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LNSP Seminar :: Wednesday, April 23

12:30 to 2:00 PM in 24-213

**Challenges in Promoting U.S. Civil Nuclear
Reactor Exports**

Dr. Vijay Sazawal

Director of Government Programs

United States Enrichment Corporation

Abstract

The surging electricity demand in developing countries and a need to pursue clean energies for better environment have created new markets for nuclear power. How will the U.S. nuclear suppliers capitalize on new opportunities in the global market place? Dr. Sazawal provides a historical evolution of so-called “123 Agreements,” and an overview of the U.S. policies that have facilitated and, in some cases, hindered nuclear exports. He also addresses the global growth in nuclear power with emphasis on attributes that define new market conditions which are radically different from past practices. Finally, the author will discuss challenges in implementing the US–India nuclear deal.

Bio

Dr. Vijay Sazawal is a member of the Civil Nuclear Trade Advisory Committee (CINTAC), sponsored by the US Department of Commerce that advises the US Government on nuclear exports. He has nearly 40 years of professional experience in the nuclear industry covering the entire fuel cycle. As director of Government Programs at the United States Enrichment Corporation (USEC), Dr. Sazawal coordinates and pursues advocacy for existing and new business initiatives within various agencies of the US federal government. Prior to joining USEC Inc., Dr. Sazawal worked at COGEMA Inc. (now Areva Inc.) for 7 years as Vice President of Engineering and Technology. He started his engineering career at Westinghouse Electric Corporation which lasted 20 years. Dr. Sazawal played an active role as a subject matter expert (SME) to government and industry in the U.S.-India civil nuclear agreement, and continues to be a senior advisor to the US India Business Council (USIBC) on nuclear matters.

From: Richard C St. Clair [mailto:stclair@MIT.EDU]

Sent: Wednesday, April 23, 2014 10:35 AM

Subject: STARTING SOON: SEMINAR- 12:30-2 pm, Lab for Nuclear Security and Policy Seminar

Massachusetts Institute of Technology
Laboratory for Nuclear Security and Policy
Seminar Series

“Challenges in Promoting U.S. Civil
Nuclear Reactor Exports”

Dr. Vijay Sazawal

Director of Government Programs

United States Enrichment Corporation

MIT Dept. of Nuclear Science & Engineering

Wednesday April 23, 2014

Room 24-213

12:30 – 2:00 PM

Refreshments 12:30 PM

Talk starts promptly at 12:45 PM



Challenges in Promoting U.S. Civil Nuclear Reactor Exports

Presentation to Department of Nuclear Science and Engineering
Massachusetts Institute of Technology (MIT)

April 23, 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.

Agenda

- Evolution of 123 Agreements and U.S. Nuclear Export Controls
- Future Growth of Nuclear Power and Emerging New Markets
- Consolidation of Major Nuclear Suppliers in the Global Market
- Priorities for Success: Winning New Reactor Orders
- U.S. Civil Nuclear Export Control Regime – Some Recent Developments
- Challenges in Implementing the U.S. – India Civil Nuclear Agreement
- Closing Remarks

Evolution of 123 Agreements and U.S. Nuclear Export Controls - I

- Rise of the “Atom” (1939-1953)
- Promise of Peaceful Use (“Atoms for Peace”)
- Atomic Energy Act (AEA) of 1954
 - Declassification of secret information about the nuclear fuel cycle (“Restricted Data”)
 - Technology transfer from the federal government to the private sector
 - Cooperative agreements with friendly countries with a commitment to provide enriched fuel
 - Facilitated creation of IAEA (1957)
- Original 123 Agreement (1954)
 - Identified exports
 - Source and special nuclear materials
 - Technology to develop atomic energy for peaceful purposes, including medical isotopes
 - Identified contents of the agreement
 - Scope, duration and terms & conditions
 - “Guaranty” by the recipient on security safeguards and standards
 - “Guaranty” that any material or technology transferred will be used for peaceful purposes
 - “Guaranty” that any restricted data transferred will not be disseminated further

Evolution of 123 Agreements and U.S. Nuclear Export Controls - II

- Presidential Determination
 - The agreement will not constitute an unreasonable risk to the common defense and security of the U.S.
- Key Congressional Committee Acquiescence
 - Approved bilateral agreement and Presidential Determination to rest with the Joint Committee on Atomic Energy for 30 continuous days while Congress is in session
- Agreements with foreign countries were negotiated by the AEC who also submitted the agreement to the White House for the President's approval

AEA of 1954 Unleashed “U.S. Atomic Diplomacy”

