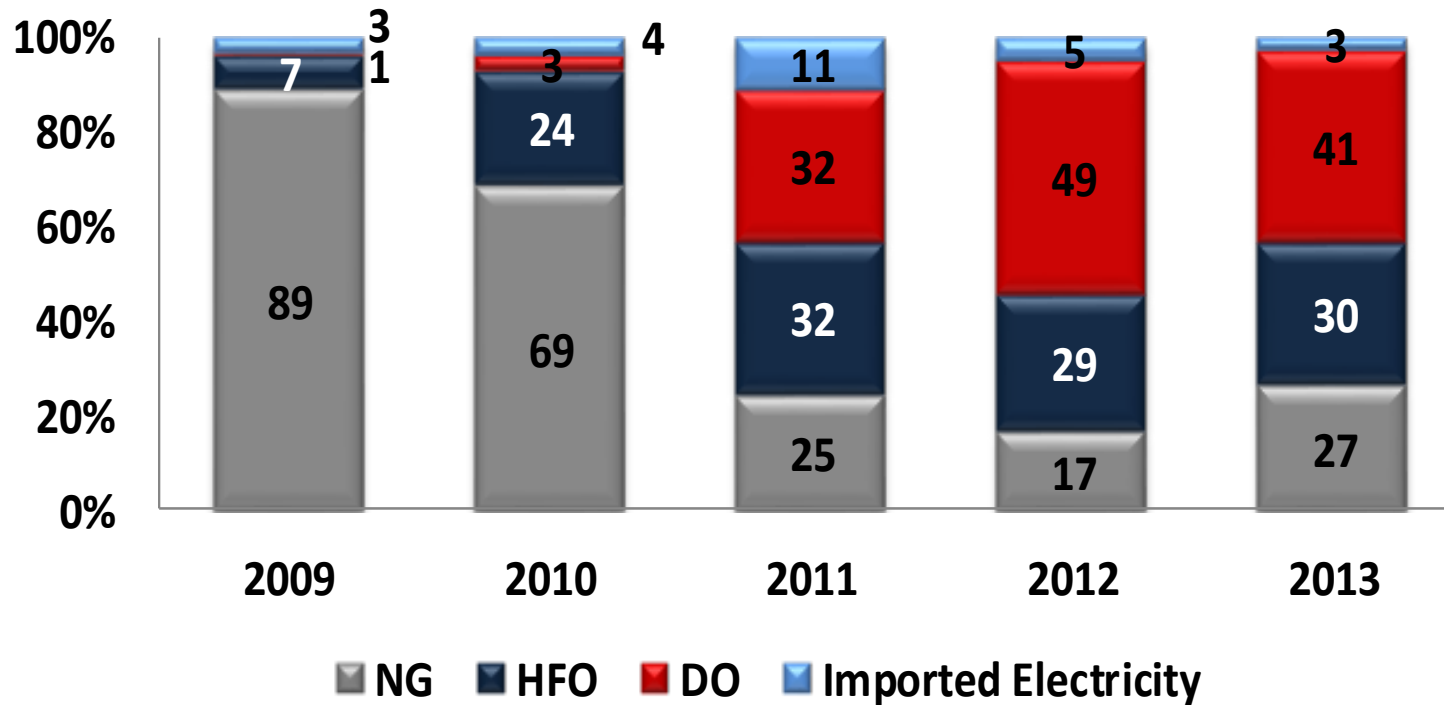


# Generated Electricity by Fuel

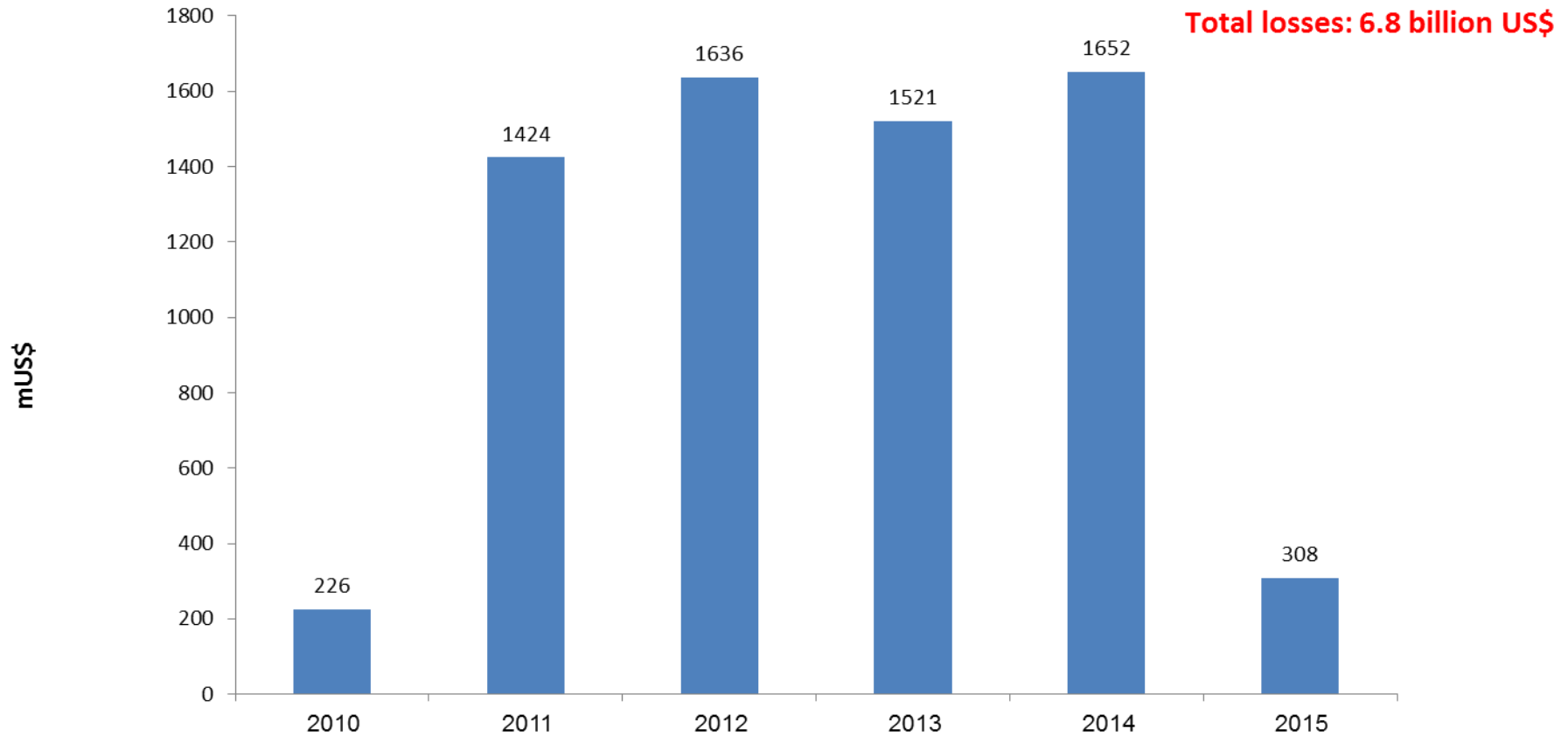


# Jordan's Power System

*Electricity generation by fuel type:*



# Direct Losses due to Natural Gas Interruptions



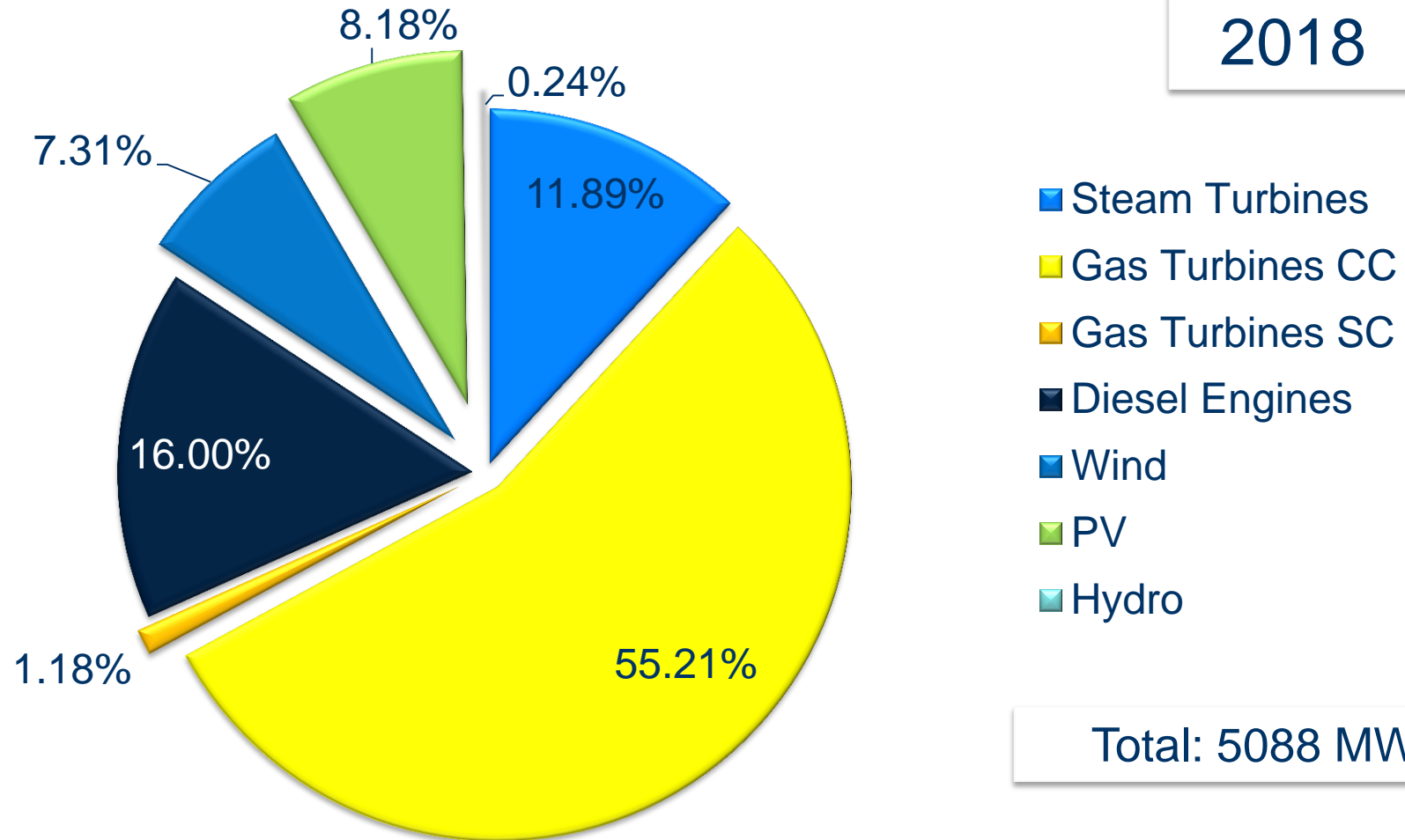
# Jordan's Energy Options

- Available energy options are limited:
  - ❑ Natural Gas:
    - A short term option
    - Not a reliable energy source for medium and long terms
    - Cost is subject to market volatilities
  - ❑ Renewable Technologies:
    - Limited utilization
    - Cannot be a base load option
  - ❑ Oil Shale:
    - Only a limited medium-term option
    - Reserved for special uses
    - Not an environmentally friendly option
  - ❑ Nuclear Energy

