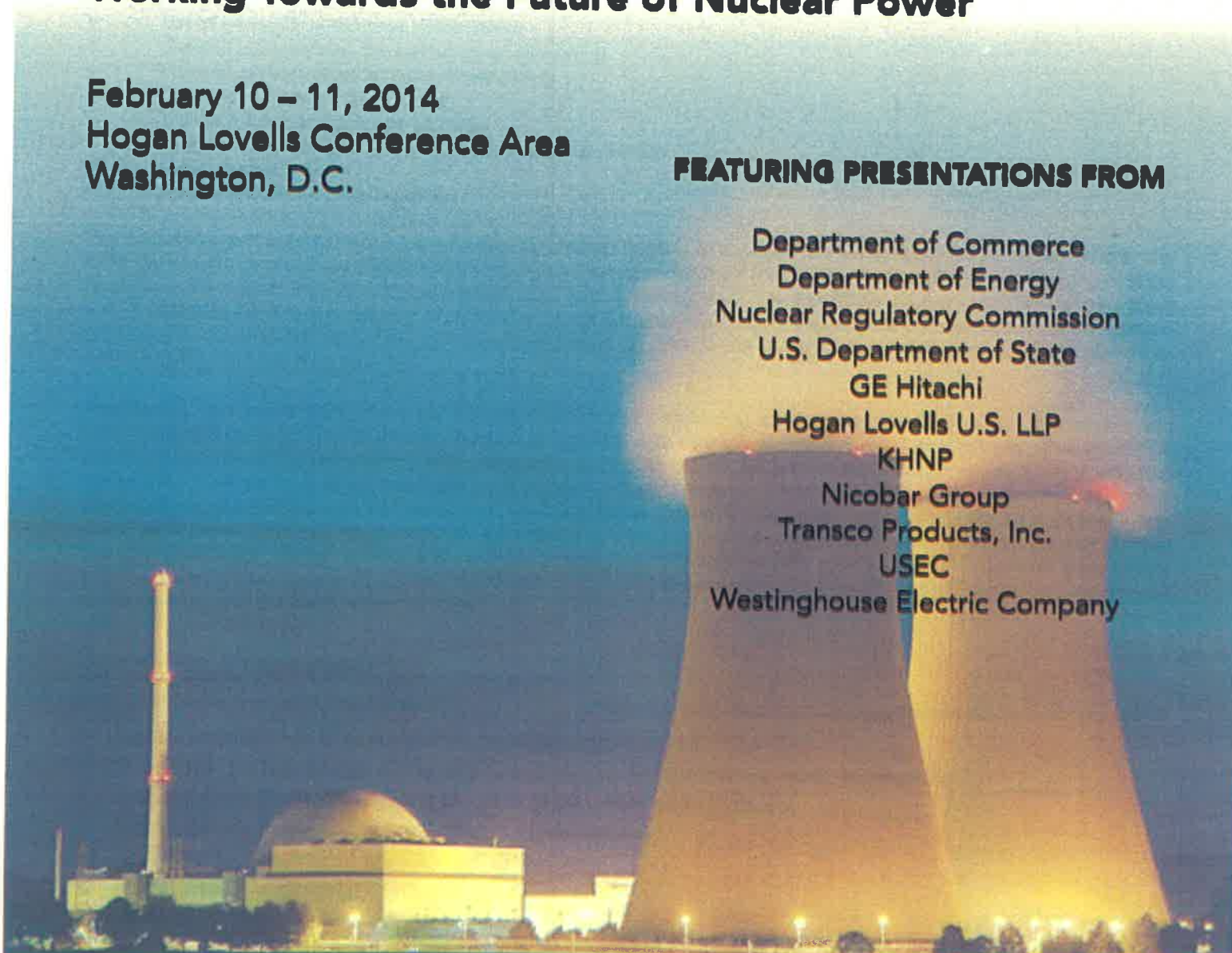


**5<sup>TH</sup> ANNUAL  
NUCLEAR EXPORT CONTROL SYMPOSIUM:  
Working Towards the Future of Nuclear Power**

February 10 – 11, 2014  
Hogan Lovells Conference Area  
Washington, D.C.