- As the “Cold War” heated up, the civil nuclear cooperation agreements turned into instruments of U.S. foreign policy
 - Early agreements covered supply of HEU for research reactors. Power reactors came much later
 - The first agreement was signed with Turkey in June 1955, followed 5 days later with Belgium, Canada and U.K.
- By the end of 1955, agreements were concluded with 22 countries
- By the end of 1956, agreements were signed with 14 more countries
- By the end of 1957, agreements were signed with 5 more countries
- By the end of 1960, U.S. had concluded a total of 44 agreements, including one with EURATOM in 1958
- France tested its first nuclear weapon in 1960. A possibility that Germany may be next, led President Kennedy to push for a global non-proliferation treaty
- Following the 1962 Cuban crisis, U.S. and USSR took a number of steps towards limited disarmament and non-proliferation
- Non-proliferation Treaty (NPT) was signed in 1968 and came into force in 1970

Atomic Energy Act of 1954 “As Amended”

- The U.S. Nuclear Non-Proliferation Act (NNPA) of 1978 required all 123 Agreements to be renegotiated upon expiration
- The amended 123 Agreement retained a similar structure as the original, with increased emphasis on non-proliferation and a broader Congressional review. The agreements are negotiated by the U.S. Department of State, which also is required to submit a Nuclear Proliferation Assessment Statement (NPAS) to the President
- Section 123a, paragraphs (1) through (9) list nine criteria that must be included in an agreement with a nuclear non-weapon state
 - Safeguards in perpetuity
 - Full scope IAEA safeguards
 - Peaceful use only
 - In case of non-peaceful use, right to demand return
 - No retransfer without U.S. consent
 - Physical security of nuclear material
 - No enrichment or reprocessing of the transferred nuclear material or nuclear material produced
 - Monitoring and storage of transferred or generated HEU and Pu
 - Above criteria apply to all nuclear material and facilities resulting from the agreement
- Congressional review period was extended to 90 days of continuous session of U.S. Congress
- Congressional approval required for “exempted agreements” that did not meet the non-proliferation criteria of Section 123a

U.S. Bilateral Agreements for Peaceful Nuclear Cooperation

1. Argentina (16 October 1997/16 October 2027)
2. Australia (22 October 2010/22 December 2040)*
3. Brazil (21 July 1955/15 September 2029)
4. Canada (21 July 1955/1 January 2030)*
5. China (30 December 1985/30 December 2015)
6. Egypt (29 December 1981/29 December 2021)
7. Euratom (22 June 1972/22 June 2014)
8. India (6 December 2008/6 December 2048)**
9. Indonesia (30 December 1981/30 December 2031)
10. Japan (30 July 1988/30 July 2018)***
11. Kazakhstan (5 November 1999/ 5 November 2029)
12. South Korea (19 March 1973/19 March 2016)
13. Morocco (16 May 1981/16 May 2021)*
14. Norway (2 July 1984/2 July 2014)
15. Russia (11 January 2011/11 January 2041)
16. South Africa (4 December 1997/4 December 2022)
17. Switzerland (23 June 1998/23 June 2028)*
18. Thailand (27 June 1974/27 June 2014)
19. Turkey (2 June 2008/ 2 June 2023)*
20. Ukraine (28 May 1999/28 May 2029)
21. U.A.E (17 December 2009/17 December 2039)
22. IAEA (7 August 1959/7 August 2014)
23. Taiwan (22 June 1972/ 22 June 2014)

— Negotiated prior to NNPA
* Rolling 5-year extensions
** Rolling 10-year extensions
*** Remains in force until terminated by either party

U.S. Civil Nuclear Export Control Regime

Process	Agency	Jurisdiction	Advisory Agencies	Comments
10 CFR Part 810	DOE	Nuclear technologies and services related to the production of Special Nuclear Material (SNM)	DOC, DOD, DOS and the NRC	<ul style="list-style-type: none"> • Does not require 123 Agreement in some cases • DOE issues authorization
10 CFR Part 110	NRC	Nuclear equipment and material	DOC, DOD, DOS and DOE	<ul style="list-style-type: none"> • Requires 123 Agreement • NRC issues export license
Export Administration Regulations (EAR)	DOC	“Balance of Plant” (BOP) in a nuclear power station, dual-use items listed on the Commerce Control List (CCL)	DOE, DOD, DOS	<ul style="list-style-type: none"> • Does not require 123 Agreement • Bureau of Industry and Security (BIS) issues export license

Growth of Nuclear Power – Operating Plants

- Operating nuclear power plants: 434 reactors, 30 countries, installed capacity of 374 GWe
- 15 countries generating most nuclear power currently (excludes Japan)
 - USA (100 reactors, 19% share)
 - France (58 reactors, 75% share)
 - Russia (33 reactors, 18% share)
 - South Korea (23 reactors, 30% share)
 - Germany (9 reactors, 16% share)
 - China (20 reactors, 2% share)
 - Canada (19 reactors, 15% share)
 - Ukraine (15 reactors, 46% share)
 - U.K. (16 reactors, 18% share)
 - Sweden (10 reactors, 38% share)
 - Spain (7 reactors, 21% share)
 - Belgium (7 reactors, 51% share)
 - India (21 reactors, 4% share)
 - Czech Republic (6 reactors, 35% share)
 - Switzerland (5 reactors, 36% share)