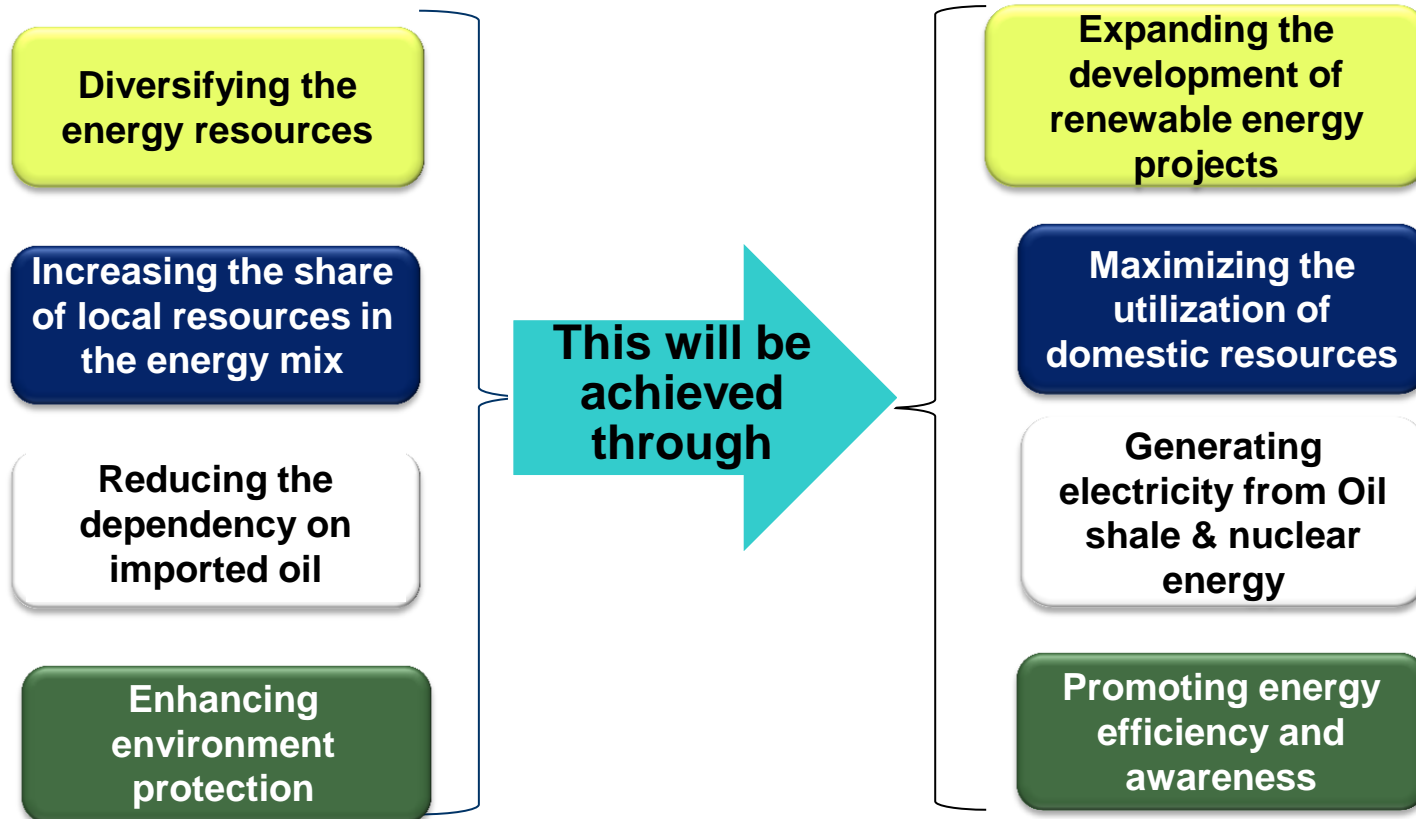


# Generating Plants Capacity [MW]

2018



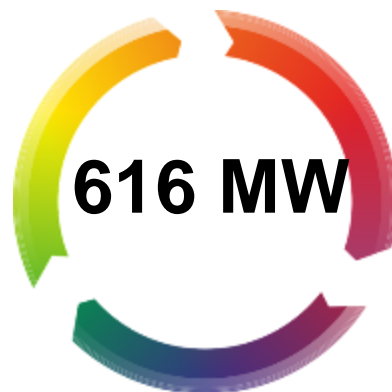
# Energy Strategy Main Goals



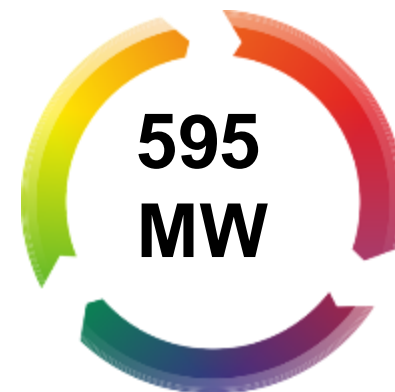
# Renewable Projects in Jordan



Total Operational



Total Under Construction

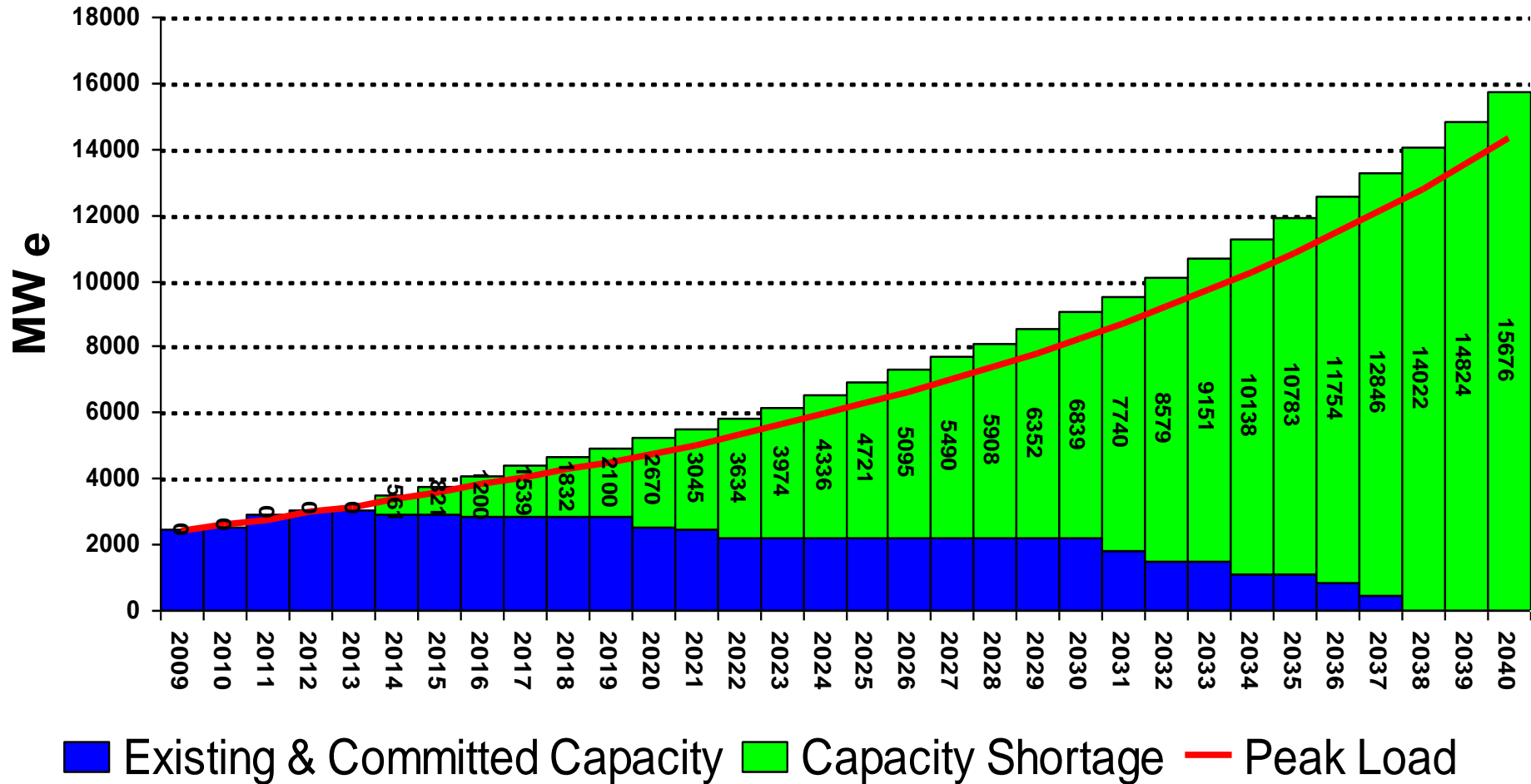


Total Under Financial Closure



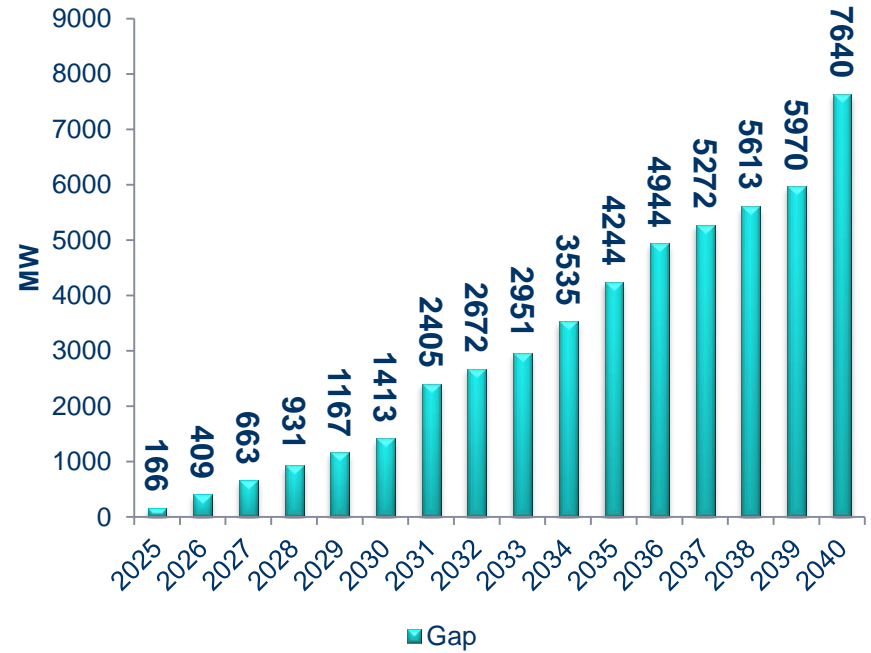
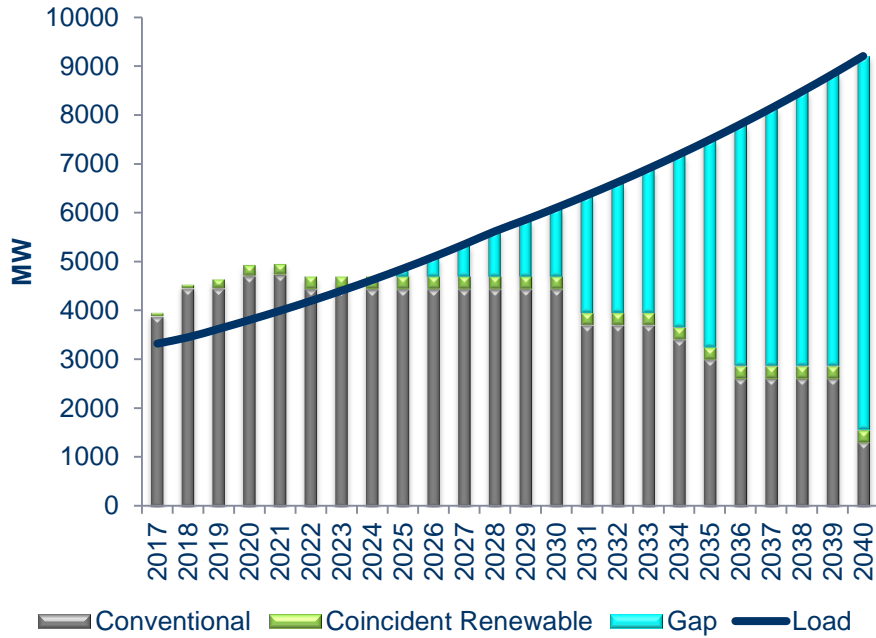
Total Capacity: 1755 MW

