

Private Circulation



# ASIAN NUCLEAR ENERGY

Powering Global Nuclear Commerce

Vol. 2 Issue 1 Jan - Feb 2009

## U.S. Nuclear Trade Mission Looking for Joint Ventures



# In This Issue



## COVER STORY 05

**U.S. Nuclear Trade Mission Looking for Joint Ventures**

06

## FOCUS

**India's N-Energy Generation Projected to Touch 57,000 MW by 2030**



## INTERVIEW 13

**Develop Thorium-Based Reactors to Reduce Uranium Imports**

15

## OPPORTUNITY

**Obama Supports N-Deal, Promises to Make it Work**



## OPPORTUNITY 19

**Two-Way Indo-US Nuclear Trade to Get Big Boost**

24

## OPINION

**India will Make Greater Contribution in N-Energy Area**



Founder Chairman  
**Late Shri R.K. Prasad**

**Distributed by:**  
**New Media Communication Pvt. Ltd.**

**Managing Editor:** Satya Swaroop  
**Director:** B.K. Sinha & Cdr. P.S. Amar  
**Group Editor:** Dev Varam  
**Creative & Content:** Sunetra Nair  
**Consulting Editors:**  
Prabhoo Sinha, Rajiv Tewari,  
Md. Sabir Nishat & Archana Sinha  
**Strategic Advisor:** Vinaya Shetty  
**Deputy Editor:** Tripti Chakravorty  
**Asst. Editor:** Chandra Karki

**Head-Busi. Dev.:** Veerendra Bhargava  
**Manager:** Sunil Kumar  
**Sr. Executive Special Project:** Prajwala Poojary  
**Account Asst.:** Vrunda Gurav  
**Circulation:** Madhavi, Jawaharlal  
Santosh Gangurde, Vijay Wangade & Suraj Jha

**Art Director:** Santosh Nawar  
**Visualisers:** Maya Vichare & Sagar Banawaliakar  
**Photographer:** Bilal Khan

**BRANCHES:**  
**Kolkata:**  
Anurag Sinha, Regional Head, Mob: 098300 15667  
Amrita Chatterjee, Asst. Editor, Mob: 098360 63759  
E-3, 4th Floor, Swagata Apartment,  
Thakurpukur Kolkata- 700 104  
Tel: 033-24537708. Fax: 033-24380719  
Email: anurag@newmediacomm.biz

**Pune:**  
Jagdish Khaladkar, Regional Director,  
Tel: 098230 38315  
Geeta K., Regional Head,  
Sahyog Apartments 508, Narayan Peth,  
Patrya Maruti Chowk, Pune 411 030.  
Telefax: 020 2445 1574  
Email: pune@newmediacomm.biz  
jagdishk@vsnl.com

**Australia Office:**  
Bandhana Kumari Prasad, 129 Camboon Road,  
Noranda, Perth, W.A. 6062 Tel: 0661 892757447  
Email: bandhana@newmediacomm.biz

**New Media Communication Pvt. Ltd.,**  
New Media House, 1 Akbar Villa,  
Near Old State Bank, Moral-Maroshi Road,  
Andheri (E), Mumbai - 400 059  
Tel: +91-22-2925 0690. Telefax: +91-22-2925 5279  
E-mail: enquiry@newmediacomm.biz  
www.newmediacomm.com

**Printed & Published by**  
Satya Swaroop, from New Media House, 1 Akbar Villa,  
Near Old State Bank, Moral-Maroshi Road,  
Andheri (E), Mumbai - 400 059.  
Tel: +91-22-2925 0690. Telefax: +91-22-2925 5279

The news items and information published herein have been collected from various sources, which are considered to be reliable. Readers are however requested to verify the facts before making business decisions using the same.



## India, the Land of Opportunities, Welcomes US N-Trade Mission

Dear Reader,

Greetings. Asian Nuclear Energy welcomes the US Nuclear Trade Mission to India. We take this opportunity to salute the Mission members and its facilitators - the US-India Business Council and the Nuclear Energy Institute (NEI) - for their resolve to undertake this visit, which has been rescheduled in the wake of the November 26 terrorist attacks on Mumbai. This resolve also emphasizes the Mission's objective of exploring the opportunities in India in the field of civil nuclear energy and what the US firms could offer their Indian counterparts in terms of the state-of-the-art technology. Today, the world is knocking at India's doors, thanks to the Indo-US civilian nuclear energy deal. This single deal, which has passed through the toughest of times in both India and the United States in the last three years, has opened up amazing opportunities for global nuclear commerce. The US nuclear industry, which has remained inert for nearly three decades, is active again. Even before the Indo-US deal was formalized, France signed a similar nuclear pact with India. Russia, which is already a major nuclear partner of India, has also inked a comprehensive deal to further fortify and expand its nuclear ties with this country. Canada is re-entering the Indian nuclear market. Recently, the UK government too has lifted its ban on nuclear-related exports to India. Suddenly the nuclear option has caught the imagination of the whole world. Most countries are planning to set up nuclear energy plants in order to cut down on carbon emissions. Global warming has truly served a warning to nations. In the midst of all these developments, India has emerged as a major catalyst of nuclear commerce. Remember, this country has been treated as a nuclear pariah for more than three decades for the sin of having developed nuclear weapons, though they were strictly meant to be deterrents. The sanctions slapped on India in the wake of its testing a nuclear device in 1974 had been further reinforced in 1998 when the country exploded a nuclear bomb. These sanctions had denied India access to advanced nuclear technology. But all this has changed now. In a significant development, the 45-nation Nuclear Suppliers' Group (NSG) in September 2008 agreed to waive its restrictions on India. Two things have helped change the global attitude towards India. First, India's record as a responsible nuclear weapons country and its assurances to abide by nuclear safeguards as stipulated by the International Atomic Energy Agency (IAEA) have satisfied all the parties concerned. The second is India's emergence as a global economic power in the last two decades. India's unprecedented economic growth, averaging at the annual rate of 8-9 percent, has unleashed the country's hunger for energy to sustain its development. Hence the civilian nuclear energy option, which is now taking a concrete shape. Nuclear technology and component supplying companies as well as raw material exporters from the US, France, Canada, Russia and a host of other countries are joining the queue at India's door. India has arrived on the world nuclear scene. And that's what counts. We wish the US Nuclear Trade Mission a success and all our readers a Happy and Prosperous New Year.

Wish you happy reading

Satya Swaroop  
Managing Editor  
satya@newmediacomm.biz

# U.S. Nuclear Trade Mission Looking for Joint Ventures

In a significant move that may trigger nuclear commerce on a massive scale between the United States and India, the former will be showcasing its advanced technological might in this field at various Indian nuclear centers in January, 2009.

A Commercial Nuclear Mission, initiated by the US-India Business Council and the Nuclear Energy Institute (NEI) is arriving in Mumbai in the third week this month for talks with officials of the Indian nuclear establishment and representatives of private sector companies keen on joint ventures in this field.

The largest trade mission of U.S. commercial nuclear executives ever to visit India includes around 50 delegates representing more than 30 US companies, some of whom are globally well known.

Led by Steve Hucik, GE-Hitachi, the mission comprises delegates from General Electric, Westinghouse, Bechtel Nuclear, the Shaw Group, Babcock & Wilcox, Black & Veatch, Fluor, CH2M Hill, Curtiss-Wright, Holtec International, Uranium One, Thorium Power, Cameco, Converdyn, and USEC, among others.

The group was to have visited India in December, 2008 but its itinerary was rescheduled due to the terrorist attacks in Mumbai, the commercial capital of India, on 26 November.

This is the first nuclear delegation to visit India after the signing of its historic nuclear deal with the US on October 11, 2008 in Washington. The intent of this visit is to establish an advantage in the projected \$150 billion business potential with India.



The message is clear; it's nuclear commerce. The US, whose economy is passing through an unprecedented downturn, is keen to take advantage of energy-starved India's potential to help its own nuclear energy industry. It's a win-win situation for both India and the US. But the bigger winner is the nuclear commerce and trade across the globe, with benefits percolating down to each and every member of the 45-member Nuclear Suppliers' Group.

The US is keen to be among the first major players to take advantage of the deal it has signed with India. France, the bulk of whose energy requirements are met by nuclear power and Russia have also signed a civilian N-pact with India.

The main purpose of the Mission, comprising executives from major nuclear reactor technology manufacturers, nuclear energy engineering and consulting firms, suppliers of nuclear fuel, conversion technologies and radiation analysis experts, is to spur commercial activity in both India and the US.

It may be noted that the US nuclear energy industry has been rather inactive for more than three decades, with not a single plant having come up during this period. Now that the US initiative has been launched, there will be a deluge, with most other countries falling in line. After all, nuclear energy is the best deterrent to the effects of global warming, with its effectiveness to reduce carbon emissions across the globe. ■

# India's N-Energy Generation Projected to Touch 57,000 MW by 2030

Now that the euphoria kicked up by the Indo-US deal in civilian nuclear energy has subsided, top nuclear scientists and analysts expect very tangible benefits in terms of nuclear power generation in India and project it to touch 57,000 MW by 2030 against the 4120 MW currently produced from 17 nuclear power plants.