Growth of Nuclear Power – Plants Under Construction

- 75 reactors are under construction in 15 countries

Country	Reactor(s)	Total Net Capacity (MW)
Argentina	2	717
Belarus*	1	1109
Brazil	1	1245
China	31	33850
Finland	1	1600
France	1	1600
India	6	3907
Japan	2	1325
Korea	5	6370
Pakistan	2	630
Russia	10	8362
Slovakia	2	880
Ukraine	2	1900
U.A.E.*	2	2690
USA	5	5633

* New entrants

Emerging New Markets and Future Trends – I

- IAEA
 - 30 more countries interested in nuclear power
 - Poland, Turkey, Bangladesh and Jordan are making good progress
 - IAEA has established the Integrated Nuclear Infrastructure Group (INIG) to assist newcomers in developing a safe and structured nuclear program

- IFNEC
 - Membership has grown to 32 participant countries with another 31 countries as observers (total Of 63 countries)
 - Nearly 1/3 of the member countries are hoping to build nuclear reactors in the future
 - U.S. is helping by providing technical expertise to promote expansion of nuclear energy for peaceful purposes in a manner that is safe and secure, and promotes non-proliferation and safeguards

- U.S. Energy Information Administration (July 2013)
 - World-wide use of energy (mostly for transportation and electricity) will surge 56% by 2040 compared to 2010 levels
 - Half of the energy growth will come from China and India
 - Nuclear energy will double from 2010 to 2040
 - Most of the growth in nuclear energy will come from China, India, Russia and South Korea

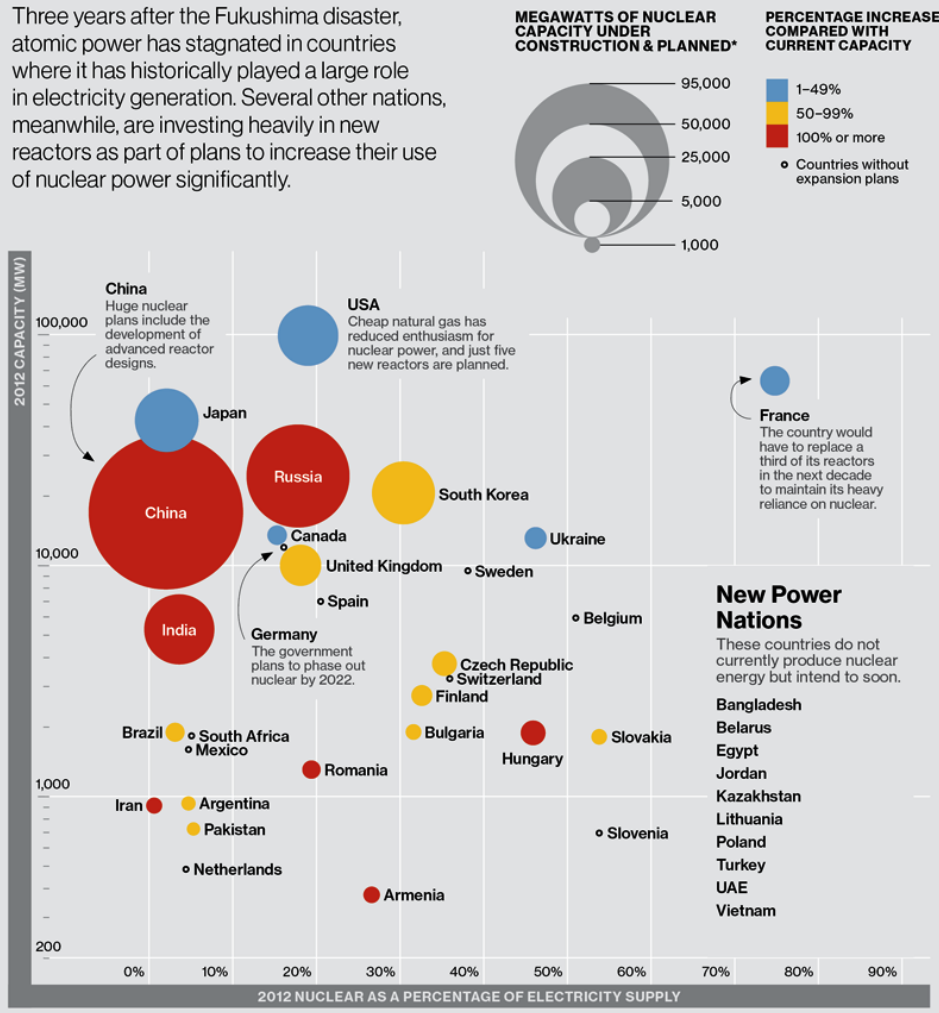
Emerging New Markets and Future Trends – II