# Available and Committed Capacities versus the Electricity Median Load Forecast (OLD)

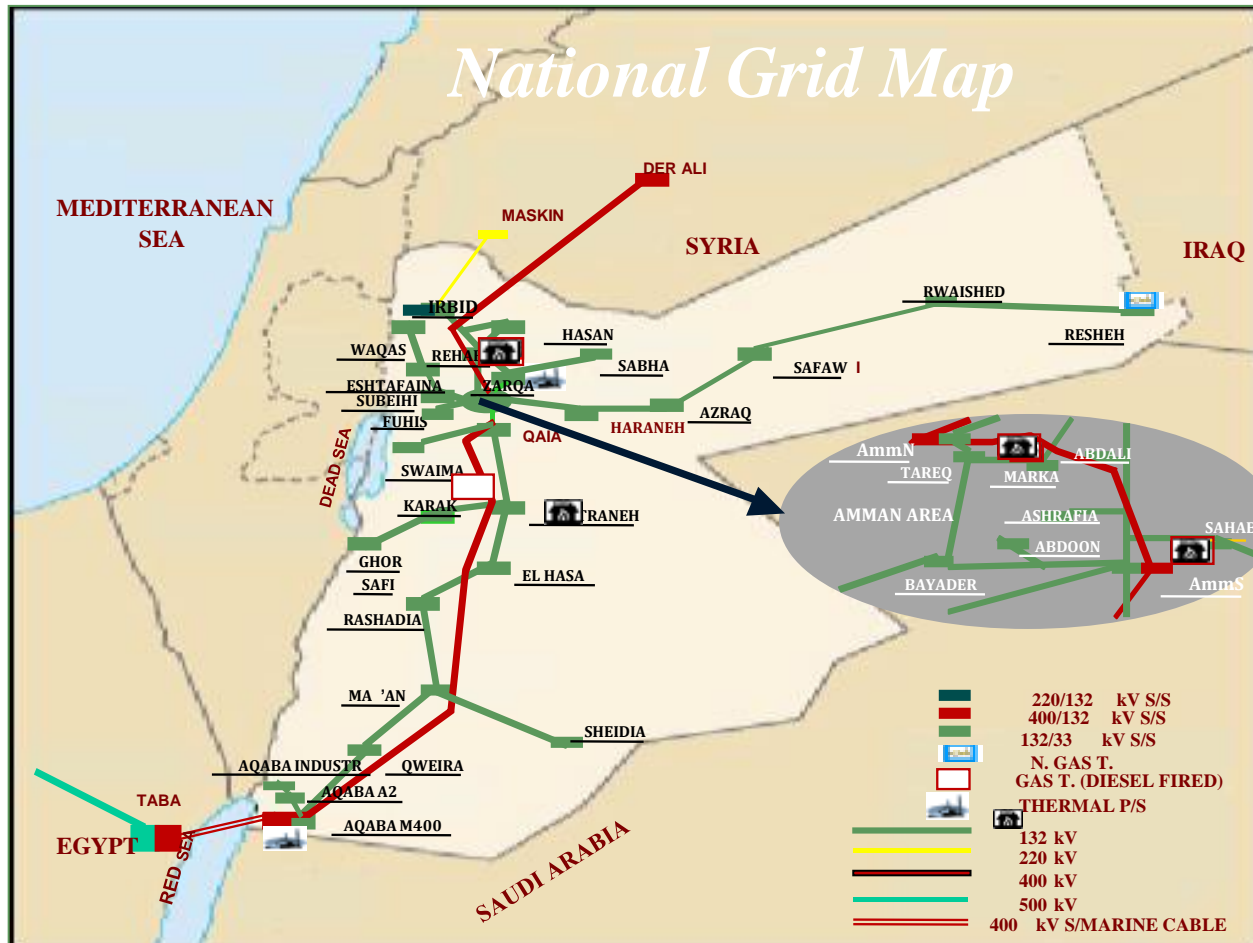




# Jordan Power Balance (2017-2040) [updated]



# Regional Interconnection



# Jordan Nuclear Strategy

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Pursue two parallel tracks:

- A. Small Modular Reactor
- B. Large Nuclear Reactor



# Two Parallel Paths

## Large Reactor (1000 Mwe)

Start direct negotiations with interested vendors on the feasibility of construction of 1000 MWe PWR on BOT/BOOT basis.