Nuclear scientist and author L. V. Krishnan, former director of the Safety Research and Health Physics Group at Kalpakkam believes that the nuclear energy share could jump in about two decades from six percent as of now to anywhere between 20 percent and 30 percent of the contribution from coal, which still accounts for the bulk of power generation in India.

"That is the growth potential that seems within reach now," Krishnan said in an article written for an internet news website. He referred to a study by the Centre for the Study of Science, Technology and Policy based in Bangalore, there is a good chance of nuclear power contributing about 57,000 MW by 2030 through LWRs and FBRs. By building more PHWRs too -- with totally indigenous technology, but run on imported uranium fuel -- the level could touch 70,000 MW or higher. Krishnan pointed out that the Indo-US nuclear deal will help in improving the country's power situation in at least three ways. First, it makes it possible to procure uranium from the world market. But, according to the separation plan indicated by the Prime Minister in Parliament, only four reactors with a total capacity of 740 MW out of a total of 4,120 MW come under safeguards this year. Any natural uranium that India bought right now would help fuel only these four reactors. The relief that would bring for the other operating reactors would be quite small.

More reactors would be placed under safeguards in 2010, 2012 and 2014, taking the total in this category to 2060 MW with an annual fuel requirement of about 330 tonnes, which could be met by imports. No significant improvement in power generation from imported uranium

could be expected for the next few years. Thereafter, annual import of uranium could rise to 1200 tonnes when the total capacity of the safeguarded heavy water reactors reaches 7,660 MW, so as to maximise electricity output. Very little of it is likely to come from the US because the US itself relies on imports to meet over 75 per cent of its needs.

Second, building several light water reactors with outside help could lead to a rapid rise in the share of nuclear electricity. Needless to say, all of these would be under safeguards. The rise would be limited primarily by the size of the investment the country can make given the prevailing capital cost of the reactors -- which seems to range between Rs 9 crore and Rs 13 crores per megawatt -- and the number of teams that could be deployed to build them. To expect around 30 new reactors by 2020 does not seem unrealistic if capital is available. Rather than rush to place orders, it would be wise to negotiate with the different interested suppliers to bring the prices within an affordable range. The Chinese have set a good precedent here.

Third, new plants are needed for recovery of plutonium in the spent fuel from the heavy water reactors to launch a sizable fast breeder programme. Some thought should be given to establishing quickly a large national reprocessing facility under safeguards. Procurement of some equipment, components and instruments from foreign suppliers might hasten the process. The prototype fast breeder reactor now under construction seems to be making good progress. But, it is not under safeguards. Future breeders could be built in a shorter time, if they



were to be placed under safeguards.

Currently, few other countries have interests similar to that of India. Most are not too keen to reprocess spent fuel, being content to store it away, though this is likely to change some time in the future. They do not also have plans for an early fast breeder programme as India does, being more keen to burn plutonium than breed. Nor do they have a thorium programme. If we pursue our interests unmindful of what others may do, there could come a time when they choose a similar path and follow us.

Investment on a national enrichment facility to support imported light water reactors needs careful

consideration. It may not seem necessary as long as lifetime fuel supply is assured. Such a facility would still depend on uranium supply from external sources, and therefore subject to disruption in operation in the event of a supply cut off.

Between 1990 and 2007, power generation in the country through use of coal rose by about 75 percent, from 40,000 MW to 70,000 MW. Assume for a moment that over the next 23 years it trebles to reach 210,000 MW -- that is, coal output increases by over threefold to 1,200 million tones. This is far less than what some think is needed to support continued 8 per cent GDP growth but still no mean achievement, if it happens. ■

---

## **NPCIL to raise N-power generation by five-fold to 22,000 MW in five years**

The nuclear deal between India and the US has infused a new lease of life into the country's sole nuclear power company, the Nuclear Power Corp of India Ltd (NPCIL), which has so far managed to install 4,120 MW of capacity. Now, NPCIL has set its eyes on an ambitious target of 22,000 MW in the next five years. S K Jain, Chairman and Managing Director of NPCIL, talks about how the company is well equipped to grab the opportunity coming its way in a newspaper interview. Excerpts.

Today, NPCIL has 17 reactors under operation and five under construction, which will be commissioned to the grid next year. So then, we will have 22 reactors. This will have a total capacity of 4,400 mw based on heavy water.

The current five-year plan calls for eight reactors of 700 MW with our own technology and fuel. That will take the programme to 10,000 MW. This is the maximum that can be produced with the available resources of uranium in the country.

So, in the absence of a deal, we would have generated some 10,000 MW for the next 20 years. Plus another 2,000 MW by fast breeder reactors. The subsequent stages, wherein we will be using plutonium and

thorium, is a long-term programme, which will take another three to four decades.

Still this 10,000 MW would have been a problem, because of the difficulties in the country - environmental apprehensions over uranium mining kept mining projects from commencing, so mining could not keep pace with the nuclear power programme. As a result, the 17 reactors we have are operating at 50 percent capacity.

Even the eight units of 700 MW which will be taken up in the current five-year programme were actually supposed to be taken up in the last five-year programme. Therefore, the expansion of nuclear capacity has been deferred by four to five years just because of the constraints of mining.

### **How much fuel will you need to run the reactors at 100 percent capacity?**

There are already six reactors under safeguards. Out of these six, only one is a heavy water reactor, for which we require fuel. Eight more reactors that are proposed under the 11th five-year plan will be brought under International Atomic Energy Agency safeguards. For these nine reactors (1 heavy water + 8 new reactors), we require 400 tonnes of natural fuel per year. And around 40 tonnes of enriched uranium for Tarapur I and II and 60 tonnes per year of enriched uranium for Kundakulam I and II. ■

## 21 N-Power Projects in the Pipeline

In September, India and France signed a landmark nuclear cooperation accord in Paris, paving the way for the sale of French nuclear reactors to New Delhi and a new era in bilateral ties. Like the Indo-US nuclear deal, it covers the supply of reactors and atomic fuel and is being seen as a key step in India's bid to secure its position as a nuclear power.

India is kick-starting its nuclear facilities by setting up 21 nuclear power projects based on three different technologies which include the setting up of six French reactors of 1,600 MW, four Russian reactors of 1,000 MW and four American reactors of 1,500 MW within the next five years.

Sources in the Nuclear Power Corporation of India Ltd (NPCIL) point out that each of these reactors is likely to cost a minimum of \$2 billion and will collectively produce 30,000 MW of nuclear energy.

While the French nuclear company Areva is setting up the French reactors, the Russian public sector unit Rosatom and the US' General Electric and Westinghouse are likely to be shortlisted for setting up reactors.

Rosatom has already set up four nuclear reactors in Koodankulam which are expected to be operational in early 2009. According to NPCIL sources, the power generated from the Koodankulam plants

will be available at Rs 2.50 per unit. But nuclear physicist R. Raman expects the production cost of power being generated from nuclear plants to average around Rs 4 per unit though the cost to the consumer will be much higher.

"The NPCIL has to keep its price competitive. Coal-based power is available at Rs 2.50 per unit. Nuclear power will also have to compete against wind and solar energy. Nuclear fuel cannot be sold at a rate higher than other energy sources available in India," said Raman. "The cost of dismantlement and spent fuel costs will have to be included in this price," he added.

NPCIL is planning to set up 10 light water reactors (LWRs) which are cheaper than the existing pressurised heavy water reactors. NPCIL scientists point out it is cheaper to transfer technology and set up the plants in India, for which land will have to be acquired.

A nuclear project includes generating equipment, a water system, civil works and the entire electrical distribution system. NPCIL sources are confident that 30 percent of inputs for each of these projects can be sourced from within India.

Apart from the 10 LWRs envisaged under the Indo-US nuclear cooperation deal, NPCL is also planning to set up eight reactors of 700 MW, three fast breeder reactors and one advanced heavy water reactor of 300 MW. The LWRs will be fired by imported uranium. The first two will come up in 2014-15. ■



## A Big Breakthrough towards Uranium Self-Sufficiency

# India Develops World's 1st Prototype Advanced Heavy Water Reactor

India is the first country in the world to develop a prototype Advanced Heavy Water Reactor (AHWR), as the mainstay of its nuclear power programme. This is a new kind of reactor that uses a mix of thorium and uranium as fuel and yields more uranium than it actually consumes. It would thus enable India to become self-sufficient in its supplies of uranium.

"We have completed the designs and even the peer review. Now we are in the stage of completing the safety review and work on the construction of the first AHWR could begin as early as next year," said Anil Kakodkar, Chairman of the Atomic Energy Commission. Kakodkar, who is also Secretary in the Department of Atomic Energy, said the Nuclear Power Corporation should take about seven years to construct the first AHWR. The company could go full steam ahead to construct other AHWRs, after monitoring its performance for

a year or two, which could become the stronghold of the country's nuclear power programme by 2020.