- Ux Consulting
 - New countries likely to have nuclear plants by 2030 are: South Africa, Poland, Turkey, Vietnam, Saudi Arabia, Jordan and Bangladesh
 - Egypt is also likely to build a reactor within the next 15 years
 - 2/3 of all new builds will come from China, Russia, India and South Korea (CRIS)
- BP's World Energy Outlook 2035
 - Global nuclear power will grow 1.9% annually up to 2035
 - In OECD countries, nuclear generated in projected to decline by 0.2% annually
 - Global growth in nuclear power will be driven by non-OECD countries
 - The rise in nuclear power will be mostly on the back of growth in China, Russia and India

The Global Nuclear Power Picture (Post-Fukushima Accident)

Nuclear Options

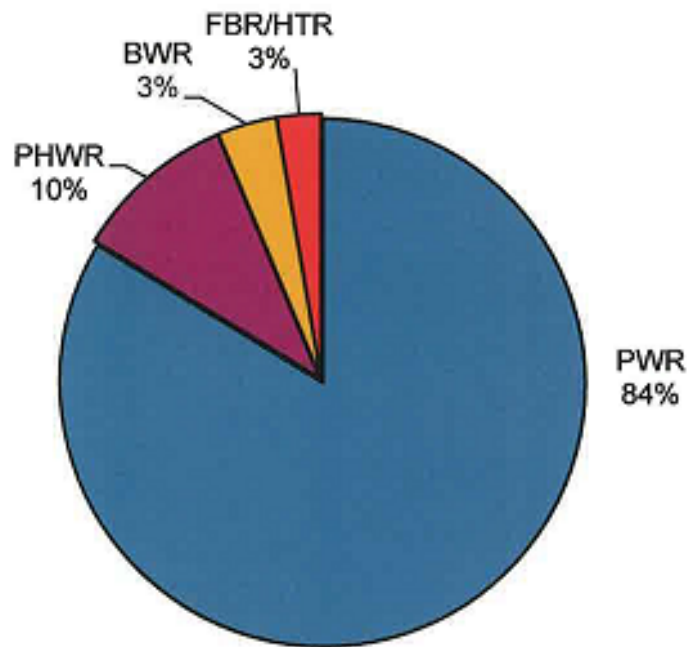
Three years after the Fukushima disaster, atomic power has stagnated in countries where it has historically played a large role in electricity generation. Several other nations, meanwhile, are investing heavily in new reactors as part of plans to increase their use of nuclear power significantly.



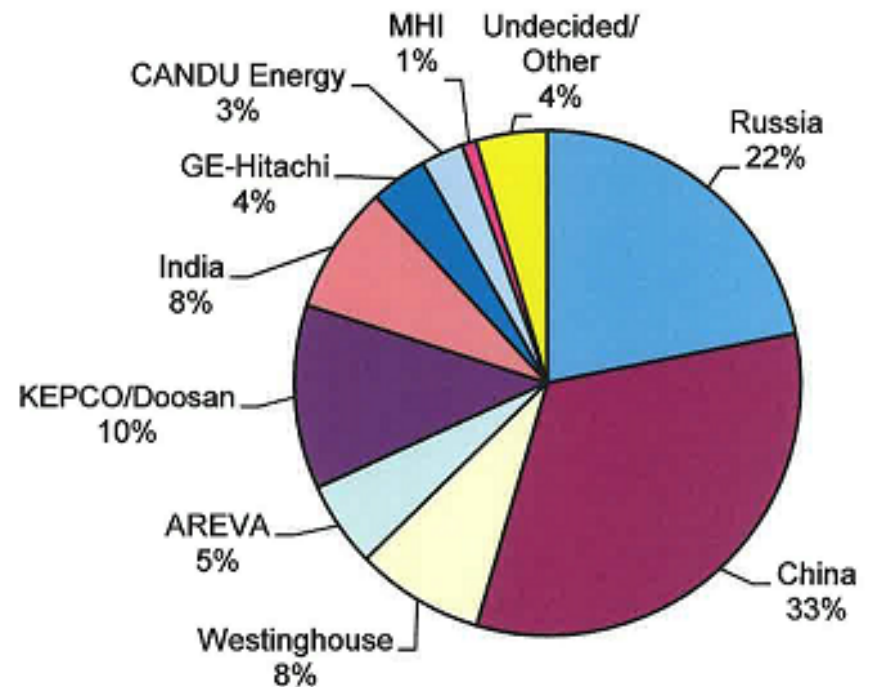
Source: MIT Technology Review (2014)