**FEATURING PRESENTATIONS FROM**

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USEC  
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**Comments from Dr. Ratan Kumar Sinha, Chairman of the Atomic Energy Commission (AEC), Government of India, on the presentation**

**From:** "chairman"  
**Date:** Monday, March 03, 2014 4:16 AM  
**To:** "Dr. Vijay Sazawal"  
**Cc:** "RK Sinha"  
**Subject:** Re: My Recent Presentation on the U.S.-India Civil Nuclear Deal

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This mail has been scanned by IMSS 7.1

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Dear Dr. Sazawal,

I thank you very much for sending to me a copy of your powerpoint presentation covering the various dimensions of our nuclear power programme. I must say that you have captured the essence of the current status and directions of our programme, as relevant to our international civil nuclear co-operation.

Thank you once again, and with my warm regards,

Yours sincerely,

(R.K. Sinha)



# Challenges in Implementing the U.S. – India Civil Nuclear Agreement

February 11, 2014

Vijay K. Sazawal, Ph.D.  
Director of Government Programs

*Disclaimer: Opinions expressed by the author are solely attributable to him and not to USEC Inc.*

# Topics

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- Five Myths about the Indian Civil Nuclear Program
- Key Challenges
- Cost of Electricity
- Nuclear Liability
- Remaining Open Issues
- Bilateral Nuclear Agreements signed by India
- India's "Plan B"
- Concluding Remarks

# Five Myths about the Indian Civil Nuclear Program

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1. “Indian Nuclear Liability law is the most severe obstacle to consummating a commercial contract between U.S. nuclear reactor suppliers and NPCIL”
2. “India has no intention to award commercial contracts to U.S. nuclear reactor vendors”
3. “India favors Russian nuclear vendors over all other international nuclear suppliers”
4. “India will import nuclear reactors only under political and diplomatic pressure from nuclear reactor exporting countries”
5. “India’s need for imported nuclear reactors is open ended as its population and power consumption needs are bound to increase in the future”

# Five Myths about the Indian Civil Nuclear Program - 1

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## Myth #1

“Indian Nuclear Liability law is the most severe obstacle to consummating a commercial contract between U.S. nuclear reactor suppliers and NPCIL”

## Reality check:

- No power project will be approved by the Government that does not assure a viable tariff regime for electricity generated
- For a capital intensive project like a nuclear power plant, a successful closure will require a close knit team relationship between the NSSS vendor and the client (NPCIL) to jointly agree on value engineering, domestic content, subcontractor selections, financing and contractual T&C's, including nuclear liability
- Putting it the other way, if India's nuclear liability law was exactly as suggested by the U.S. Administration and U.S. Suppliers, there would still be no closure until the viable tariff regime is achieved

# Five Myths about the Indian Civil Nuclear Program - 2

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## Myth #2

“India has no intention to award commercial contracts to U.S. nuclear reactor vendors”

### Reality check:

- Government of India made a commitment to seek commercial agreements with U.S. reactor vendors for a minimum of 10,000 MWe at two designated sites, in a letter to the U.S. government on 10 September 2008
- India is the only country where each international supplier has been designated at site, and the emphasis is not on making vendors compete against each other, but on team relationship between the vendor and client to achieve economic viability of the project. Every nuclear vendor is a winner
- In July 2009, India announced selection of Mithivirdi site in Gujarat for 6 Westinghouse AP-1000 reactors and Kovvada site in Andhra Pradesh for 6 GE reactors. NPCIL has designated project organizations and provided additional resources for interacting with the two U.S. nuclear vendors in developing these projects
- Subsequently, India initiated pre-project activities at the two sites, including receiving Terms of Reference (TOR) from the Ministry of Environment & Forests (MoEF) to carry out Environmental Impact Assessment (EIA) Studies
- Mithivirdi (Westinghouse) site received site construction approval in July 2013
- NPCIL and Westinghouse executed a preliminary contract for the initial phase of work related to development of AP-1000 in Gujarat in September 2013. First set of project deliverables are expected to be completed in March 2014 resulting subsequently in the first payment by NPCIL to Westinghouse

