

**Thorium Power, Ltd. – News Update  
August 31, 2007**

**Letter from Seth Grae, CEO**

Dear Stockholders:

We are pleased to share this latest news update, which includes company news as well as industry-related developments.

**Media Coverage**

In an extensive analysis titled “Thorium: Cleaner Nuclear Power,” *Power Technology* noted that Thorium Power is at the forefront in driving the push for a wider use of thorium, noting that “thorium could be a major step towards making nuclear power cleaner, safer and more secure.” Elsewhere, *The Hindu* reported on the US-India civil nuclear agreement discussions, noting that India's nuclear power industry “has announced plans to expand the nation's 2006 installed capacity valued at more than \$150 billion.” In another article, outgoing President A.P.J. Abdul Kalam called for intensive research into converting thorium to maximize its use and to generate electricity with thorium-based reactors.

**Industry Developments**

Last month, we also observed a number of developments focused on the rapid emergence of nuclear energy debate in the mainstream. The Nuclear Energy Institute found that eighty-two per cent of people living close to US nuclear power plants are in favor of nuclear energy and seventy-one percent would be willing to see a new reactor near them. Meanwhile, the Electric Power Research Institute found that the US could save \$1 trillion in its fight against carbon emissions if it “aggressively deployed advanced technologies - including nuclear power.” Elsewhere, the Brazilian government announced that it will decide in 2008 where to build new nuclear power plants and The Department of Energy in the Philippines is set to establish a special body to study the development of nuclear energy in the country. Finally, we continue to see progress in the India-US nuclear deal and last month saw the Indian Cabinet’s unanimous support for the deal.

These latest developments continue to strengthen our unique positioning as a source of solutions to address the major industry concerns— how to solve proliferation, reduce waste and improve profitability.

Very Truly Yours,  
Seth Grae  
Chief Executive Officer

### **Thorium Power News**

**Associated Press – West Texas, UT system pushing for first-of-a-kind reactor in U.S. (08.20.2007)** – The newswire reports on plans for an Andrews, Texas-based nuclear reactor facility which involves a collaborative agreement between The University of Texas; the cities of Andrews, Odessa and Midland; McLean, Va.-based Thorium Power Inc., Sandia National Laboratories in Albuquerque, N.M.; and General Atomics.

**Power Technology – Thorium: Cleaner Nuclear Power? (08.10.2007)** – The magazine reports that the debate has begun on whether thorium is a safer, more reliable resource than uranium. The article notes that Thorium Power is at the forefront in driving the push for wider use of thorium with its proven ability to retrofit uranium reactors for thorium and its long running thorium-uranium fuel project based at Moscow's Kurchatov Institute.

**IndUS Business Journal – U.S., India overcome nuke deal squabbles (08.01.2007)** – The business journal reports on India-US civil nuclear agreement discussions, noting that India's nuclear power industry has announced plans to expand the nation's 2006 installed capacity valued at more than \$150 billion. The article also notes that US energy and infrastructure companies, including Thorium Power, Ltd., are "clamoring" to be part of the expansion.

### **Nuclear News**

**World Nuclear News – US nuclear neighbours not Nimby (08.21.2007)** – The news source reports on a recent survey commissioned by the Nuclear Energy Institute that found eighty-two per cent of people living close to US nuclear power plants are in favor of nuclear energy and seventy-one percent would be willing to see a new reactor near them.

**World Nuclear News – Epri: invest in low-carbon technology immediately (08.15.2007)** – The news site reports on a discussion document written by the Electric Power Research Institute (Epri) which found that the US could save \$1 trillion in its fight against carbon emissions if it 'aggressively' deployed advanced technologies - including nuclear power. The report notes that its proposed nuclear research program would cost the US commercial nuclear industry \$430 million per year, of a total required for all technologies of \$1.4 billion per year shouldered mainly by the private electricity sector.

**World Nuclear News – US reactor gets go-ahead for completion (08.02.2007)** – The news site reports that the board of the Tennessee Valley Authority (TVA) has unanimously approved its completion of a five-year project costing an estimated \$2.49 billion. The article notes that construction of two 1270 MWe pressurized water reactors (PWRs) began at Watts Bar in 1972 but was suspended in 1985.