Global Nuclear Power Scenario 2020

New Reactor Types, 2009-2020



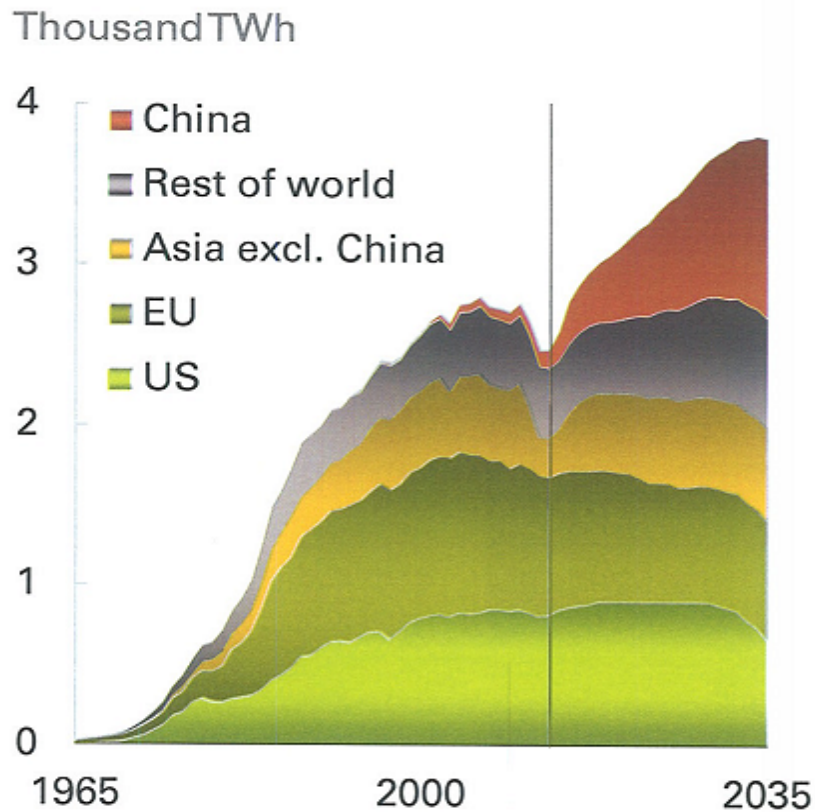
New Reactor Vendors, 2009-2020



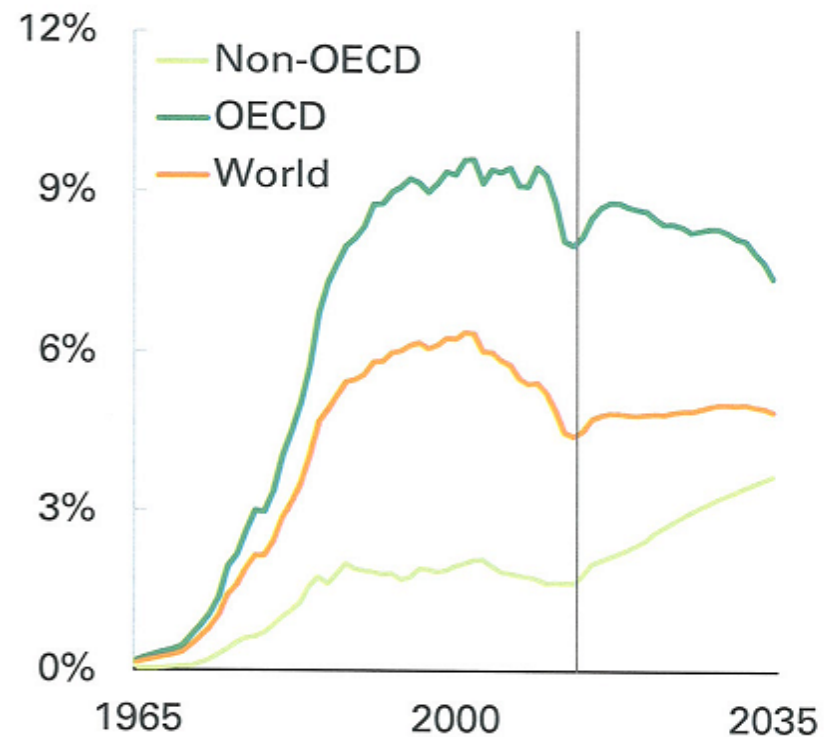
Source: UxC Nuclear Power Outlook, Q4 2013