# Five Myths about the Indian Civil Nuclear Program - 3

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## Myth #3

“India favors Russian nuclear vendors over all other international nuclear suppliers”

### Reality check:

- The first reactors purchased by India were two BWR's purchased from GE in 1964, which commenced operations in October 1969. These reactors continue to operate even today.
- Russians got a head start during the breakup of the Soviet Union when their economy tanked and nuclear engineers had little or no work
- The agreement to build Kudankulam reactors was signed in 1988, well before the 1992 restrictions imposed by the NSG
- Negotiations, however, did not begin until 1998 and it took nearly 3.5 years to complete a techno-commercial agreement, leading to project construction beginning in 2002
- KK-1 and KK-2 were priced at about \$3.5 billion, Russia provided very cheap financing that covered 1/3 of the project cost
- KK-3 and KK-4 will not be cheap. A combination of market pricing and differences in policy perceptions is holding back closure on the final contract under negotiations since 2008
- It is truly a “level playing field” for all NSSS suppliers



# Five Myths about the Indian Civil Nuclear Program - 4

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## Myth #4

“India will import nuclear reactors only under political and diplomatic pressure from nuclear reactor exporting countries”

### Reality check:

- India developed its indigenous nuclear power program after global sanctions were imposed on India in 1974, when it conducted its first underground nuclear explosion, followed by even more rigorous sanctions following the 1998 nuclear weapon tests
- India has mastered the entire nuclear fuel cycle, including enrichment and reprocessing. Its nuclear complex is extensive and pluralistic. It is recognized by the IAEA for its pioneering research in thorium fuel cycle and fast reactors
- The Indian nuclear program is synonymous with country’s pride and its technical prowess to develop its own technical capabilities. Institutionally, the country’s nuclear program enjoys a great degree of autonomy and is shielded from political influences that are prevalent elsewhere
- India’s Atomic Energy Commission (AEC) and particularly its Chairman has, comparatively, the same stature in India that Admiral Rickover had in the U.S. while running the U.S. Nuclear Navy. The AEC Chairman reports directly to the Prime Minister of India
- Indian nuclear establishment is immune from political and diplomatic pressures

# Five Myths about the Indian Civil Nuclear Program - 5

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## Myth #5

“India’s need for imported nuclear reactors is open ended as its population and power consumption needs are bound to increase in the future”

### Reality check:

- India has a 3-stage nuclear program intended to address its growing energy needs in the future
- Stage I consists of indigenously developed reactors and imported LWR’s and cover a period of 30-50 years
- Stages II and III consist of Fast Breeder Reactors and Advanced Thorium Reactors which are being developed, designed, tested and constructed without external assistance
- The Indian Government took a cabinet decision in 2005 that authorized up to 8 imported LWR’s to be constructed in India. In 2008, DAE, under the leadership of Dr. A Kakodkar, proposed importation of 40 GWe of LWR’s to ensure Stages II and III of the nuclear program achieve the objective of wiping out power deficit by 2050
- There are no plans to import additional reactors once the Stage I phase is over