## SMR

Continue technical & economic assessment to down-select to the most viable and suitable SMR options.

Conduct detailed feasibility studies on the short-listed SMRs.

# Challenges



# Bilateral & Multilateral Cooperation

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- Signed Nuclear Cooperation Agreements with France, China, Russia, UK, South Korea, Canada , Argentina, Spain, Japan, Romania, Italy, Turkey, Czech Rep., Armenia, and Saudi Arabia.
- Global Nuclear Energy Partnership, member since September 16, 2016 transformed to International Framework for Nuclear Energy Cooperation.
- Global Threat Reduction Initiative.
- Partnership for Nuclear Security.



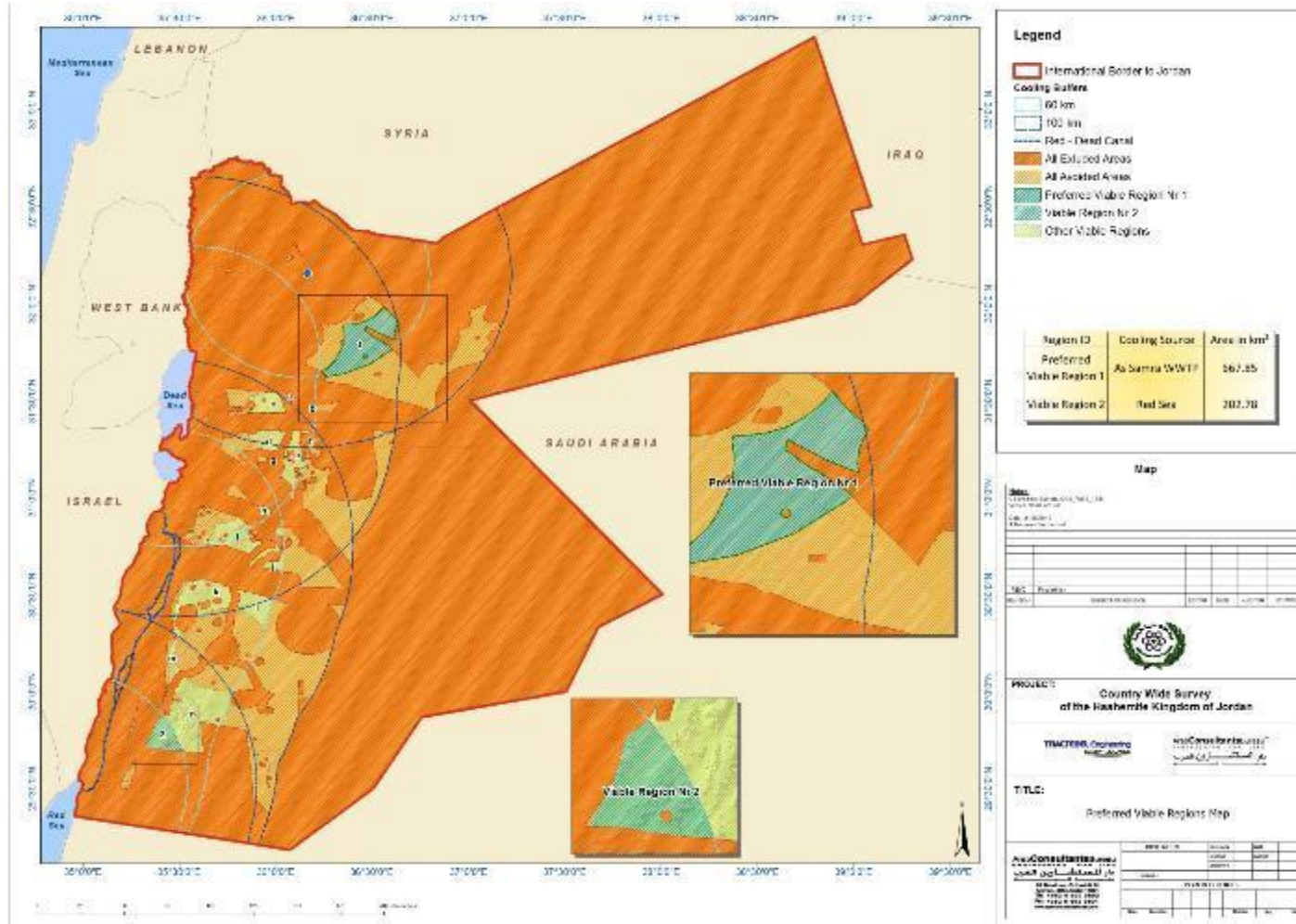
# Financing Challenges for Jordan in Particular

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- Scale of the investment relative to Jordan's GDP.
- Limited Government financing available – unlike many other Arab countries.
- Jordan's credit rating and IMF restrictions are hurdles for financing and ability to provide sovereign guarantees (which are likely to be required).
- First nuclear power plant – no track record of construction or operation.
- Regional issues.



# Post-Fukushima Viable Site Regions





# Amra Region



# Palo Verde Inland NPP Site – Arizona, USA

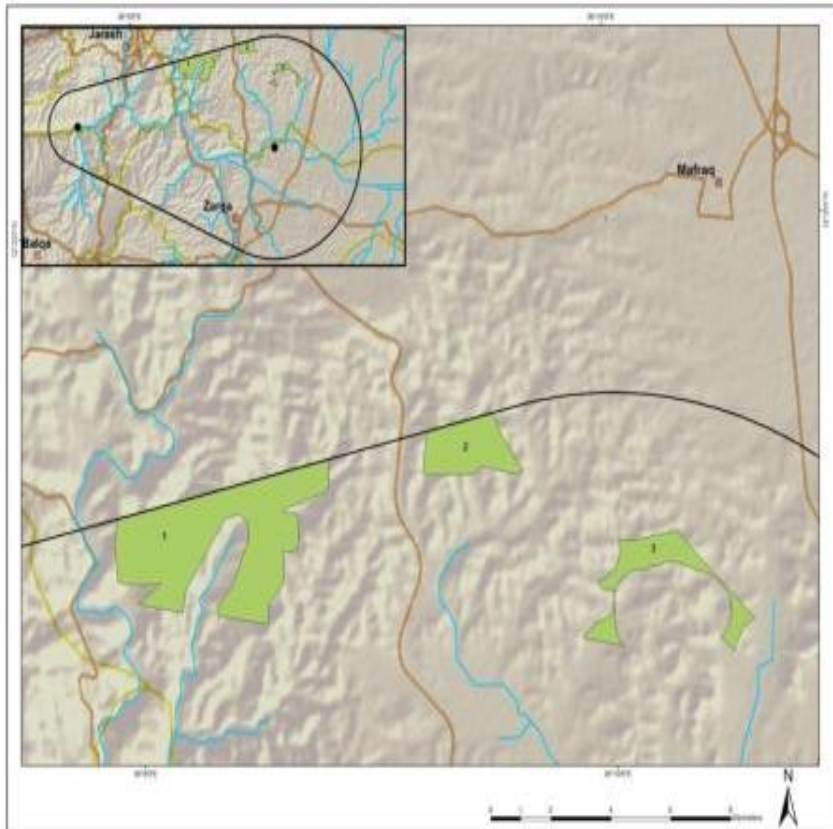
Example of inland NPP using wastewater for cooling