AHWR is particularly close Kakodkar's heart since he has been working on the design and other aspects of this groundbreaking reactor for the last decade. It is also the realization of a dream by Homi Bhabha, known as the father of the Indian atomic energy programme, since it will enable India to use its large thorium deposits for producing nuclear power.

Kakodkar said, India is currently adding nine new units to its nuclear power programme which will take the installed capacity of the Nuclear Power Corporation from the current 2,700 mw to over 6,700 mw by the year 2008. Presently, Russia is involved in the construction of two of the units. But India would be happy to accept offers from other countries, including France, which have expressed interest in participating in its ambitious project of taking the total nuclear power capacity to 20,000 mw by the year 2020. ■

## Canadian Assurance as N-Commerce Begins

# India Can Buy Uranium Anytime & Even stockpile

Canada, one of the key members of the Nuclear Suppliers Group (NSG), has said that India can order for uranium anytime and can even stockpile.

"India can place order for uranium anytime and they can also stockpile it," Gerald W Grandey, President and Chief Executive Officer of Cameco Corporation of Canada (largest suppliers of uranium) told reporters on the sidelines of Homi Bhabha's Centenary celebrations' inauguration in Mumbai recently.

"We have been waiting for a long time for the Indo-US deal to come through and since IAEA India specific agreement and NSG's waiver are in place, we are keen that India buys uranium from Canada anytime," Grandey, a key person who helped in the

Indo-US deal process, said.

"Now it is up to India how soon they want and how much and under what conditions," he said adding "we are ready, the decision lies with New Delhi as the customer is always right."

Grandey said, the contractual agreements are not done overnight, it takes its own time and since they had been waiting for long, they wanted India to do it fast.

Replying to a query on stockpiling, Grandey said, "stockpiling is a normal thing and under the general policy, one can stockpile for one or two years. Since in Asian countries due to scarcity of supply of uranium, they can stockpile even up to three years of inventories just as Japan has done." ■

# Japan's N-Team in India, Keen to Build Power Plants



A delegation of senior engineers representing Japanese nuclear power reactor vendors is currently visiting India. Representatives from Mitsubishi Heavy Industries (MHI), Toshiba and Hitachi began a week-long visit beginning 23 November to meet top Indian nuclear officials.

The visit by the representatives of the large Japanese companies to India for the first time since a three-decade ban on atomic trade with the country ended is an indication that they are keen to catch up with the US and France in the race to build power plants in this country.

India's first atomic test in 1974 prompted other countries to form the suppliers group and block nuclear exports to the nation.

The 45-member Nuclear Suppliers Group, which includes Japan, lifted its ban in September, enabling the passage of a landmark nuclear deal between the United States and India. This has allowed India to buy nuclear fuel and technology from the world market for its civilian energy programme.

Takuya Hattori, delegation head and president of the Japan Atomic Industrial Forum, said recently in Tokyo that the senior engineers from Mitsubishi, Toshiba and Hitachi will meet top officials of the Indian nuclear establishment.

The US and France have agreed to transfer civilian nuclear technology to India, allowing General Electric Co and Areva SA to compete for the reactors India plans to build. In Japan, the only country ever attacked with atomic weapons, popular resistance discouraged

Prime Minister Taro Aso from signing a cooperation accord with Indian Prime Minister Manmohan Singh in Tokyo last month.

"If Japan continues to talk with India with the current undecided, opaque stance, there is risk that India may turn its back on Japan," Hiroshi Sekimoto, a professor in the nuclear energy department at Tokyo Institute of Technology, said. "China, Russia and France are willing to cooperate with India."

"Japan is in a difficult situation," said Sekimoto. "The government should consider whether it can gain the public's consent if it's going for a deal with India."

India, the second-fastest growing major economy after China, aims to build 40,000 megawatts of nuclear capacity by 2020, equivalent to a third of the country's total power generation.

The monopoly Nuclear Power Corporation of India Ltd (NPCIL) plans to buy more than \$14 billion of equipment next year, Chairman S. K. Jain said. NPCIL is negotiating with General Electric and Westinghouse Electric Co. of the U.S., Russia's Rosatom Corp. and Areva, the world's biggest reactor maker, he said.

The seven-member Japanese delegation will meet Jain and Atomic Energy Commission Chairman Anil Kakodkar. They will tour nuclear sites and attend a seminar hosted by NPCIL.

"We will probably talk about the future of India's nuclear industry and exchange information on what kind of cooperation the countries can have in future," Hattori said. "We haven't decided on any concrete subjects at this moment."

The forum meets every two months to discuss nuclear relations with India. ■

# Canada keen on N-deal, looks at Business Avenues



Canada and India are negotiating a comprehensive nuclear deal that will allow the latter to develop civilian nuclear power plants, a spokesperson of the Canadian foreign office has said.

Lisa Monette, the spokesperson, told an Indian news agency said both sides had "informal" discussions in September and expect to schedule a formal session soon. Canada signalled its support for India's re-engagement with the broader nuclear energy community when it backed the Nuclear Suppliers' Group (NSG) decision.

At the same time, federally owned Atomic Energy of Canada Ltd is looking to re-enter the Indian market and is currently negotiating a nuclear co-operation agreement with India that would allow AECL to re-establish business ties, despite concerns that India has not signed the international nuclear Non-Proliferation Treaty.

"India is a responsible democracy that shares with Canada the fundamental values of freedom, democracy, human rights and respect for the rule of law," she remarked.

"India has made substantial non-proliferation and disarmament commitments to achieve the trust of the Nuclear Suppliers Group, which were reiterated in a political statement on September 5."

The negotiations come after Canada backed a decision by the NSG to provide an exemption for India that would allow it to develop civilian nuclear power even as it maintains its right to develop weapons

without international scrutiny, Monette said.

She said Canada and India have longstanding bilateral ties built upon shared values of democracy and pluralism and strong people-to-people links. In recent years, both countries have been working to enhance bilateral cooperation in a number of areas of mutual priority.

The 2005 Canada-India Joint Statement reaffirmed the commitment of both the countries to deepen their bilateral dialogue on key global issues and enhance their cooperation in areas of mutual priority, including regional security and counter-terrorism; science and technology; environment; bilateral trade and investment; and people-to-people links, Monette said.

Pact with Belgium.

Meanwhile, the Indian Nuclear Society has entered into an agreement of cooperation with the Belgian Nuclear Society on 11th November, 2008 to promote peaceful uses of nuclear energy in accordance with international obligations.

India has signed the agreement during King Albert II's visit to India. Belgium is seeking Indian collaboration on the development of its MYRRHA accelerator-driven system (the acronym is taken from Multi-purpose Hybrid Research Reactor for High-tech Applications, and features a sub-critical fast nuclear core), while India is looking to participate in the ITER (International Thermonuclear Experimental Reactor) fusion project.

The five-year agreement was signed at the University of Madras by Indian Nuclear Society vice-president V. Venugopal and the Belgian society's past president, Franc Deconinck, in the presence of the visiting King Albert II. It will be reviewed and extended after five years. The two societies hope that the agreement will promote cooperation in nuclear science for use in medical research, cancer therapy, crop mutation and applied sciences.

Indian and Belgian universities took advantage of King Albert's presence to sign a slew of memoranda of understanding for cooperation in education and research.

Addressing scientists and delegates at a seminar on 'Nuclear research towards sustainable development' organised by the Indian Nuclear Society and the university, King Albert II said "Belgium was happy to collaborate with India in several areas of science and technology, particularly in nuclear programme and water desalination (a technological byproduct of nuclear reactors). You have developed thorium as fuel for nuclear reactor. I would be happy for more mutual

exchange and collaborations in the coming years in some of these areas. Water desalination of sea water is another area we are interested in collaborating for common projects," he said.

Presenting a paper on the Myrrha reactor that Belgium is developing at a cost of Euro 750 million, William D. D'Haeseleer, director, University of Leuven Energy Institute, said this multipurpose reactor could be 'a very good radio isotope production machine'.

'India has made considerable advance in using thorium as reactor fuel and has mastered closed fuel cycle technology. We in Belgium are looking to collaborate on know-how in this area,' D'Haeseleer said. ■

---

## Indo-French N-Dialogue on EPR

In the French capital, Paris, Indians are being recognized, since there is a huge new renaissance in Indo-French relations. The two countries are engaged in high value nuclear dialogue.

With India receiving recently a green signal from the Nuclear Suppliers' Group to restart nuclear commerce with the world, one country that is likely to benefit from this development. It is France, which has offered to India its top of the line nuclear reactor called the European Pressurized Water Reactor (EPR), the first to be operational in the world, though they are under construction in two places. Each 1600-megawatt reactor that the French state owned company Areva has proposed is likely to cost upwards of Euro 3.5 billion to construct. Confirming the offer, Jean-Jacques Gautrot, special advisor to the Areva CEO Anne Lauvergeon, Areva, Paris said, "we are at the beginning of the commercial process in India."

The EPR is the mother of all nuclear power reactors, since none in the world are so large. It has been designed jointly by Areva in France and Siemens in Germany and as of now only six of these monsters have been ordered in the world, two each to be made in Finland, France and China in the coming years. The Finnish reactor being made at Olkiluoto is likely to start generating power next year.