# Key Challenges

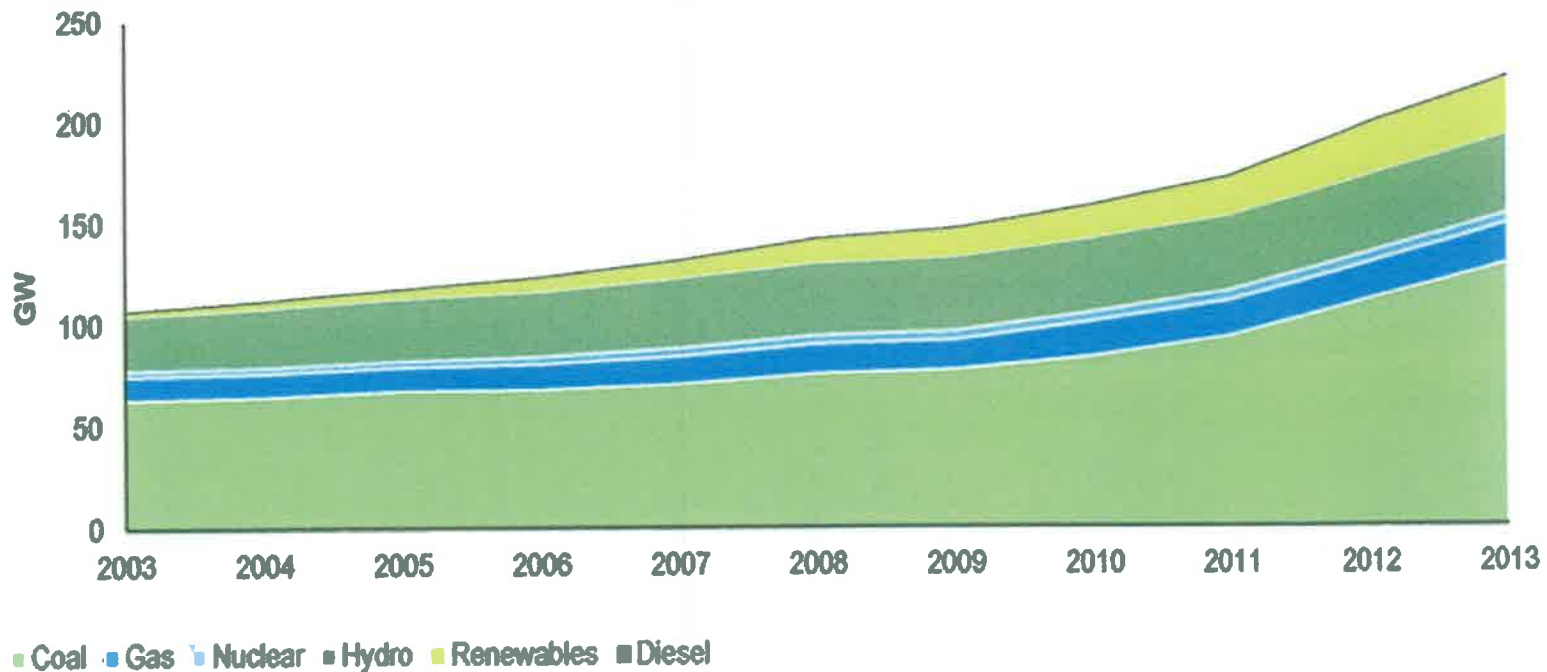
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- Progress made in the following areas:
  - Nuclear-Related Assurances and Verifications required under USG Nuclear Export licenses
  - “810” Technology Transfer/”Deemed Export” issues
  - “Administrative Arrangements under the bilateral “123 Agreement”
  - Early Works Agreement
- Contentious Topics:
  - Techno-Commercial Negotiations (achieving viable tariff)
  - Nuclear Liability

# Cost of Electricity - Production

- Indian Electricity Act of 2003 restructured the power sector, de-licensing generation, and providing open access in transmission and distribution, resulting in increased electricity production