Global Nuclear Power Production 2035

Nuclear generation by region



Share of nuclear in primary energy



Energy Outlook 2035

© BP 2014

Consolidation of Major Nuclear Suppliers in the Global Market

- The shrinking nuclear market as a result of the Fukushima accident, abundant gas supplies, and subsidized renewable energy has created fierce competition and consolidation among nuclear suppliers
 - Rosatom (Government of Russia) has streamlined its nuclear sector to offer attractive “package solutions” to customers ranging from the supply of new reactors to providing collateral nuclear fuel cycle facilities
 - Areva (Government of France) has launched a diplomatic offensive with the President of the Republic as its principal salesman overseas. French nuclear deals are sometimes combined with offers of infrastructure developments or defense sales to make the offer attractive
 - KEPCO (Government of South Korea) brings a “one stop shop” approach by making the entire “South Korea Inc.” accessible to the customer before, during and after the deal is signed
 - Toshiba/Hitachi/MHI (Japanese privately owned vendors) bring a two-pronged approach to win export orders
 - U.S. based subsidiaries or affiliations (Westinghouse and GE/H Nuclear) receive advocacy from U.S. government agencies in global markets
 - Bilateral industry consortium (MHI and Areva joining to form ATMEA) that receive advocacy from Japanese and French governments
 - Created an exports consortium of nine electric utilities and three principal nuclear suppliers to assist emerging countries in developing nuclear infrastructure, including reactors
 - CNNC (Government of China) has shown willingness to export variants of AP-1000 overseas. First two such reactors were sold recently to Pakistan. CNNC, along with another major Chinese government entity, CGN, are designing a joint export model “Hualong 1000.” Demonstration units will be built and operated in China prior to its export

Priorities for Success: Winning New Reactor Orders

- Lowest possible capital cost that matches customer affordability
 - Results in attractive electricity price relative to local purchasing power (“Political Issue”)
 - Requires high localization content
 - 3 countries are building new domestic nuclear reactors at below \$3,000 per kw – South Korea, China and India
- Financing that customers can afford
 - “80% financing at or below market rates, 20 years to pay off after 10-year grace period”
 - Export credit agencies with sufficient capital reserves and willingness to lend
- State aid that encourages high initial capital investment
 - U.S.: Energy Policy Act of 2005 (EPACT2005)
 - U.K.: Contract for Difference (CFD)
 - State subsidies to government owned reactor suppliers
- Package deals that go beyond supply of nuclear reactors
 - Russia and Japan contracts in Vietnam go beyond supply of reactors
 - Newcomers to nuclear power want help in operations as well
- Contracts that meet customer sensitivity to risk by requiring suppliers to invest in the project
 - U.S. business model (no equity provided by supplier)
 - Teaming with host utility (may require equity from supplier)
 - Build, Own and Operate (BOO) Nuclear Plant (will require significant equity from supplier)

Priorities for Success – Case Study: South Africa

- South Africa (SA) has an “observer” status in the U.S. sponsored IFNEC
- SA has an 1800 MW nuclear plant near Cape Town operated by state-run Eskom
- President Zuma has announced plans to procure additional 9600 MW of nuclear energy
- A delegation from South Africa, led by Dikobe Ben Martins, Energy Minister, visited Washington on December 2, 2013 and similar delegations have made visits to other countries who have expressed interest in selling nuclear plants
- Major nuclear suppliers expressing interest are:
 - Areva/EDF (EPR)
 - Toshiba/Westinghouse (AP-1000)
 - KEPCO (APR-1400)
 - CNNC/SNPTC/CGN (ACP1000/CAP1400/ACPR 1000)
 - Rosatom (VVER-1200)
- The winner is likely to offer the following:
 - Reasonable price with shared risks on cost
 - Concessional financing up to as high as 85% of the cost
 - “Package situation” that could include broad infrastructure development including research and education/training centers, outsourcing to local suppliers, research reactor for medical isotopes and perhaps even a fuel fabrication facility
 - Same degree of flexibility in Third-Party Liability rules
- And the winner is.....??

U.S. Civil Nuclear Exports (in Thousands of U.S. Dollars)

U.S. Civil Nuclear Exports (in thousands of U.S. Dollars)

Source: USITC

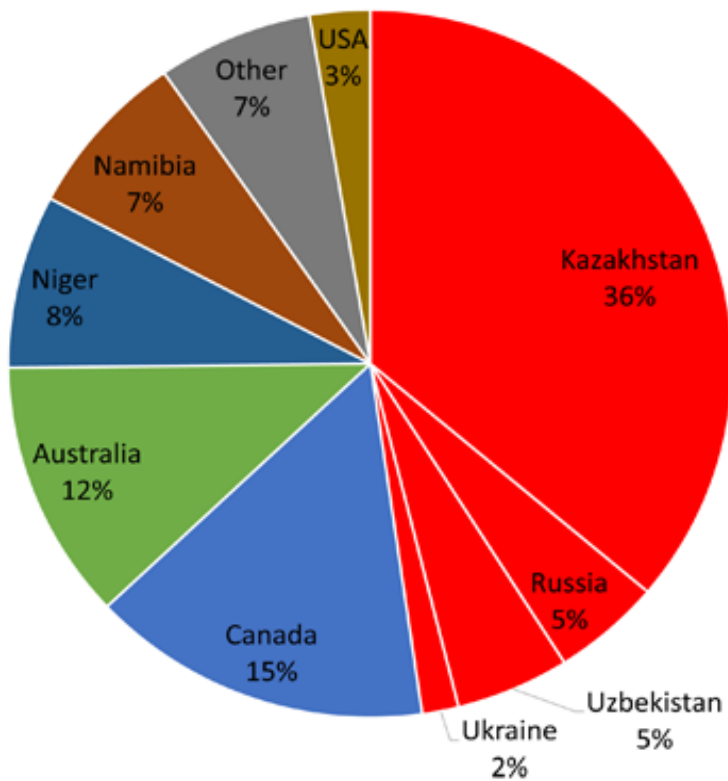
Product	2008	2009	2010	2011
Natural Uranium	\$569,920	\$282,171	\$380,694	\$1,345,898
Enriched Uranium	\$1,391,791	\$1,761,568	\$1,266,016	\$1,074,562
Nuclear Reactors	\$ 33,253	\$319	\$420	\$263
Isotropic Separation Machinery	\$10,304	\$14,258	\$6,060	\$7,720
Fuel Cartridges	\$150,432	\$183,760	\$343,812	\$314,085
Parts of Nuclear Reactors	\$88,714	\$87,462	\$71,634	\$96,737
TOTAL:	\$2,244,414	\$2,329,538	\$2,068,636	\$2,839,265