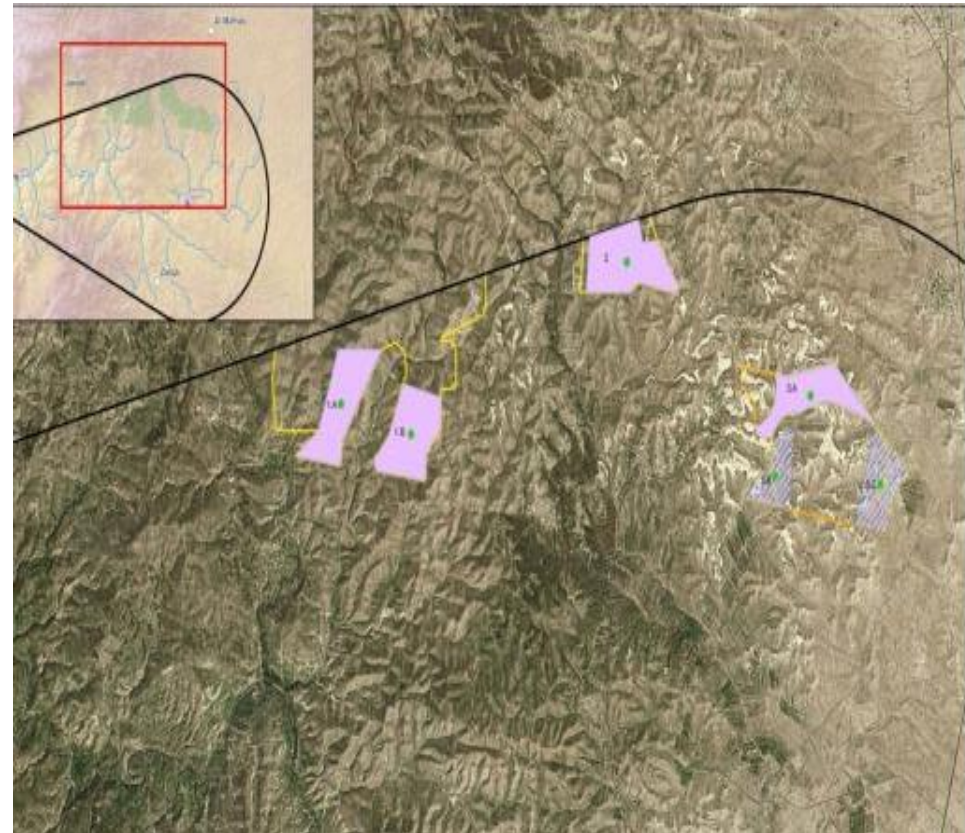


# Candidate Areas & Sites for Majdal

3 Candidate Areas



6 Candidate Sites



# Aqaba North (Region 2)



# NPP Sites Comparison

Discipline		Geosciences			Cooling		EHIH	Flooding	Borders	Information
Criteria/Attributes		OBE (g)	SSE (g)	Land Topography	Pipe Length (km)	Pumping Power (Mwe)	Stationary and Mobile Sources		Distance to Border (km)	
Selected Sites	Aqaba North (Region 2)			variable	~2 from Disi ; 40 from Aqaba	7 from Aqaba			>40	
	Majdal	0.10	0.28	Undulating	10.5	≤5			< 32	
	Amra	0.04	0.13	Flat	72	5-10			> 32	



# SMR Direction

---

- ❑ JAEC has been considering SMRs and their potential in Jordan in various capacities since 2011.
- ❑ The advantages of SMRs are many for Jordan but it has always been the maturity of the technologies for deployment, and constructability at a competitive price that were the hindering factors.
- ❑ In deciding to proceed forth today, JAEC took into consideration many factors that are bespoke to SMR.





# Why SMRs? Technical

- Because of their small size and modularity, SMRs could almost be completely built in a controlled factory setting and installed module by module. This improves the level of construction quality and efficiency, thus mitigating some of the construction risks typically associated with large reactors.
- Their small size and passive safety features lend them to countries with smaller electricity grids and less experience with nuclear power.
- Potential for sub-grade (underground) location of the reactor unit providing more protection from natural (e.g. seismic earthquakes or tsunami according to the location) or man-made (e.g. aircraft impact) hazards.
- The compact architecture enables modularity of fabrication (in-factory), which facilitates implementation of higher quality standards.
- The modular design and small size support having multiple units on the same site.
- Ability to remove reactor module or in-situ decommissioning at the end of the lifetime.
- Lower requirement for access to cooling water – therefore suitable for remote regions and for specific applications such as mining or desalination.



# Why SMRs? Economics

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- Achieving 'economies of scale' for a specific SMR design will reduce costs further. Most SMRs are designed with series production in mind.
- Size, construction time, and efficiency along with passive safety systems (requiring less redundancy) lead to smaller investment requirement for SMRs compared to that of large nuclear. In turn, procuring the funding and financing for these projects should in turn be easier or a less complex process.
- From commitment of Equity to Commissioning, SMRs require a shorter time to construct. This is a more attractive proposal for investors.





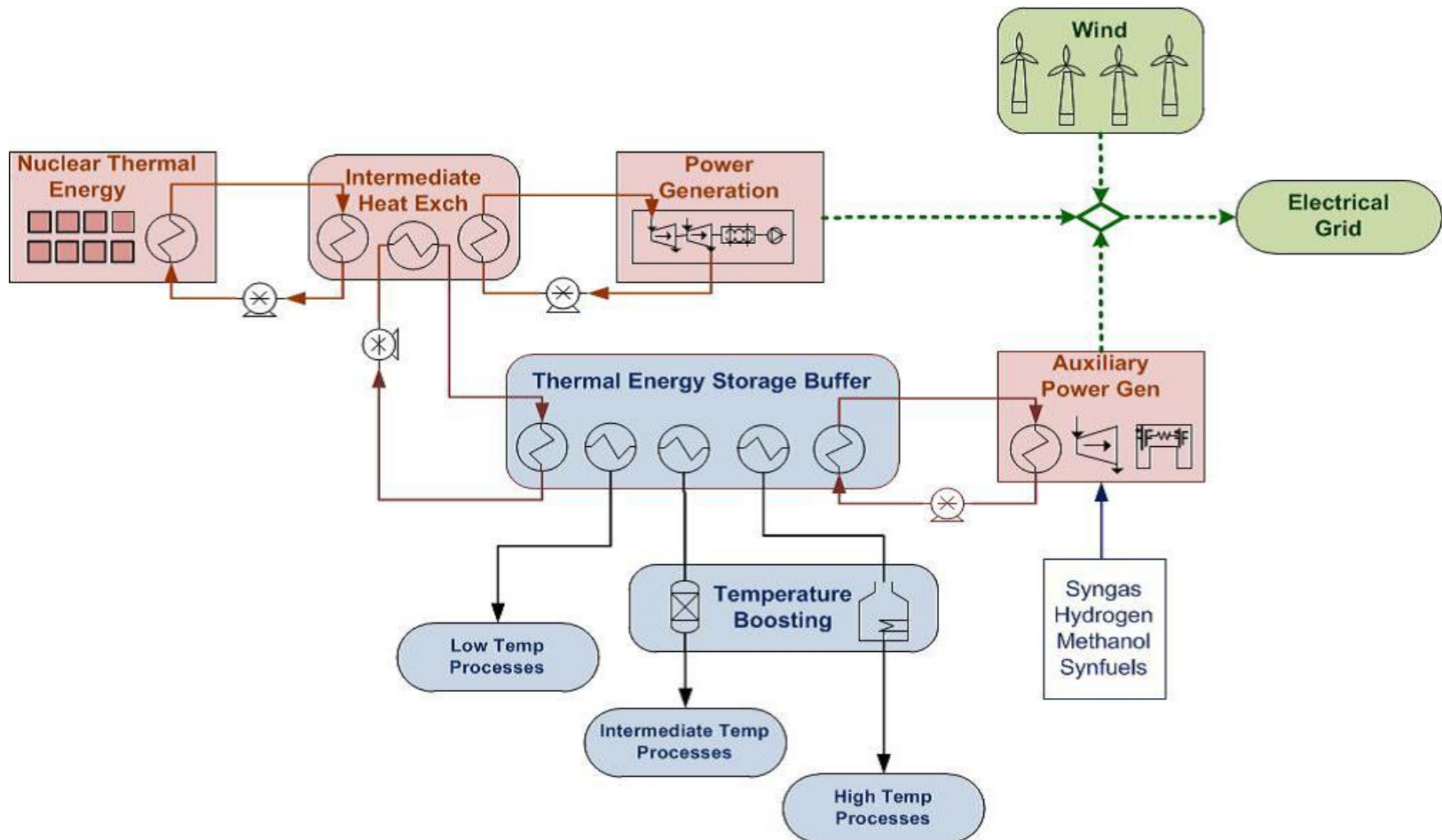
# N-R Synergy Pathway in Jordan

---

- Current technologies might suffice in creating the allure and basic foundation for this synergy, but for a small market like Jordan, inter-regional N-R Synergies might work with evolving technologies upon their successful deployment. These will include SMRs, Smart Grids, etc. These might be an integral part of the solution.
- To solve Jordan's problem, centralized large generation or desalination/treatment systems might not be as optimal as smaller and strategically located ones that work within a N-R System.
- The issue facing Jordan, is that any solution that needs to be deployed has to make sense financially and carry as little risk as possible.



# Jordan should explore Hybrid System



# Applications of Interest for SMRs

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- Replace aging fossil plants.
- Can be located close to population areas.
- In-land away from water sources.
- Mid to high seismicity
- Cogeneration of heat & electricity.
- Water and Air Cooled Condensers
- Island Mode and Load following Capabilities
- Preferably underground design with all safety systems underground.



# Jordan Requirements

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- GIII+ or better technology
- Demonstrated safety level with passive safety features
- Grid compatibility
- To be deployable in 2026-30 time frame as Nth of a kind
- Added advantage for ability for co-generation, process heat, etc.
- Reduced water make-up per MWe
- Limited EPZ to site boundary
- Possibility of dry cooling
- Design to withstand 0.3 g or greater
- Enhanced protection against external hazards
- Tariff to off taker competitive with average generation price
- Transportability (for in-land sites)



# Jordan Technical Requirements

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- ❑ SMR design shall ensure the fundamental safety functions:
  - Control of the reactivity
  - Heat removal
  - Confinement / No radioactive releases
  
- ❑ The SMR design shall be such that its sensitivity to Postulated Initiating Events is minimized with no severe accidents.
  