According to Areva, EPR is the 'most efficient and surest thing for India', since this third generation nuclear reactor it has enhanced safety features; saves over 17 per cent in uranium usage as compared to similar older

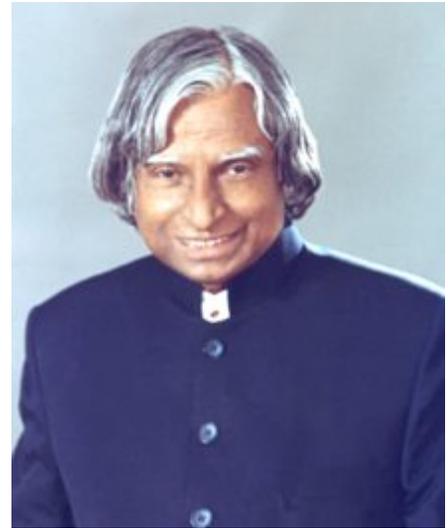
nuclear reactors; and has been designed for over 92 per cent availability. The total cost of construction and operation of an EPR over its entire life time works to be about 5 Euro cents per kilowatt hour, which Areva estimates is the cheapest for any kind of power reactor including solar, wind, coal and gas.

India has suggested that the French set up a big nuclear energy park in western India that can produce upwards of 10,000 MW from a single location, Dr S K Jain Chairman cum Managing Director for Nuclear Power Corporation of India Limited, the Indian state entity with which Areva is negotiating confirmed that the Jaitapur site south off Mumbai has been set aside for the French where land acquisition procedures have already started in earnest. Gautrot acknowledged that Areva was 'happy' with the Indian choice of the location for the proposed EPR.

Dr Jain also emphasized that India's goal is to produce locally as much as 80 per cent of the nuclear reactor by the time last pair of EPR have to be constructed and this is the only way the local industry can benefit when costly high technologies have to be imported. But a very cautious Gautrot said 'On transfer of EPR technology talks have not opened'.

One important guarantee India seeks from any nuclear vendor is a life-time uninterrupted supply of nuclear fuel and the right to re-process spent fuel. Gautrot said 'Areva will be able to give guarantee for lifetime supply of nuclear fuel to India for the 50-60 year full life of the EPR reactor'. ■

# Develop Thorium-Based Reactors to Reduce Uranium Imports



An exclusive interview, former President Abdul Kalam, a renowned nuclear scientist himself, tells Shekhar Gupta, Editor-in-Chief of Indian Express newspaper, that while the Indo-US nuclear deal will help India in effectively meeting its energy needs, the scientific community must develop thorium-based reactors in order to reduce dependency on uranium imports to make the fuel.

For five years you talked about entry and re-entry, about India becoming a superpower. When you took office, we had tested a nuclear bomb for the second time in Pokhran, missiles were going up. Isn't it wonderful that your re-entry into citizenry has coincided with India's achievement of nuclear legitimacy?

I don't know what you mean by nuclear legitimacy. I will say (we have become) a nuclear weapons state. India graduated in May 1998 as a nuclear weapons state. Whether some people agree or not doesn't matter.

**What has happened now? What does the Indo-U.S. nuclear deal do? Where does it take India's status from what we were in 1998?**

I have a definite view on that. The whole agreement is focused on uranium shortage and also the fact that we want to open up our programmes internationally so that we will get co-operation. This is one

issue. But I have a feeling. I have told atomic scientists they should immediately launch a thorium reactor process, for we have thorium in abundance. Our scientists have already begun work. It's a tough area for research because thorium is not fissile material; you have to convert it into fissile material. That means you need fast-breeder reactors; we need a number of them. I believe that in five to seven years India will have thorium-based nuclear reactors for power generation.

**And do we see Prof Kalam getting involved with that research?**

No. There are many nuclear scientists and they are doing



fantastic work. So all my best wishes to them. Whenever they call me, I will go to them.

**But this deal, the 123 agreement, is it good for India? What is your view?**

My feeling is that, given the shortage of uranium, and the fact that we have a number of nuclear reactors based on uranium, it looks to me that there's a logical conclusion. But that does not prevent us from seeking self-reliance in thorium-based nuclear reactors. This is what I'll say to young scientists: 'Let's pull all our might and come out with a thorium-based reactor.'

**Sir, if I may persist with this, do you see the deal as a deal about energy or about strategic interests?**

I feel it's about energy. After all, our nuclear scientists have a vision. Every year, they want to add about 1,000 MW. So in that continuation, by 2020, they want to have 20,000 MW. They want to graduate to India having 20,000 MW by adding 1,000 MW every year. So the whole vision is about how to get 1,000 MW every year.

**In the long run, do you see the two streams -- uranium and thorium -- competing?**

No, finally, it should be our own material, for we are rich in thorium. I am confident our nuclear scientists will succeed in this. Once we succeed, uranium-based reactors may co-exist (with thorium-based ones) but the new reactors will all be thorium-based ones.

**And those don't even have to be safeguarded.**

No, not at all. For it's your own development.

If I may persist with this . . . I apologise to you, but there's a view, which is also my view, that this (the deal) finally takes India away from the grip of nuclear apartheid.

No, there was such a club. And definitely, the deal has paved the way, after scientist-to-scientist, technology-to-technology interaction. We are doing well. In nuclear reactors, the efficiency of power production is very good.

**So it (the deal) has paved the way to joining the club.**

No, I will say that, as a result of this agreement, we definitely have options. Many options are open to us. It will remove constraints. But the most important requirement for me is self-reliance.

**Sir, on the eve of Pokhran II did you ever imagine this would happen? We expected sanctions and international reactions. Did you imagine that in less than 10 years, this (deal) would happen and that India would become a member of the nuclear club?**

You see, I said it nearly 10 years back, and even yesterday, I propagated that strength respects strength. In this present world, strength is very important. So if you have strength in a particular technical area, then other people will come around. In any area.

**Can we compliment Dr Manmohan Singh for having achieved this?**

It's unique, what he has done or qualified?

When we met recently, before finishing my assignment (as president), I told the prime minister that thorium reactors are very important.

So that's the qualification we must keep focusing on -- thorium. He, too, said we must progress there (on that front). ■

## Indo-US N-deal will Aid India's Energy Projects - Kalam

Backing the Indo-US nuclear deal yet again, former President A P J Abdul Kalam said the agreement would solve the uncertainty of getting Uranium for India's energy projects.

Kalam stressed that there was an urgent need to find alternative energy sources. "With the signing of the Indo-US nuclear deal, uncertainty of getting uranium for India would not be there," he said.

He listed sustainable development, industrial ecology

and a solid environmental policy as the need of the hour. "Humankind is taking more from nature than it is giving, thus there was a need for sustainable development.

Kalam also said India should concentrate on developing solar energy, addressing shortage of water and setting up thermal power plants. Scientists should focus on research and developing alternate sources like the wind energy. ■



## Obama Supports N-Deal, Promises to Make it Work

courage you showed in shepherding the civil nuclear cooperation agreement through your Parliament, the IAEA, and the NSG," he wrote, and pointed out, "I was pleased to vote by proxy for the agreement in (Senate Foreign Relations) Committee today, and I very much hope we can vote on this agreement before the US Congress goes out of session (the Senate voted overwhelming in favour of the deal on October 1 with Obama casting an aye vote)."

"As you know, there are some procedural obstacles that may prevent a vote this year," but he promised, "when it does come up for a vote, however, I will of course vote in favour. If time should run out in the current Congress, I will resubmit the agreement next year as president," Obama said.

"I strongly support civil nuclear cooperation, because I believe it will enhance our partnership and deepen our cooperation on a whole range of matters. Importantly, it will help India to meet its growing electricity demands while aiding in the important effort to combat global warming. But I see this agreement only as a beginning of a much closer relationship between our two great countries. I would like to see US-India relations grow across the board to reflect our shared interests, shared values, shared sense of threats, and ever burgeoning ties between our two economies and societies," he said in the letter.

Obama then laid out his vision for US-India relations going forward by suggesting that "as a starting point, our common strategic interests call for redoubling US-Indian military, intelligence, and law enforcement cooperation."

"The recent bombings remind us that we are both victims of terrorist attacks on our soil, and we share a common goal of defeating these forces of extremism," he pointed out.

Thus, Obama called for New Delhi and Washington to be in sync in terms of working together "to promote our democratic values and strengthen legal institutions in South Asia and beyond."

"We should also be working hand-in-hand to tap into the creativity and dynamism of our entrepreneurs, engineers, and scientists to promote development of alternative sources of clean energy," he said. "Imagine our two democracies in action: Indian laboratories and industry collaborating with American laboratories and industry to discover innovative solutions to today's energy problems. That the kind of new partnership I would like to build with India as president," he wrote.

Obama also expressed the hope "that a civil nuclear cooperation agreement can open the door to greater collaboration with India on non-proliferation issues," and informed Prime Minister Singh that

Prime Minister Manmohan Singh, the architect of the Indo-US nuclear deal, along with President George Bush, is least worried about its future implementation. Because, he has found a strong supporter in US Democratic presidential nominee Senator Barack Obama, the man who would be the President in all probability.