**The Hindu – India must use thorium-based nuclear reactors: Kalam (07.26.2007)** – The newspaper reports on comments at Anna University by former India President A.P.J. Abdul Kalam who is a strong proponent of the country's use of thorium-based energy. The article notes that Kalam called for intensive research into converting thorium to maximize its use and to generate electricity with thorium-based reactors.

### **India-US Civil Nuclear Deal News**

**BBC News – Indian cabinet backs nuclear deal (07.25.07)** – Reporting on the major milestone reached in the nuclear deal, the news service notes that the “Indian government says that it has reached agreement with the United States on implementing a controversial civilian nuclear co-operation accord.”

**Asia Times – India splitting atoms over nuclear deal ( 08.22.2007)** – Reporting on the current impasse of the India-US civil nuclear agreement, the paper stresses that constructive engagement with the US is in India’s best interests as it sees a new international system of power and strategy emerge.

## **West Texas, UT system pushing for first-of-a-kind reactor in U.S.**

**By Betsy Blaney**

**Associated Press (ran in abc13.com, *Dallas Morning News*, *El Paso Times*, *Fort Worth Star Telegram*, *Houston Chronicle*, *LubbockOnline.com*, *MyFoxHouston.com*, *MyWestTexas.com*, *Sherman Denison Herald Chronicle*)**

**August 20, 2007**

ANDREWS, Texas — This small West Texas town that decades ago grew up out of the oil boom now wants to leap into the nuclear age.

Though years from becoming reality, a cutting-edge nuclear reactor — the first built on U.S. soil in 30 years — is being pursued not as a power source but as part of an energy research complex that could lead to advances in hydrogen power.

Those involved, the University of Texas system and several of its schools, local governments and private industry, hope to build the nation's first reactor of its kind in Andrews County, west of the city.

The county is already home to a low-level nuclear waste processing and storage site operated by a Dallas-based company.

Andrews, with a population of about 10,000 and located about 30 miles from the New Mexico border, emerged during the late 1930s as oil gushed from the vast scrub brush terrain. But the boom turned to bust in the 1980s when oil prices plummeted to about \$8 a barrel.

Since then, many West Texas communities have lost population and their economies wilted. Though oil fields elsewhere in the region and in the Permian Basin are enjoying a resurgence due to high prices, many towns and cities are hoping to tap into alternative and renewable energy industries — including wind and ethanol — to stay alive.

Andrews has hitched its hopes to a project with a long name — the High Temperature Teaching and Test Reactor Energy Research Facility — and the potential to help pull the region out of its economic doldrums.

City manager Glen Hackler says the proposed facility, expected to cost about \$500 million and be completed by 2012, would bring scientists and researchers from around the world to Andrews.

"It has the potential to continue to diversify our economy," he said. "We're convinced ... that it is as close to inherently safe as any technology can get."

About 67 percent of Andrews residents surveyed either favored or strongly favored the project, with only 10 percent opposed or strongly opposed, Hackler said.

Peggy Pryor, 57, who's lived in Andrews most of her life, is one of the latter.

Too much of the research performed inside the facility will be kept from the public, she said.

"And we don't have any control, it's out of our hands," Pryor said. "If it's so good why do they keep pushing it to West Texas? (We're) getting to be ... the dumping ground."

And what's next after the reactor? Pryor said.

"It's an open door for other things to pop in," she said. "Definitely."

One environmental group has similar concerns about what's happening in the region, noting that a uranium enrichment plant also is slated to be built just across the border in Eunice, N.M.

Public Citizen spokesman Tom "Smitty" Smith said the area is gaining a reputation as "nuclear megamall" and the reactor "would add another shop." But those who want to bring the research facility to Andrews say such fears are unwarranted. Unlike traditional nuclear power plants, the underground test reactor would be cooled by helium rather than water, which project officials say eliminates the danger of meltdown.

Japan and China are the only other countries with high temperature test reactors, and each is attempting to use them to generate hydrogen as an alternative energy source.

The Andrews reactor would be fueled with uranium, as well as some types of plutonium and thorium and nuclear wastes now stored in secure locations across the U.S., project officials have said.

Fuel pellets about the size of poppy seeds would be covered with three layers of ceramic coating and can withstand temperatures up to 3,600 degrees without rupturing.

Smith said there is a downside to such "pebble-bed" reactors.