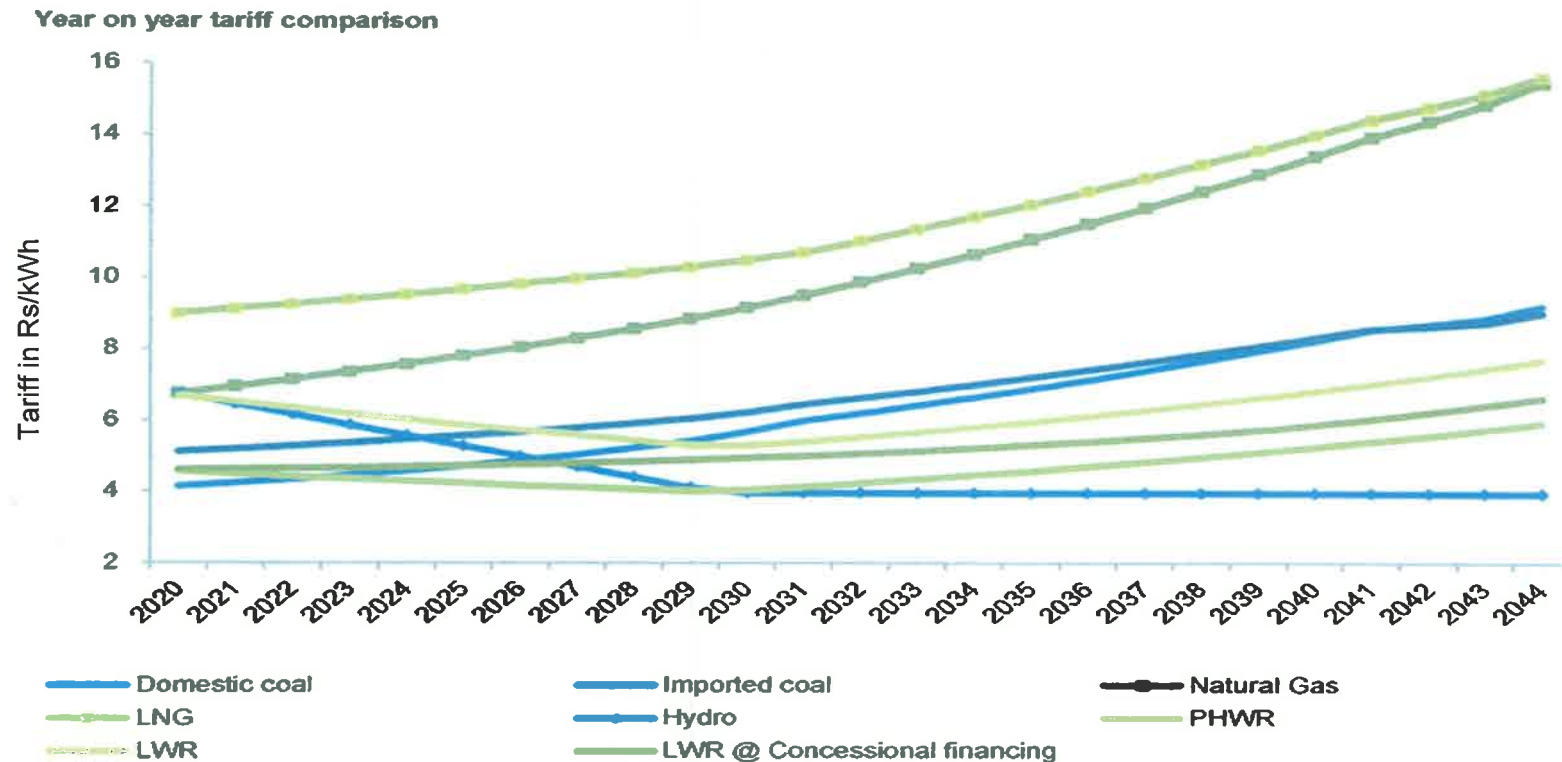
Historical capacity addition trend



(Reproduced from Nuclear Power in India: A Way Forward, Deloitte, 2013)

# Cost of Electricity - Production

- Electricity Act of 2003 does not regulate electricity generated from nuclear power plants in India. However, competitiveness and affordability are keys to an effective energy policy