Regretting that he could not meet with Prime Minister Singh during the latter's recent visit to the US, Obama has, in a letter to the Indian leader, expressed his "great admiration for the courage you showed in shepherding the civil nuclear cooperation agreement through your Parliament, the International Atomic Energy Agency and the Nuclear Suppliers Group."

The letter, dated September 23 on the day of the Prime Minister Singh's arrival in New York, Obama said at the outset, "I am very pleased that your visit provides us with the opportunity to strengthen the US-India relationship: deepening and broadening the friendship between our countries will be a first-order priority for me in the coming years. I am sorry that I was unable to meet with you on this trip, but very much look forward to doing so in the near future."

"I also want to take this opportunity to express my great admiration for the

"this subject will be one of my highest priorities as president. I am committed to the goal of a world without nuclear weapons, and will make this a central element of US nuclear weapons policy."

"I will work with the US Senate to secure ratification of the international treaty banning nuclear weapons testing at the earliest practical day, and then launch a major diplomatic initiative to ensure its entry into force," he said.

The Comprehensive Test Ban Treaty was envisaged to be one of the major foreign policy successes of the Clinton administration, and president Clinton was on the verge of pressing India and Pakistan too into signing this treaty, but all of his plans were thwarted

when the then Republican-controlled US Senate dumped this agreement and refused to endorse it, much to the embarrassment of Clinton and his administration.

In fact, at the time it was rumored that the Clinton administration was holding out India and Pakistan's acquiescence to signing the CTBT as a quid pro quo to the lifting of the punitive sanctions imposed against both New Delhi and Islamabad after their tit-for-tat nuclear tests in May of 1998.

In his letter, Obama vowed to "also pursue negotiation on a verifiable, multilateral treaty to end production of fissile material for nuclear weapons," known as the Fissile Material Cut-off Treaty. ■

---

## 'Indo-US N-Deal Unique, Cannot be Replicated with Pakistan'

The United States has said that the Indo-US nuclear deal is unique in nature and cannot be replicated with Pakistan.

"The agreement we have with India is unique to India, not a model for anything else," Assistant Secretary of State for South and Central Asian Affairs Richard Boucher, said at a recent Round Table on Pakistan, held in Washington.

Describing the Indo-US civilian nuclear agreement as "unique" which cannot be replicated elsewhere as a model, the Bush administration has made it clear that Pakistan cannot be the beneficiary of a similar deal and no such cooperation with Islamabad is on the table.

The nuclear cooperation with Pakistan is "just not on the table," he said, according to a transcript released by the State Department.

Boucher's remarks came against the backdrop of repeated statements by the Pakistani leadership seeking a nuclear agreement on the lines of the Indo-US deal.

"We are absolutely committed to working with Pakistan on Pakistan's energy needs. And indeed during the strategic partnership meeting we had with the Foreign Minister and others who were here, we talked about Pakistan's energy needs. We talked about how to improve the cooperation. And Pakistan's energy problems are also balanced by Pakistan's energy potential," Boucher said.

Speaking about Pakistan's energy potential, the senior Bush Administration official said "a lot of that is in coal, particularly clean coal; a lot of it's in hydro power, in some of the mountainous areas of the country; a lot of it's in alternate energy wind farms and other things down by the Macram coast."

"So in the end we're going to help Pakistan, work with Pakistan on Pakistan's energy potential which has a uniquely Pakistani character. That's where we really need to reinforce our efforts. And we heard very strongly from the Pakistan side they want us to do more. We told them we agreed. We'd try to step up our cooperation," Boucher said.

When asked about nuclear cooperation with Pakistan, he said "it's just not on the table."

"But as I said, the goal is to help Pakistan with its energy needs. When a kid turns on the light bulb to do his homework he doesn't really care if the light comes from coal, hydro, nuclear or whatever.

"He cares that the light bulb goes on. We want to help turn the lights on for kids to do their homework," Boucher said agreeing with the notion that there is indeed a "very serious" energy crisis in Pakistan.

"Absolutely. I think there's a developing programme by the government to address those energy needs. But yeah, there's a lot to do, and unfortunately a lot of the energy investments take time so it's hard to immediately satisfy the needs for energy that are appearing now," he said. ■

# Deal will Open Up Broader Dialogue on Nuclear Energy - Prof Karl F. Inderfurth



Karl F. Inderfurth, a Professor at the Elliott School of International Affairs at George Washington University, believes that the US-India nuclear deal will open up a much broader dialogue in the field of nuclear energy. Inderfurth, a foreign policy adviser to the presidential campaign of Sen. Barack Obama, expressed this following viewpoint in a recently released report of the Asia Foundation, entitled America's Role in Asia: Asian and American Views.

A strong India is important for balance of power purposes in Asia and for providing stability in the strategically important Indian Ocean littoral area. India is in a position to safeguard sea-lanes that are used to transport more than half the world's oil and gas. The navies of the United States and India have begun to conduct joint exercises aimed against threats to maritime commerce.

There has been a quantum jump in U.S.-India defence ties in the past several years - with joint military exercises, the signing of a 10-year defence framework agreement, and increased interest in defence procurement and collaboration between defence industries. These ties should be accelerated.

Another arena for greater strategic cooperation is in counter-terrorism. India has been a target of terrorist attacks longer than the United States. Expanding counter-terrorism cooperation requires increased information sharing and building tighter liaison bonds between U.S. and Indian intelligence and security services.

Underpinning the strategic partnership should be a concerted effort to realise the full economic potential of the U.S.-India relationship. Steps need to be taken to deepen commercial ties, identify and remove impediments on both sides (still far too many), and clear the way for a new era of trade cooperation and investment. Deeper economic ties will also have the added advantage of providing needed ballast in the overall relationship when political differences arise, as they surely will.

It has long been a goal of the United States to engage India as a partner in global efforts to control the spread of nuclear weapons.

But for more than a quarter of a century, the two countries have been on the opposite side of the nuclear divide - unable to reconcile India's nuclear weapons programme and its security compulsions with the nuclear nonproliferation concerns and policies of the United States.

The US-India civilian nuclear agreement announced in 2005 launched a major effort to bridge that divide. With that

announcement, the United States explicitly recognised India's status as a full-fledged nuclear power, and committed itself to a partnership in the realm of civilian nuclear energy. The recent decision of the 45-member Nuclear Suppliers Group to approve access by India to nuclear fuel and technology is a major step forward in this regard. It brings to an end, in Prime Minister Manmohan Singh words, "India's decades-long isolation from the nuclear mainstream." Over time these developments may open the door to an even broader nuclear dialogue the United States and India could pursue, especially to counter the dangers posed by nuclear know-how proliferating and non-state terrorist groups seeking to obtain and use weapons of mass destruction, something that neither country wants to see.

At the same time, it is also essential to recognise that the civilian nuclear agreement is an important part - but not the sum total - of the much improved and expanding broad-based relationship between the two countries that already includes sensitive areas once virtually off limits to any form of cooperation, such as high-technology transfers and joint ventures in space. These areas were once considered the "litmus test" of the new US-India relationship. That test is being passed. ■

## 21 Firms Seek Permission to Build 34 Reactors

# US N-Energy Industry Poised for Great Revival

After three decades of stagnation, the American nuclear energy industry is poised for a great revival. According to the Nuclear Regulatory Commission, 21 companies have sought permission to build 34 power plants, from New York to Texas.

Also, factories are springing up in Indiana and Louisiana to build reactor parts. Workers are clearing a site in Georgia to put in reactors. Starting in January, millions of electric customers in Florida will be billed several dollars a month to finance four new reactors.

Very recently, the French company Areva, the world's largest builder of nuclear reactors, and Northrop Grumman announced an investment of more than \$360 million at a shipyard in Newport News, Va., to build components for seven proposed American reactors, and more for export.

The change of fortune has come so fast that the Nuclear Regulatory Commission has gone into a frenzy of hiring, bringing on hundreds of new engineers to handle the crush of applications.

Many problems could derail the so-called nuclear revival, and virtually no one believes all 34 proposed plants will be built. It is still unclear how many billions they would cost, whether the expense can be financed in a troubled credit market, and how the cost might compare with other power sources.

But experts who follow the industry expect that at least some of the 34 will be built. But given rising public concern about global warming and a recent history of reliable operation among nuclear plants, "the climate for introducing new plants is probably the best it's been since the industry started canceling plants" 30 years ago, said Brian Balogh, a history professor at the

University of Virginia. Unlike most types of power generation, nuclear plants do not emit the gases that cause global warming, once they are completed.

In the United States, orders for new reactors essentially ended in October 1973. That was also the month that the Arab oil embargo began, inaugurating an era of economic problems that drove up construction costs and suppressed demand for power. In the end, more than 100 nuclear reactors, some in advanced stages of construction, were canceled, and tens of billions of dollars were squandered.