Note: these figures do not include nuclear services or dual-use items.

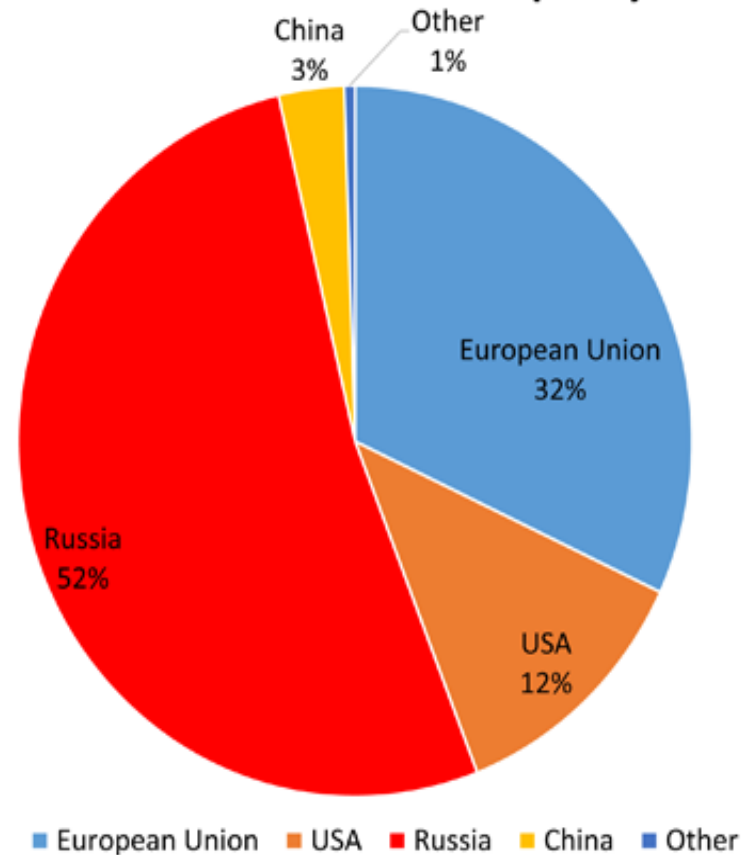
U.S. Department of Commerce | International Trade Administration

World Production of Uranium and Enrichment Capacity

World Production of Uranium



Estimated World Enrichment Capacity



Source: Casey Research (2014)

U.S. Civil Nuclear Export Control Regime – Some Recent Developments

- The U.S. bilateral civil nuclear agreements with friendly countries have more stringent requirements for controls, safeguards and monitoring, as required by the NNPA, that exceed even the most recent changes introduced in the NSG Guidelines
- Changes proposed by the executive branch to the “10 CFR Part 810” (affecting transfer of sensitive technologies) will make trade with China, India and Russia even more tedious and bureaucratic
- A new law being proposed in Congress (HR 3766) will require significant changes in the manner “123 Agreements” are negotiated and approved by Congress, requiring nations to forsake certain sovereignty rights that are presently allowed under the NPT, NSG and IFNEC rules
- The U.S. Export-Import Bank (EXIM), an important tool in promoting U.S. nuclear exports, has been operating under a series of short-term extensions with a miniscule lending authority. It lacks U.S. Congressional authorization beyond September 2014. Reauthorization efforts have been unsuccessful so far
- Lack of a global liability regime is a challenge. While OECD countries follow the Paris Convention, most other countries follow the Vienna Convention, a couple of countries, including the U.S. advocate for CSC, which is consistent with the U.S. domestic laws, and yet others have no liability laws (China, Japan, South Korea, South Africa). India has taken a different approach
- The concept of “Level Playing Field” puts equal burdens on a customer as well as a supplier