(Reproduced from Nuclear Power in India: A Way Forward, Deloitte, 2013)

# Cost of Electricity – “Viable Tariff”

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- The U.K. Government and EdF established a “strike price” of £92.50/MWh (15.3¢/kWh or Rs 9.4/kWh) in 2023 for the first new reactor in U.K. (Hinkley Point C)
- In China, National Development and Reform Commission, has set a uniform tariff of 0.43 Yuan/kWh 7.5¢/kWh or Rs 4.5/kWh) in 2013 for all nuclear output in China
- EdF calculates the “complete cost” of its nuclear output at Eur 46/MWh (6.3¢/kWh or Rs 4/kWh) in 2013, and is required to sell up to 25% of its nuclear power to rival utilities at Eur 42/MWh (5.7¢/kWh or Rs 3.5/kWh) in 2014
- It is reported that Temelin 3 and 4 power tariff is expected to be under Eur 70/MWh (9.5¢/kWh or Rs 6/kWh) in 2025. Reports from Prague suggest that the project may be delayed until 2030
- Europe’s wholesale spot electricity price today is around Eur 40/MWh (5.2¢/kWh or Rs 3.2/kWh)
- Kudankulam Nuclear Power Plant unit 1 (KK-1), that was initially estimated to provide power at Rs 2.6/kWh (4.2¢/kWh) in 2007, now will provide electricity at Rs 4/kWh (6.5¢/kWh) following its startup in 2013
- DAE has set a target tariff of providing electricity by nuclear power in 2021 at under Rs 6.50/kWh (10.5¢/kWh)
- Unconfirmed reports indicate that the latest cost submissions from all three foreign vendors exceed target tariff set by DAE/NPCIL, but “final negotiations” are underway with the Russians and the French to arrive at a satisfactory closure
- Tariffs of India’s indigenously designed and constructed reactors are in the range of Rs 1.75 to Rs 2.8/kWh

# Nuclear Liability – Present Status

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- Indian Parliament passed the nuclear liability Act in August 2010. The Rules for implementing the Act were ratified on November 11, 2011
- Taken together, the law has a similar structure as the Convention on Supplementary Compensation (CSC) that is promoted by the U.S. Government and industry as the “global liability regime”, but differs in the following key areas:
  - Caps operator liability at 15 billion rupees (about \$250 million)
  - Grants plant operators right of recourse against equipment suppliers (Article 17)
  - Holds plant operators accountable to all laws in force, including those not addressed specifically in the liability law (Article 46)
  - The Rules permit the operator to limit the amount as well as duration of the liability to suppliers, but it is deemed unsatisfactory by U.S. suppliers
- In November 2013, a DAE technical team completed a draft report on Probabilistic Risk Assessment Analysis (PRAA) providing an assessment of probabilities of particular equipment or a sub-system to fail in a manner that can lead to an accident. The report is undergoing peer reviews at the this time and has not been made public
- It is interesting to point out that the U.S. Department of Energy (DOE) is also developing a rule to implement a retrospective risk pooling program for nuclear suppliers to fund the U.S. contribution to the international supplementary fund required under the CSC (PL 110-140, Section 934) [Ref: Federal Register, vol. 75, no. 143, 7/27/10]

# Nuclear Liability – What Next?

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- The Indian nuclear liability Act is not likely to change, but Rules may be revised sometime in the future to bring clarity in regards to amount and duration of liability that is accrued to suppliers
- The PRA work is intended to ensure predictable liability require for the suppliers, not unlike that proposed under the Section 934 of The Energy Independence and Security Act of 2007 that implements the CSC in the U.S.
- DAE is working with the General Insurance Corporation of India (GCI) to implement the PRA liability model
- India has not yet ratified the CSC, nor is it required under the Indian Liability Act to do so
- Potential contractual solutions for suppliers
  - Indemnification of the supplier by the operator/customer (NPCIL)
  - NPCIL waiver of its recourse rights against suppliers (politically difficult)
  - Contractually defining NPCIL as the lead supplier (besides being the operator) – an approach being used presently by Indian vendors
- India recognizes that nuclear liability is an open issue and is working on its resolution. Further discussions are planned on the subject by the U.S. and India in the near future