On top of that, the Three Mile Island accident in 1979 and the Chernobyl explosion in 1986 made nuclear power a hard sell. And cheap turbines were developed to burn natural gas to generate electricity. By the 1990s, even some nuclear plants that had been running for a few years were deemed too costly and were closed.

But nuclear power never went away. The United States has 104 commercial reactors in operation, and the industry has improved their reliability markedly, increasing their output. They generate almost 20 percent of the country's electric power.

"We have a long-term vision," Anne Lauvergeon, chief executive of Areva, said in an interview here on Thursday, explaining her company's decision to join forces with Northrop Grumman at Newport News.

To help spur a revival, Congress provided \$18.5 billion in loan guarantees in a 2005 energy law, plus operating subsidies similar to those available for solar and wind power, and insurance against regulatory delays. The Georgia Power Company wants new units adjacent to its two Vogtle reactors, finished in the 1980s, and workers there are tearing down old buildings left over from that construction to make space for new construction.

At the Port of Lake Charles, La., the Shaw Group and Westinghouse Electric, owned by Toshiba, are building a factory bigger than 10 football fields that will make components for new reactors in the United States and around the world. BWX Technologies, a subsidiary of McDermott International, is setting up a plant in Mount Vernon, Ind., to resume manufacturing reactor vessels and other big components. Both companies expect work for years to come. ■



# Two-Way Indo-US Nuclear Trade to Get Big Boost

The civilian nuclear energy agreement between India and the United States has opened up opportunities of enormous proportions for both countries. It will help both countries to undertake expansion of their nuclear power generating capacities. While India expects to benefit from the deal in terms of improved supply of nuclear fuel and upgradation of technology, it is in a position to offer to US companies, highly-skilled and low-cost manpower who execute construction of plants in both countries.

The massive two-way trade opportunities in the field of nuclear energy were highlighted by experts from both countries said at a recent seminar, organized by the Georgia Institute of Technology.

US companies will now be able to work on nuclear power plants in India, which plans to increase its nuclear power output from 3,800 megawatts to at least 30,000 megawatts over the next 25-30 years. The US currently produces about 100,000 megawatts of nuclear power.

Under the agreement, India will be able to provide engineers and technology for the U.S. nuclear power plant expansion, which would be possible as India's nuclear industry grows.

For instance, if Southern Co. gets



approval for two new reactors at Plant Vogtle near Waynesboro, Ga. it might be able to hire engineers from India as the U.S. faces a critical manpower shortage in the nuclear field.

Southern Co. wants to build two new 1,150 megawatt reactors at Plant Vogtle. Vogtle currently has two reactors, each capable of producing 1,215 megawatts of power.

Anupam Srivastava, Director of the Asia Program at the University of Georgia's Center for International Trade and Security, estimated that US companies will be benefited by \$10 billion to \$12 billion in business over the next seven or eight years from India's nuclear expansion.

In the US, applications for 26 new reactors are pending before the Nuclear Regulatory Commission, said spokesman Joey Ledford.

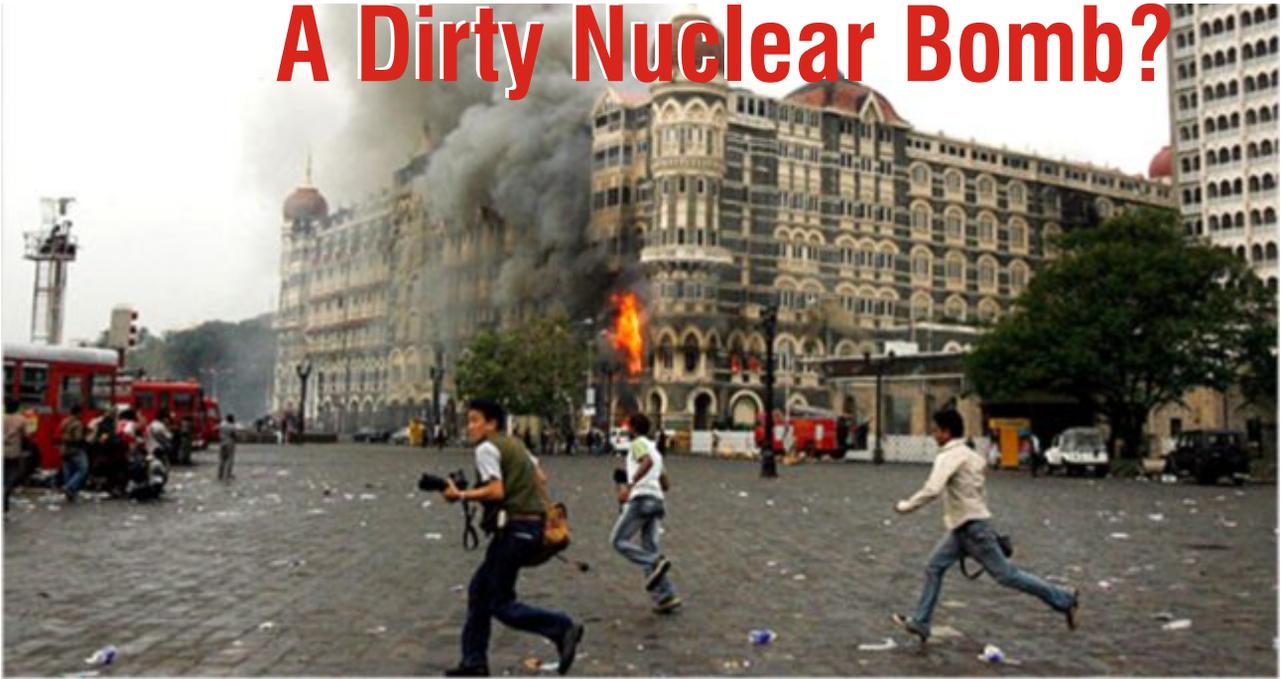
As India's nuclear industry grows, it will be able to provide the US sector with engineers, said V. Siddhartha, member of a United Nations committee on nuclear non-proliferation. A recent report by the American Physical Society cited "critical shortages" in the US nuclear workforce, in part because of a 30-year lull in nuclear plant construction here.

"Insourcing" engineers, parts, components and sub-systems from India could lower the capital costs of U.S. nuclear plant construction, Siddhartha said. India is also researching nuclear reactors that use a chemical element, Thorium, as fuel.

"India's vast Thorium reserves - the second largest in the world - could very well become the world's nuclear fuel of choice by the middle of the century," Siddhartha said.

"The business opportunity is a two-way opportunity," he said of the U.S.-India nuclear deal. "It's not a one-way opportunity." ■

# Next in Terrorist Arsenal, A Dirty Nuclear Bomb?



Terrorists struck Mumbai, India's financial capital on 26th November, killing nearly 200 people. The Islamic jihadists, who had come by sea, used guns, grenades and RDX bombs to perpetrate the massacre before they were shot dead by Indian commandoes. In the latest attack, the worst hit was the Taj, the city's iconic landmark five-star hotel, just a grenade throw from the premises of India's Atomic Energy Commission. Amidst the anger and anguish triggered by the bloody event, which may not be the last, there looms a question in everyone's mind as to what would be the next step by the next wave of terrorists? A biological warfare? Or use of a dirty nuclear bomb?

Experts say that a nuclear device for any terrorist would be a radiological dispersion bomb. This so-called 'dirty bomb' would consist of waste by-products from nuclear reactors wrapped in conventional explosives, which upon detonation would spew deadly radioactive particles into the environment. This is an expedient weapon, in that the radioactive waste material is relatively easy to obtain. Radioactive waste is widely found throughout the world, and in general is not as well guarded as actual nuclear weapons.

In the United States, radioactive waste is located at more than 70 commercial nuclear power sites, in 31 states. Enormous quantities also exist overseas - in

Europe and Japan in particular. Tonnes of wastes are transported long distances, including between continents. In Russia, security for nuclear waste is especially poor, and the potential for diversion and actual use by Islamic radicals has been shown to be very real indeed.

The threat from radiological dispersion dims in comparison to the possibility that terrorists could build or obtain an actual atomic bomb. An explosion of even low yield could kill hundreds of thousands of people. A relatively small bomb, say 15-kilotons, detonated in Manhattan or Mumbai could immediately kill upwards of 100,000 inhabitants, followed by a comparable number of deaths in the lingering aftermath.

Extreme versions of such gamma-ray emitting bombs, such as a dynamite-laden casket of spent fuel from a nuclear power plant, would not kill quite as many people as died on 11th September 2001.

A terrorist attack on a commercial nuclear power plant with a commercial jet or heavy munitions could have a similar affect to a radiological bomb, and cause greater casualties. If such an attack were to cause either a meltdown of the reactor core (similar to the Chernobyl disaster), or a dispersal of the spent fuel waste on the site, extensive casualties could be expected. In such an instance, the power plant would be the source of the

radiological contamination, and the plane or armament would be the explosive mechanism for spreading lethal radiation over large areas.

In the US there have been a series of dire new warnings about possible terrorist threats-capped by a government commission's report that terrorists are likely to stage a biological or nuclear attack somewhere in the world during the next five years.