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

- Indian exceptionalism is historic
 - India emerged as the voice of the Non-Aligned Movement (NAM) during the Cold War
 - When President Eisenhower delivered the “Atoms for Peace” speech in the U.N. General Assembly in December 1953, the President of the Assembly was India’s representative to the U.N. at the time. Nevertheless the Indian PM, while acclaiming the peaceful use of atom, rejected other parts of the Eisenhower speech related to control of uranium resources by selective countries and organizations
 - The 1955 Geneva Conference, preceding the formation of IAEA, was chaired by the head of the Indian AEC. At the conference, India acknowledged its limited uranium resources, but announced a 3-stage nuclear program development that included reprocessing and fast reactors
 - In 1956, the “Washington Group” (developing the IAEA statute) co-opted India as a core member in order to attract NAM endorsement. India successfully argued its objections to formation of a de-facto uranium cartel and rejected requirements to have IAEA take custody of excess plutonium
 - In 1967, a year before the NPT is signed, India announced that it will not sign the NPT, calling it discriminatory. It nevertheless committed to abiding by its principles (Article V of the NPT allows peaceful nuclear explosions)
 - In 1974, India conducted a nuclear test calling it a peaceful nuclear explosion (PNE)
 - India’s 3-stage nuclear development program, first announced in a conference in New Delhi in 1954, continues to guide its national nuclear energy policy today

Status of the U.S. – India Civil Nuclear Agreement

- 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

Techno-Commercial Negotiations

- A key objective of techno-commercial negotiations is to establish economic viability of a project
(*Viability – “able to be done,” or “worth doing” - Macmillan Dictionary*)
- Letter from Foreign Secretary, Government of India, to Undersecretary of State, U.S. State Department, September 10, 2008:
“ ... It is the intention of the Government of India and its entities to conclude discussions with US nuclear energy firms and conclude agreements Construction of nuclear power units at least at two sites approved by the Government of India, which would be capable of generating a minimum of 10,000 MWe on the basis of mutually acceptable technical and commercial terms and conditions that enable a viable tariff regime for electricity generated.”
- The Joint Statement Issued by President Obama and Prime Minister Singh, New Delhi, November 8, 2010:
“They reiterated their commitment to build strong India-U.S. civil nuclear cooperation through the participation of the U.S. nuclear energy firms in India on the basis of mutually acceptable technical and commercial terms and conditions that enable a viable tariff regime for electricity generated.”
- The Joint Communique’ between U.S. Secretary of State and the Indian Foreign Minister, New Delhi, July 19, 2011:
“They reiterated their commitment to build strong India-U.S. civil nuclear cooperation through the participation of the U.S. nuclear energy firms in India on the basis of mutually acceptable technical and commercial terms and conditions that enable a viable tariff regime for electricity generated.”

Cost of Electricity – “Viable Tariff”

- 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. The Czech utility cancelled the tender in April 2014 due to its inability to security government subsidies
- 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 the 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

India: Nuclear Liability – Present Status

- 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 (India claims Article XII.2 of CSC allows such modifications):
 - 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]

India: Nuclear Liability – What Next?

- 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 required 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 looking into the creation of a Nuclear Insurance Pool with the help of the Ministry of Finance that will involve multiple state-owned insurance companies 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 between the U.S. and India in the near future

India: Administrative Open Issues

- 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, was that approvals took a long time
 - 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 the “India Specific” 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 as planned

India's "Plan B"

-
- 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 it may take longer to mature. It may proceed independent of foreign LWR vendors entering the Indian nuclear market

Closing Remarks

- Nuclear power will continue to grow, but the growth will mostly occur either in countries with rapidly growing economies or newly emerging third-world markets
- Most new customers of nuclear power will be government owned utilities and any new procurements for nuclear power will be based on long-term infrastructure development plans in these nations. This reality calls for a different business model than what U.S. suppliers have traditionally implemented in the past
- At the same time, the number of exporters offering nuclear reactors has increased with most being owned by governments who engage in promoting civil nuclear commerce as integral to their national foreign policy
- The U.S. government, while having made significant progress in projecting “Team USA” and “Atoms for Prosperity” awareness campaigns in the international arena, nevertheless does not promote U.S. nuclear exports as an extension of U.S. foreign policy in a consistently strong manner. The U.S. Government also needs to promote and assist U.S. nuclear vendors in joining the supply chain of non-U.S. reactor suppliers
- Recent proposals from the U.S. Administration and the U.S. Congress to change domestic and export laws will inhibit civil nuclear trade overseas, and especially with developing countries that are making huge commitments to nuclear power
- India is looking at alternatives if it is unable to achieve its stated goal of procuring 40 GWe of imported LWR’s
- Success for U.S. suppliers will not come easy. A combination of proven designs with actual construction experience, value engineering that maximizes local outsourcing, and creative financing is necessary to be affordable, but not sufficient. In many cases, nuclear reactors sales may be only a part of a bigger “package solution” for infrastructure development planned by a recipient country

Backup

- Background Articles Written by Author on the U.S. – India Nuclear Deal can be Sourced at:

<http://www.kashmirforum.org/articles.htm#agree>