# Administrative Open Issues

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- NNSA's new 810 rules require specific authorization, approved by the Secretary of Energy, for transfer of technology and other related matters when dealing with India
  - Initial experience, involving only a few 810 applications, took a long time to receive approvals
  - While NNSA has turned down industry requests to put India under the "General Authorization" category, it should create an accelerated process to expedite 810 approvals for India
- The Administrative Arrangements (AA's) under the bilateral 123 Agreement have not been signed off. There seemed to be an agreement earlier, but it is unclear when a final agreement will be reached
- India has not yet ratified Additional Protocol to the IAEA safeguards agreement that was agreed by the IAEA Board in March 2009 and signed by the two parties in May 2009
- India intends to complete implementation of the "Separation Plan", agreed under the U.S.- India nuclear deal by December 2014

# Bilateral Nuclear Agreements Signed by India

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- India considers following bilateral nuclear agreements essential to its nuclear commerce
  1. Argentina (completed)
  2. Australia (being negotiated)
  3. Canada (completed)
  4. France (completed)
  5. Japan (being negotiated)\*
  6. Kazakhstan (completed)
  7. Mongolia (completed)
  8. Namibia (completed)
  9. Russia (completed)
  10. South Korea (completed)\*
  11. U.K. (completed)
  12. U.S. (completed)

(\* has significant implications)

# India's "Plan B"

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- India has initiated work on an indigenous 900 MW PWR call the Indian Pressurized Water Reactor ("IPWR")
- Base Technology Platform:
  - 220 MW natural uranium (NU) fueled PHWR
  - 540 MW natural uranium (NU) fueled PHWR
  - 700 MW natural uranium (NU) fueled PHWR
  - 500 MW mixed oxide (MOX) fueled fast breeder reactor
- Extensive Nuclear Fuel Development Program:
  - Program intended to reduce spent fuel volumes
  - Slightly Enriched Uranium (SEU) for PHWR
  - Metal fuel instead of MOX fuel in fast reactors
  - Enriched uranium instead of Plutonium in fast reactors
- Experiences in PWR designs:
  - 20 MW naval reactor at Kalpakkam (operating since 2006)
  - 83 MW naval propulsion reactor in the first Arihant class nuclear submarine (achieved criticality on 11 August 2013)
- IPWR is a 10-year design and technology development program, but may take longer to mature. It may proceed independent of foreign LWR vendors entering the Indian nuclear market

# Concluding Remarks

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- India remains a land of opportunity for global nuclear power suppliers. It is possibly the only nuclear market where vendors will not be asked to compete against each other to give the “best deal.” Each vendor works with the customer (NPCIL) using a win-win approach for success
- Indian pledge to purchase U.S. brand reactors is genuine. However, success will not come easy. While NPCIL has been able to meet the “viable tariff regime” with indigenous reactors, imported reactors are expensive and need a combination of value engineering, maximum local outsourcing and very creative financing to be competitive and affordable in India
- Indians can be reasonable in settling bilateral disputes and issues of contention. But the process may involve a higher degree of flexibility and ingenuity than what a supplier has experienced elsewhere. Invest in local businesses and learn from local entrepreneurs who deal with India’s cumbersome bureaucracy and legal system, and still make good money along the way.
- India is looking at other alternatives if it is unable to achieve its stated goal of procuring 40 GWe of imported LWR’s
- Nuclear power symbolizes a way out for Indians to eradicate poverty in their nation and reduce its carbon footprint. It is critical to India’s future, and the U.S. has a big role in making that happen