The drumbeat started recently, when Director of National Intelligence Mike McConnell said that the potential for a WMD attack in the coming decades is growing. The probability is increasing, he said, that the world will see "large casualty terrorist attacks using chemical, biological, or, less likely, nuclear materials." And the U.S. intelligence community recently released a study warning of an increased

risk of the use of mass-casualty weapons by 2025.

"With a nuclear attack, it's a one-shot deal," says an expert. "With a biological attack, terrorists can strike a city, reload the aerosol can, and come back a week later with the same agent and attack again."

At the same time, terrorist groups currently lack both the materials and the scientific know-how to produce biological weapons, he said, adding, that hurdle could be overcome if the price were right.

As for warning of a likely attack in the next five years, that conclusion was reached after the commission interviewed more than 250 scientists, intelligence, governmental, and nongovernmental experts around the world from Vienna to Moscow to Sandia National Labs in New Mexico. ■

## India on Guard against Terrorist Attacks on N-Plants

India's nuclear establishment has tightened security at its various atomic reactors and power plants across the country, in the wake of the recent terrorist attacks on Mumbai in which nearly 200 people were killed.

According to Atomic Energy Commission Chairman Anil Kakodkar, the security of the nuclear power plants across the country is being reviewed and any additional measures required to protect them will be put in place.

"Already several security measures have been put in place. We are reviewing in the context of what happened in Mumbai and certainly whatever additional (security), which are necessary, we will put in place", Kakodkar said in the southern Indian city of Chennai.

A terrorist attack on a commercial nuclear power plant with a commercial jet or heavy munitions could have a similar affect to a radiological bomb. It can cause greater casualties. If such an attack were to cause either a meltdown of the reactor core, or a dispersal of the spent fuel waste on the site, extensive casualties could be expected. In such an instance, the power plant would be the source of the radiological contamination, and the plane or armament would be the explosive mechanism for spreading lethal radiation over large areas.

S Basu, Facilities Director, Bhabha Atomic Research Centre (BARC), who visited Kalpakkam in Tamil Naeu, welcomed the Government's announcement declaring Kalpakkam nuclear power plant and 10 km radius around it as a "no fly zone", following heightened threat perception to sensitive installations.

Almost in every security meeting held following the recent Mumbai attacks, the intelligence agencies had been stressing the need to declare Kalpakkam a no fly zone.

Atomic Energy Regulatory Board (AERB) chairman S K Sharma who together with Basu visited Kalpakkam to take part in a seminar on safety, said that the nuclear installations in the country are safe as the 'in-built' security system of reactors made them immune to any attacks, including from air.

The Directorate-General of Civil Aviation (DGCA) sent notice to all airlines, prohibiting all flying activity up to a height of 10,000 feet over the Kalpakkam area.

The government declared the Kalpakkam nuclear power plant a no fly zone to prevent any 9/11 kind of targeting of this sensitive site. Kalpakkam now joins the only other atomic installation, Tarapur in Maharashtra, to have flights barred over its immediate airspace. ■

# US Helped India Integrate into Global Nuclear Commerce Regime

- Ashley J. Tellis

**When the history of Indo-US relations is written, Ashley J. Tellis, an Indian American strategist, will find a very special place in the riveting narrative of how the nuclear deal was conceived, birthed, nurtured, protected and finally delivered against heavy bureaucratic and political odds. As senior advisor to the US State Department, Tellis shepherded the deal in Washington, liaised with the Indian Government at the highest levels and, most importantly, kept the faith.**

**He spoke to Seema Sirohi of rediffmail.com on the issue. We reproduce important excerpts.**

**To what do you attribute the constant tension in getting the deal through?**

This was built into the very nature of the initiative, which could not have gone ahead if Sonia (Gandhi) had not made the political decision to confront the Left. The administration sought the deal primarily as an effort at building a new relationship with India, whereas many in the United States, including Congress, would acquiesce to it only to the degree that it contributed to non-proliferation objectives. Since the deal was to change over 30 years of US policy, it wasn't easy. The bill to approve the deal says that the Hyde Act would be supreme.

It's Congress's way of affirming that its own legislation is supreme. I don't see why that should matter to India in any material sense. What should matter to India is the 123 document, which represents its agreement with the US. But the Hyde Act (Henry J. Hyde United States-India Peaceful Atomic Energy Cooperation Act of 2006) is a big problem for India. It's mainly a rhetorical problem because the Indian Government has asserted that the Hyde Act and other US legislation do not bind India. That's both right and wrong.

It's right in that India is not party to the Hyde Act or the Atomic Energy Act but it is wrong in that these domestic laws define the boundaries within which the 123 Agreement has been negotiated. The purpose of the deal was to help preserve an Asia not dominated by a single power.

Congress has expressed its intention but how that is

implemented will depend on the executive and the circumstances. Moreover, the international community is under no obligation to comport with Congressional preferences.

**Will President Bush take care of India's concerns when he signs the Bill into Law?**

I don't know what his statement will say. What matters is the principle. Every President since Richard Nixon has very zealously guarded and protected his prerogatives under the Constitution. So I expect that President Bush, if he issues a statement, will say that he will implement the legislation without undermining his prerogative to conduct foreign policy.

**Will Bush's commitment in his statement bind future presidents?**

No signing statement issued by one president binds another. Ultimately, it all depends on what the policies of the day are but the policies towards India will only grow more liberal over time.

**The bill requires Congress approval for future reprocessing agreement?**

Not really. The reprocessing agreement will be treated as a subsequent agreement, which does not require affirmative Congressional approval. If Congress wants to disapprove of the agreement, however, it will have to find a veto-proof two-thirds majority.

**The tough language has created disquiet in Delhi.**

Yes, the disquiet has arisen because everyone in India wanted literally a one-line resolution of approval. While that was desirable even from the administration's point of view, it was unrealistic. Our Indian critics shouldn't forget that despite Congressional discomfort with the deal, it has essentially voted a resolution that does not materially change anything fundamental in the 123 Agreement. It has articulated various expressions of policy, but little else.

There are presidential reporting requirements and determinations, which are operative, but these don't burden India. The bottom line is that the legislation doesn't change anything that the US or India has

committed to. We shouldn't miss the forest for the trees.

**Would there be trouble if India were not to follow the US line on Iran?**

I think there will be no consequences at all for the deal. India doesn't follow the US line in the WTO, it doesn't follow the US line on climate change. Why should Iran be any different? The two are not linked. Our US opponents forced a linkage because they were trying to get leverage during negotiations. India will be free to pursue its own foreign policy and we will do the same with ours.

**Why did the US decide to do this deal?**

There are sound strategic reasons for it. It was to engineer a new beginning between our two countries. This administration felt very strongly that the old policy of trying to target India was not yielding fruit, and that it had become counterproductive. So Bush made the bold decision that he was going to change existing policy in very dramatic ways. Over the last four years, he put in place various building blocks to implement this change.

**Was it partly driven by the rise of China?**

It has nothing to do with the rise of China directly. The purpose of the initiative was to strengthen India, help it to grow as a power of consequence. That objective, if successful, would be good for India and the United States: it would help to preserve an Asia not dominated by any single power.

**Did you ever feel the deal may not survive?**

I never believed its demise was ever a possibility. I was in very close touch with leaders at the highest levels in the Indian and US governments. Whatever the uncertainties in the body politic, the President and Secretary of State never wavered in their determination to push hard once they got the go ahead from India. Congress has voted a resolution that does not change anything fundamental in the 123 Agreement.

Prime Minister Manmohan Singh was absolutely determined to make this happen.

**What was Foreign Minister Pranab Mukherjee's role?**

He played an extraordinary role. Next to the Prime Minister, he was the singularly most important individual at two or three different levels. First, only he could negotiate with the Left-he was always very sober

and never victim to extravagant expectations. Second, his bureaucratic weight in the government and his years of experience were critical. He kept the bureaucracy going, reached out to the coalition, dealt with the press, and argued the case vigorously in Parliament.

**Aren't you forgetting a very important lady?**

No, I am not. I think Sonia Gandhi was obviously critical as was Rahul. But whatever they did, they did behind the scenes, at a level I was not privy to. It is quite obvious that this initiative couldn't have gone forward if Sonia had not made the extraordinary political decision to confront the Left. That was ultimately her call.

**If the Democrats come to power, what are the implications for the deal?**

I hope they stay the course. With the deal completed, the action now moves to the private sector. The goods and services of interest to India are not provided by the US government but by private companies. The Government is an important bystander because it controls licensing. If you get an administration that is uncomfortable with the deal, you could postulate that there might be some reluctance to issue licences freely. But on the other hand, any future administration will have to appreciate the consequences for US industry if it were to implement licensing policy in a curmudgeonly fashion.

The great thing about the deal ultimately-and this is George W. Bush's most magnificent bequest to India-is not simply the restoration of the US-Indian tie in regard to reopening civilian nuclear commerce but rather the integration of India into the global nuclear commerce regime. What Bush has effectively done is to provide India with multiple lifelines if for whatever reason the US is unable to deliver in the future.