- ❑ To ensure that the overall safety concept of defense in depth is maintained in all circumstances.



# Jordan Technical Requirements (2)

---

- ❑ Appropriate measures against the effects of single failure or common cause failures shall be taken as far as practicable in SMR plant design:
  - Redundancy
  - Diversity
  - Independence (through functional isolation or physical separation)
  
- ❑ The SMR designs shall incorporate the lessons learnt from Fukushima accident.
  
- ❑ An advanced digital I&C technology (no common cause failure between the different I&C for each module).



# Jordan Technical Requirements (3)

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- ❑ Safety goals
  - Core damage frequency (CDF) and large early release frequency (LERF) of SMR shall be lower than the best GIII+ large NPP.
  - The grace period of SMR plant shall be higher than the best GIII+ large NPP.
  
- ❑ Fuel supply security
  - A nuclear fuel procurement on the competitive open market.



# Jordan Technical Requirements (4)

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- ❑ Aircraft impact resistance
  - The design shall meet Jordan's requirement for the plant to be designed to ensure the safety of the plant in the event of a large commercial airplane crash.
  
- ❑ Proven Design and licensibility
  - Preferred internationally certified SMR design for commercial deployment and generic design approval.





# Site Considerations

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➤ **Seismicity**

The design shall withstand high seismicity level, to 0.3-0.5

➤ **Cooling water**

The design shall minimize usage of water and has the option of dry cooling

➤ **Meteorology and Environment**

The design shall minimize the influence on the environment and ecology, example; minimizing the construction work and site preparation activities

➤ **Population**

The design shall have small EPZ (limited to site boundary)

➤ **External Hazards**

The design shall withstand individual and combination of external hazards associated with the site. (Underground option is a plus).

# Technology Assessment (1)

---

- ❑ Preliminary Assessment of different SMR technologies is being conducted and in two main phases.
- ❑ The first phase will be the generic assessment phase with the aim of down-selecting the most advanced and competitive technologies that are deployable and viable in Jordan.
- ❑ Suitable technologies that are potentially viable for Jordan will be assessed in this phase.



# Technology Assessment (2)

---

- ❑ To be able to make a proper assessment and therefore, down-selection, the first phase will entail exchange of information with the Technology Providers.
- ❑ This information will be matched to a initial assessment criteria matrix.
- ❑ The next phase will be the preparation of a Feasibility Studies (FS) based on the short-listed technologies or issuance of BIS.
- ❑ As per the results of the Assessment or FSs, a Justification of Investment analysis will be made to proceed forward with the selected SMR.



# Methodology (1)

- To achieve the purpose of the tasks at hand, the works will be following the following steps:
  1. Generic technology data collection **(completed)**
  2. General assumptions and criteria **(completed)**
  3. Viable technology selection for Jordan **(completed)**
  4. Detailed vendor sourced data collection **(in progress)**
  5. Assessment of different SMR technologies **(in progress)**
  6. Information verification with Technology Providers **(in progress)**
  7. Technical/Economic assessment for technologies
  8. Selection of shortlisted technologies
  9. Issuance of BIS or commencing on detailed technical/economic analysis for the purpose of FS preparation
  10. Preparation of report containing analysis and results for the Justification of Investment.



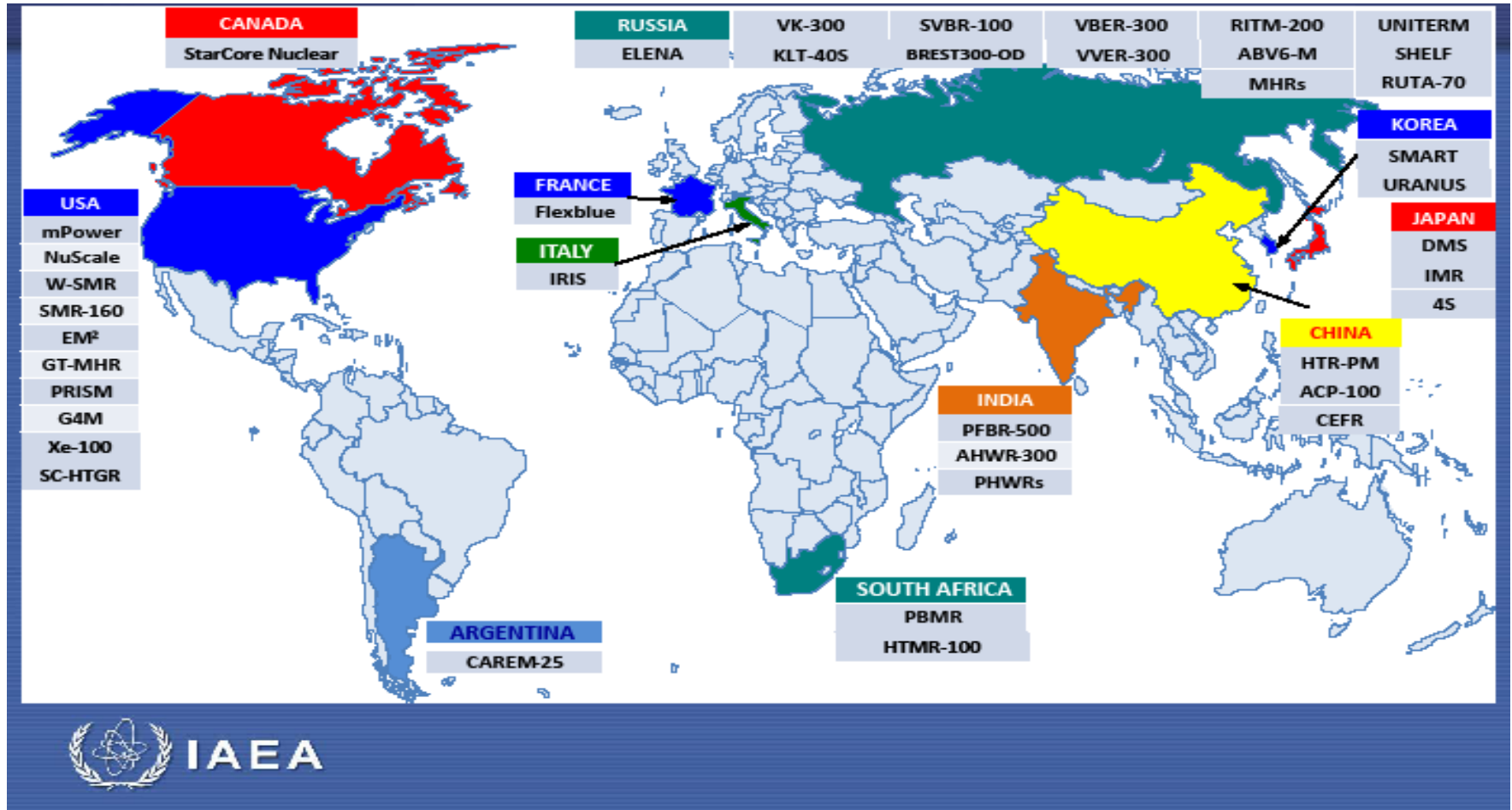
# Data Collection (1)

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- There are currently many SMRs being developed worldwide and in various stages (some are still on drawing board while few are under construction).
- JAEC's interest is the SMR's that are either:
  - **immediate deployment** and
  - **Near term deployment**
- In the assessment, we will only consider technologies that fall under **immediate and near term deployment** (deployment by 2025-2030).
- The selection of the technologies, data collected, and discussions with vendors will be focusing on the SMRs which will be deployed by 2025-2030.