**You are an advisor to Senator John McCain's campaign. Describe him.**

He is quite a remarkable man. He has a strong sense of duty, honour and commitment to country. He is very focused on thinking about the world and the US in strategic terms. He is not driven by ideology or whim. There is a strategic consciousness that he brings to bear, a consciousness that takes him pretty much in the same direction that it took President Bush as far as India is concerned. If you have a McCain administration, you will have nothing but very good news from the perspective of US-India relations. ■

# India will Make Greater Contribution in N-Energy Area - Dr. Anil Kakodkar

The year 2008 had been a remarkable year for India, said Dr. Anil Kakodkar, Chairman, Atomic Energy Commission and leader of the Indian Delegation to the 52nd Annual General Conference of Member States of the International Atomic Energy Agency (IAEA), held from 29 September to 4 October, 2008.

"This has been a remarkable year for India in the field of nuclear energy," Kakodkar said in his address to the Conference. Following are the excerpts from his speech.

"The approval by consensus of the Agreement for the Application of Safeguards to Civilian Nuclear Facilities by the IAEA Board of Governors and the Statement on Civil Nuclear Cooperation issued by the Nuclear Suppliers Group have created conditions for India to make an even bigger contribution to the growth of international civil nuclear cooperation. Here we would like to acknowledge the contribution and assistance of our close friends in the international community who have made it possible.

While development of such cooperation will contribute to the strengthening of India's energy security, India is also looking forward to enhance its assistance to friendly countries. India has an ongoing programme on 220 MWe PHWRs, a reactor system that is competitive in terms of capital costs, safety performance and unit energy cost. This system is well suited to the needs of countries with small electricity grids, especially those in the developing world.

Today we have reached a critical point in global development efforts, which is marked by a huge increase in the energy requirements of emerging economies, unfulfilled developmental aspirations of a vast majority of the global population and the serious threat that our planet faces in terms of climate change. According to the Inter Governmental Panel on Climate Change, "warming of the climate system is unequivocal, as is now evident from observations of increases in the global average air and ocean temperatures, widespread melting of snow and ice and rising to global average sea level".

It is, therefore, clear that as we work towards meeting enhanced energy requirements, we need to realize this not in the business as usual mode but with much greater dependence on non-fossil energy sources. Such an approach is necessary as a part of climate change mitigation strategies, as well as for sustainability of available energy resources.

"One of the challenges that all of us engaged in nuclear technology development must address is to drive knowledge based holistic approach to the entire gamut of technology-society interface."



India has accorded high priority to realizing a significantly larger share for nuclear power in our overall electricity generation. Rapid development of nuclear energy has the viable potential for making the necessary energy available for sustainable development of the world at large.

India has been practicing a comprehensive programme in atomic energy covering the entire fuel cycle in respect of uranium, plutonium and thorium based fuels. While the three stage development of our nuclear programme is dictated by our prime long-term objective of realizing energy independence on the basis of our vast thorium resources, our understanding and experience with thorium clearly reveals several benefits of the thorium fuel cycle, particularly in heavy water reactors, in terms of proliferation resistant nuclear energy production as well as efficient fissile plutonium disposal which may also be of interest to other countries. ■

# N-Energy, Key Global Business Driver

We would witness the "Destiny of Two Nations" in creating a new world order where wealth creation for one does not require other to lose - Tulsi Tawari

In the upheaval of major collapse of financial bubbles starting from the US, the world economy is entering a new era of correction and paradigm-shift through realignments. Leading nations (from Asia, Europe and America) require to connect strategically for making the whole world prosperous and safer for all people simultaneously.

No one can hope to grow at the cost of others any longer. Nuclear energy, being the most vital global strategic parameter, should be seen as the key business driver in developing cross-border-value-chains in reshaping the global commerce as never before. The world has seen devastating effects of

release of energy from an atom; the time has come to demonstrate the constructive power of an atom to lead strategic-cooperation among nations to maximize wealth-creation for all world citizens.

The nuclear tie-up between India and US represents the greatest strategic initiative ever, not only in the interest of these two nations rather the whole world, as this opens the path of knowledge-exchange among scientists, technologists and entrepreneurs at a level the world has never seen before. In a sense, what we would witness is the "Destiny of Two Nations" in creating a new world order where wealth creation for one does not require other to lose.

---

## N-Energy is the Best Answer to Power Woes

- M.R. Srinivasan

Nuclear energy is the best answer to all power woes. That was the gist of a talk organized by the Bangalore Management Association and Karnataka Power Transmission Corporation, where former Chairman, Atomic Energy Commission, M.R. Srinivasan described the nuclear energy as the best option to meet country's energy needs.

He felt southern India is going to be one of the biggest platforms to cultivate this energy after foreign powers like Russia have started investing in a high-capacity plant at Kudankulam in Tamil Nadu.

There are two operating nuclear power stations at Kaiga in Uttara Kannada. Two more are about to get started, which will make it a 880 MW plant. According to Srinivasan, the Power Grid Corporation of India is also looking for two more sites to locate two 700 mega watt plants, and considering Kaiga as one of the possible locations.

Additionally, the Kudankulam power station is supposed to supply power to all the southern states, including Karnataka. "Russia is keen on building four more units in Kudankulam. The 123 agreement has

facilitated such investment and if everything goes fine, the deal will be signed in December. And Karnataka will also enjoy a share of it," he outlined.

India produces 150 gigawatts of energy, of which only four gigawatts is nuclear. But the government is presently focusing on rapid ramp-up, which would translate to almost 30 gigawatts of nuclear energy by 2020. Srinivasan said nuclear power, on an average, costs Rs 2 per unit, which is acceptable considering the price of coal at Rs 1.50.

Principal secretary (energy) K Jairaj said the state is spending up to Rs 9 per unit, which is costing the government a lot. There is 17 to 20 percent energy shortage in the country. "The power crisis is looming larger every day. There is inadequate supply, distribution inefficiencies, losses to theft, local resistance to hydro plants for ecological reasons, and of course, our state does not produce coal or lignite." The power that comes to Raichur thermal plant is transported from Talcher in Orissa and the transportation cost is three times higher than the cost of coal. ■

## ONGC & UCIL Sign Pact to Explore Uranium

The Oil and Natural Gas Corporation Ltd. has recently signed a memorandum of understanding with the Uranium Corporation of India Ltd. for cooperation in uranium exploration and development.

The MoU was signed in New Delhi by ONGC Chairman and Managing Director R. S. Sharma and UCIL Chairman and Managing Director Ramendra Gupta, in the presence of Dr. Anil Kakodkar, Chairman of the Atomic Energy Commission and Secretary, Department of Atomic Energy.

The aim of the agreement is to exploit the complementary expertise of the two public enterprises. ONGC has rich experience in hydrocarbon exploration. UCIL, run by the Department of Atomic Energy, is in the forefront of uranium mining and processing, backed by the Atomic Minerals Directorate for Exploration and research headed by Dr. Anjan Chaki. UCIL is actively exploring possibilities of acquiring uranium properties and exploration licences in several countries.

UCIL has been doing prospecting for uranium in the states of Meghalaya, Rajasthan, Andhra Pradesh and Karnataka, but it has been stymied by environmental

concerns and non-availability of sophisticated mining equipment. Currently the country depends almost entirely on the Jaduguda mines in the Singhbhum district of Jharkhand, which cannot supply the quantities required to run India's nuclear power plants at full capacity.

India's uranium production is very small compared with countries such as Canada, Australia and Kazakhstan.

Earlier this month, India and Russia signed an agreement for the Russian supply of uranium to Indian nuclear power plants, which is expected to jack up capacity utilization of existing Indian nuclear power plants to 90 per cent from the current low level of 40 to 60 per cent (a result of a uranium shortage).

The agreement, signed by Prime Minister Manmohan Singh and Russian President Dmitry Medvedev ties up the supply of 2,000 tonnes of uranium to India. India has also signed up France for the supply of 300 tonnes of uranium for two proposed 1,000-MW light water reactors to be built by Areva, the French nuclear power equipment company. ■

---

## 'Atomic Energy Act to be Amended to Catch Up With N-Tech Advancement' - Kapil Sibal

Union Minister for Science & Technology and Earth Sciences Kapil Sibal has sought amendment to Atomic Energy Act of 1962 in a bid to help India build bridges with nuclear power producing countries to end its technological isolation.

Speaking at a function organized by ASSOCHAM and Society of Indian Law Firms (SILF) in New Delhi recently which conferred upon him Outstanding Law Leader Award 2008, Sibal said India would have to initiate legislation process in a manner so that technological bridges are established with economies of scale.

According to him, the current Indian laws are too prototype and old that do not allow India to keep pace with technological advancement that has been taking

place worldwide.

He said the current legislation procedures that exist in India also do not understand the significance and importance of technological revolution which is why there is a disconnect between legislative process and business development.

Referring to amendment to the Atomic Energy Act 1962, Sibal felt that it should be initiated as early as possible to defeat the competitors of India as most of their laws have been modified to absorb imports of technology while India has still been sustaining and trying to build on 19th centuries laws which do not allow businesses to self regulate. ■