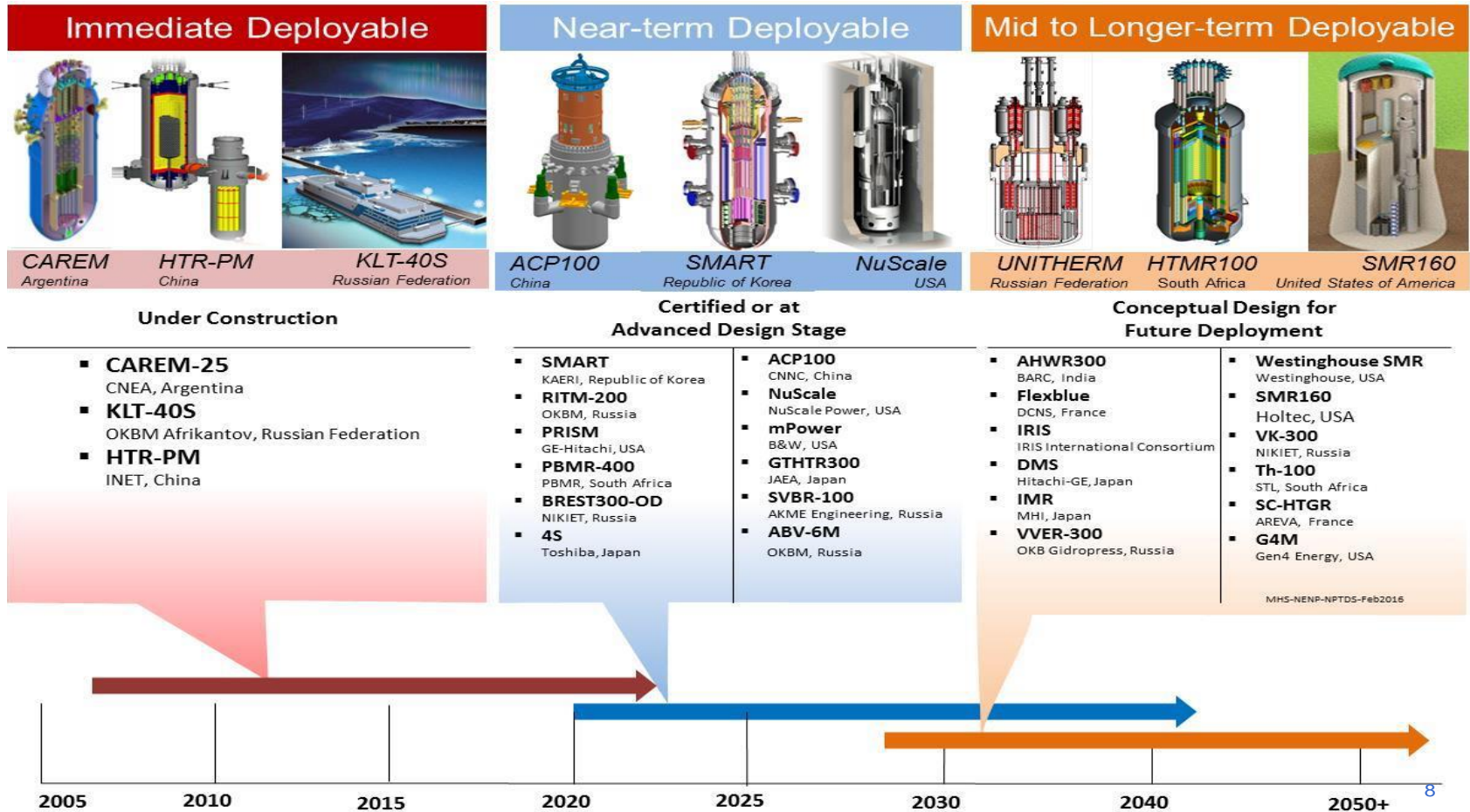
# Map of Global SMR Technology Development



# SMRs status worldwide



## SMRs Estimated Timeline of Deployment



# Data Collection (2)

- In effect, there are a multitude of reactors (around 15), matching our criteria some of which are at an advanced licensing stage. Included in the list are Light Water Reactors (LWR) & Gas Cooled Reactors (GCR).

Immediate ( before 2020)			Near term ( before 2030)		
<b>CAREM</b>	CNEA, Argentina	iPWR,	NuScale	NuScale, USA	iPWR
<b>KLT-40s</b>	OKBM, Russia	FNPP	ACP100	CNNC, China	iPWR
<b>HTR-PM</b>	INET, China	Gas Reactor	SMART	KAERI, Korea	iPWR
			UK SMR	Rolls Royce UK	Compact PWR
			Xe-100	Xe-Energy	HTR
			RITM	OKBM	iPWR





# General Assumptions (1)

---

- In the initial phase of assessment (prior to direct discussions with vendors) the goal was to limit the technologies to those that are most viable and fit our criteria and requirements.
- General assumption:
  - Deployment time: by 2026-2030 operational in Jordan
  - Mature technology and vendor: only LWRs and HTGRs
  - Size: micro reactors are excluded, less than 50 MWe
  - Only land based reactors: FNPP and submerged are excluded



# Excluded SMRS

□ The following reactors types were excluded:

➤ **Floating Nuclear Power Plants (FNPP) and Submarine SMRS**

- High cost ( cost of NPP + cost of Submarine or barge)
- Security ( only Aqaba a coast, very close to borders)
- Environment ( close to people, industrial port, tourism, aqua life)

➤ **Micro reactors**

- All micro reactors like 5 or 10 MWe were excluded, these have special use and not feasible for electricity generation.

➤ **Novel technologies, such as:**

- LMRs
  - LMRs do not have much operating experience
  - Difficult to license in Jordan



# Selected List

<b>SMR</b>	<b>Country of origin/Vendor</b>	<b>Type</b>
NuScale	USA/NuScale Power	iPWR
UK-SMR	UK/Rolls Royce	Compact PWR
ACP100	China/CNNC	iPWR
SMART	South Korea/ KAERI	iPWR
RITM-200	Russia/ Afrikantov OKBM	iPWR
HTR-PM	China/ CNNC	HTR
Xe-100	USA/X- Energy	HTR



# Methodology and Criteria

---

- Currently there are 7 potential SMRs.
- Next step is to have a 3 shortlisted SMRs ( based on matrix evaluation criteria).
- Subsequently down select to one based on matrix criteria, key factors and economic assessment.



# Technology Evaluation Approach

---

- The differences between technologies and their impact on Jordan will be assessed through rigorous evaluation methodologies designed to bring full visibility and transparency:
  - ❑ Assessment of the vendor technology towards Key Factors (important for Jordan)
  - ❑ Evaluation Matrix
  - ❑ Best-in-Class for each evaluation criteria
  - ❑ Price under competitive environment



# Key Factor Evaluation

Key Factor	1	2	3
General Safety Design Criteria			
Exclusion Zone			
Seismic			
Aircraft Crash			
Fukushima Dai-ichi Lessons			
Digital I&C Systems			
Licensing & Design Certification			
Fuel Supply and Security			
Back End of the Fuel Cycle			
Radioactive Waste Management			
Non-proliferation			
Thermal Efficiency			
Operability & Maintainability (including availability)			
Cooling Water Design			
Vendor Long Term Sustainability			
Total			

# Matrix Assessment Criteria

- ❑ General ( meeting current international licenseability requirements, areas of risks, vendor and owner responsibilities, etc.)
- ❑ Design ( design lifetime, efficiency, design adaptation to Jordan's environment and site characteristics, cooling, foot print and plant layout, etc)
- ❑ Operation and maintenance (refueling outages, regular maintenance, staffing for operation and maintenance, etc.)
- ❑ Construction (Construction period, approach of modular construction and assembly, manufacturing capabilities, transportation of heavy equipment, etc.)
- ❑ Reactor performance (Availability, efficiency, load follow capability, etc.)
- ❑ Nuclear Safety (Defense in depth, operational safety, internal and external hazards, passive safety features, grace period, CDF, LERF, etc.)
- ❑ Fuel cycle, waste management and non-proliferation (Nuclear Fuel design and safety, SNF pool design and capacity, fuel handling system to deal with failed fuel elements, experience in fuel supply, experience in waste management and reduction of waste, etc)
- ❑ Licensing and operating experience ( proven design, compliance with IAEA safety standards, reference design, etc.)
- ❑ Vendor long term commitment (vendor readiness, localization, etc.)
- ❑ Economic (Capex, O&M, LCOE)



# Best-in-Class

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- An alternative way to evaluate the plant technology, and it is intended to complement the evaluation matrix using a simple rule:
  - Best technology for each evaluation criteria is given a gold medal, and the second a silver medal and so on

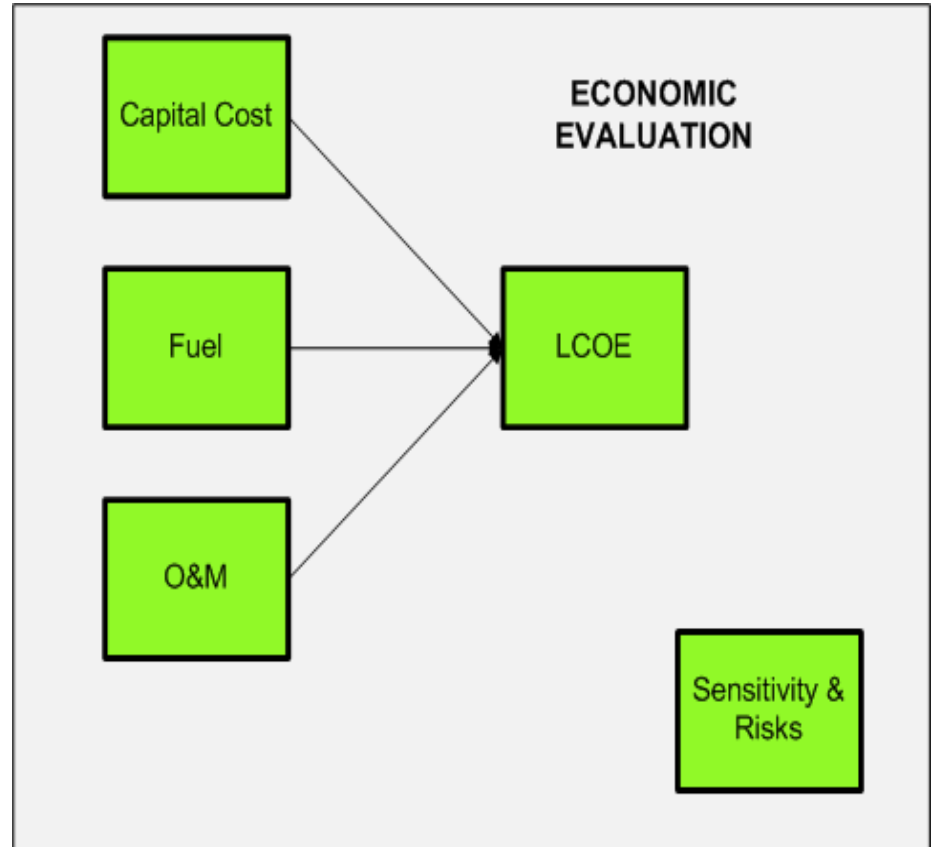




# Economic Evaluation Approach

Economic Evaluation process:

- ❑ Detailed review of Capital Cost and adjustments.
- ❑ Adjusted Capital Cost input to LCOE.
- ❑ Technical Evaluation input for Fuel and O&M prepared for LCOE analysis.
- ❑ Sensitivity and Risks.

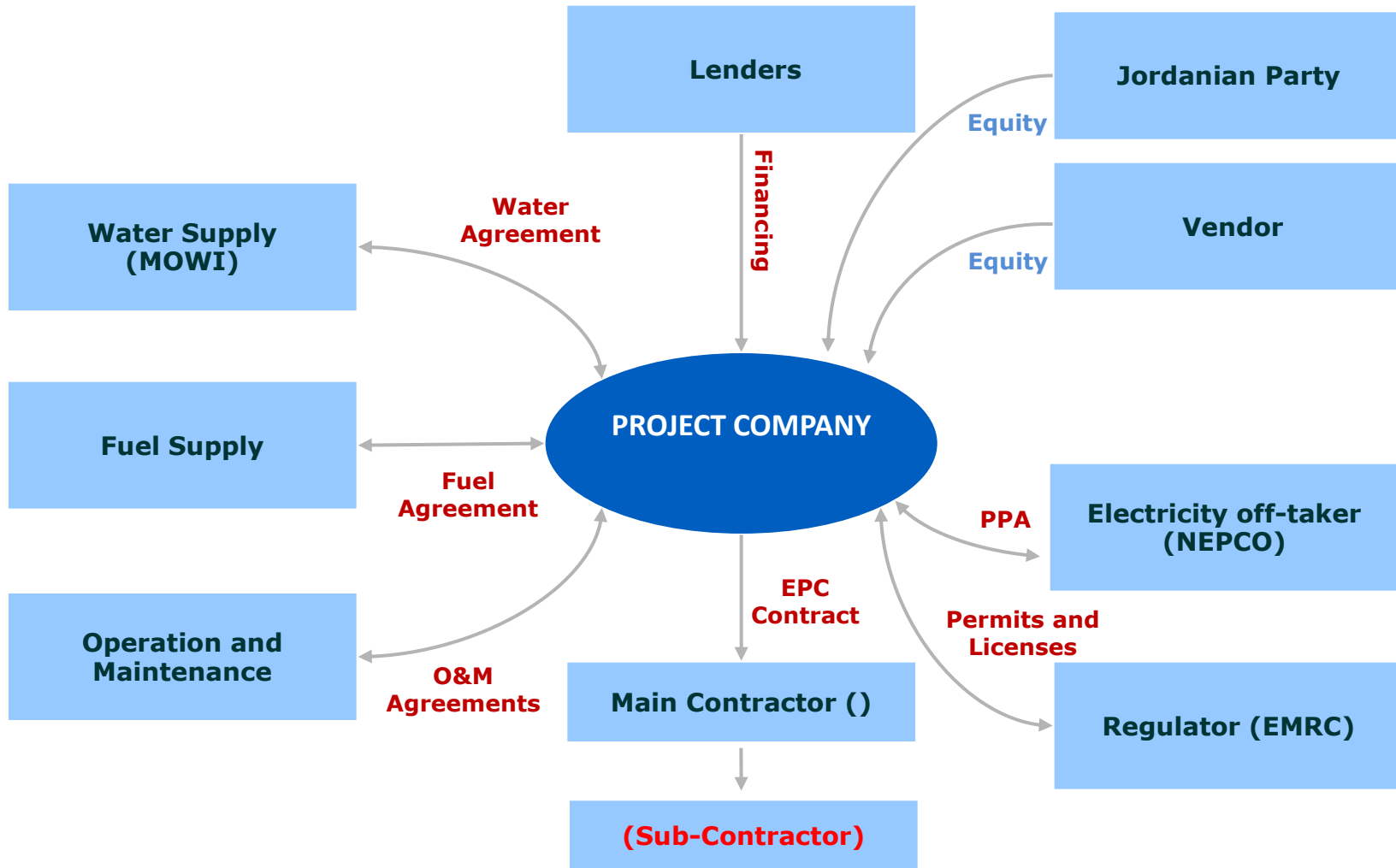


# Summary Decision Table

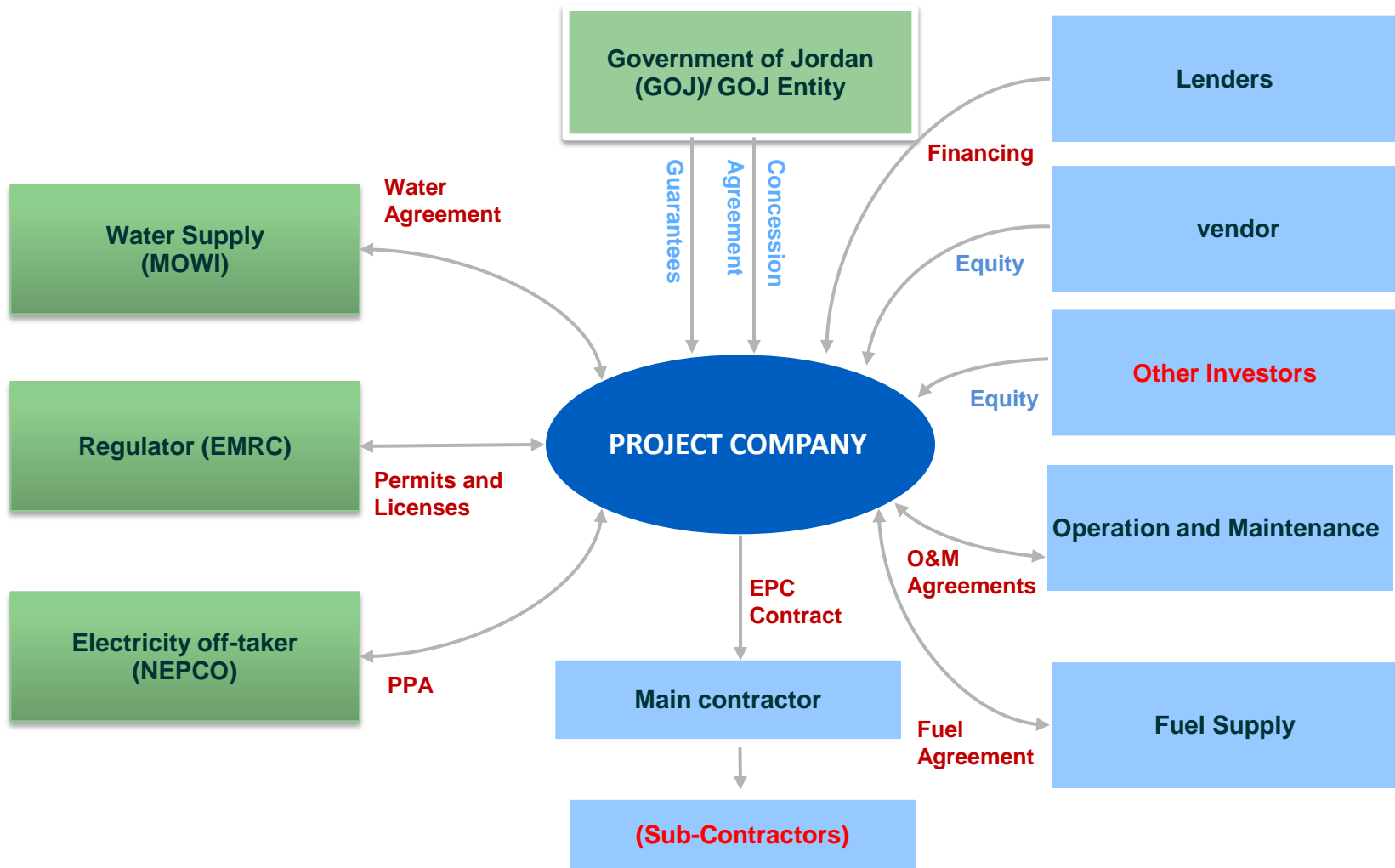
Methodology	Unit	1	2	3
Key Factor Evaluation	% of total score			
Evaluation Matrix	%			
Best-in-Class	Number of gold medals			
Adjusted Price (\$/KWe) LCOE				



# Generic Project Structure



# BOT / BOOT Project Structure



Agreements With the Government of Jordan (and affiliates)



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# Thank You