"Seemingly minuscule flaws in one pebble could lead to significant and catastrophic results," he said. "It doesn't take much radioactive material to contaminate a community."

The idea to pursue the reactor came out of the University of Texas in the Permian Basin a couple of years ago.

In February 2006, the University of Texas system board of regents unanimously agreed to help with the project's preliminary design, approving a collaborative agreement between the system, its Permian Basin, Austin, Arlington, Dallas, El Paso campuses; the cities of Andrews, Odessa and Midland; Sandia National Laboratories in Albuquerque, N.M.; General Atomics; and McLean, Va.-based Thorium Power Inc.

Andrews County and the three West Texas cities together contributed \$1.5 million — or about half the cost — for a preliminary design. The technical portion of the plan was completed earlier this year, and work continues on the educational and business model, Hackler said.

A \$1 million federal grant from the Department of Defense will help pay precicensing fees and additional design costs, he said. The group is working to attract private investors who would build the reactor and research laboratories.

"Really, the partnership is trolling the waters," Hackler said.

## **Thorium: Cleaner Nuclear Power?**

**By Mitch Beedie**

**Power Technology**

**August 10, 2007**

With uranium reserves depleting and fear of terrorism growing, a new opening has been created for the debate on thorium. Mitch Beedie reports.

Decades ago, many countries abandoned the idea of using thorium as a replacement for uranium. But long-term proponents have always believed the thorium fuel cycle could make nuclear energy as safe and sustainable as possible.

But now there are new concerns pushing the thorium debate that revolve around secure uranium supplies and nuclear proliferation – these are encouraging research and development around the world. And then there are nations like India, which has said it aims to base its future nuclear industry on the fuel source.

"The thorium fuel cycle could make nuclear energy as safe and sustainable as possible."

The attraction for the likes of India are the several major advantages that thorium can claim over uranium. Thorium is seen by some as the nuclear fuel of the future. For a start, there is much more thorium than uranium in the Earth's crust, and all the thorium mined can be used in a reactor (compared to below 1% of natural uranium). Thorium fuel cycles also produce much less plutonium and other radioactive transuranic elements than uranium fuel cycles.

Uranium-based reactors can be retrofitted, bringing three major benefits – improving security, allaying environmental concerns and improving economics. The fuel cycle can also be proliferation resistant, stopping a reactor from producing nuclear weapons-usable plutonium. And with the spent fuel having significantly reduced volume, weight and long-term radio-toxicity, safety margins are increased and operating costs reduced.

### ***FINDING THORIUM***

Australia and India have the largest thorium reserves, and substantial deposits have been found in Norway, the US, Canada, South Africa and Brazil. For 30 years thorium-based fuel cycles have been researched in numerous countries including Germany, India, Japan, Russia, the UK and the US.

Pure thorium is a silvery-white metal that, when exposed to air, forms thorium oxide or thoria (ThO<sub>2</sub>) which has the highest melting point of any known oxide. It has found various uses including light bulbs, welding electrodes, heat-resistant ceramics and high-refractive-index glass for high-quality optical lenses.

Thorium (atomic number 90) occurs naturally, with soil often containing above ten parts per million, and it is about three times more abundant than uranium. It is found in several minerals, most commonly the rare earth-thorium-phosphate mineral monazite.

Although nearly 30 isotopes have been isolated (from thorium-210 to thorium-236) thorium has only one naturally occurring isotope: thorium-232. This decays very slowly, with a half life of millions of years. It is therefore much safer than uranium or plutonium.

### ***RETROFITTING URANIUM REACTORS WITH THORIUM***

In the US, companies such as Thorium Power, which has done intensive research and work on thorium-based nuclear designs, have already proved they can retrofit for thorium. Thorium Power says thorium-based nuclear fuels can be used in LWRs and other reactors without significant change to the reactor design.

"Pure thorium is a silvery-white metal that, when exposed to air, forms thorium oxide."

Thorium Power uses a seed-and-blanket fuel assembly. The central region or 'seed' containing plutonium provides the neutrons needed to kick-start the thorium-uranium fuel rods surrounding it in the outer region or 'blanket'.

The design is being tested in a live research reactor in Moscow which is expected to lead on to a full-size commercial reactor.

The blanket uses fuel rods that have a basic design similar to that of conventional fuel rods used in current-day commercial LWRs (light water reactors). The main difference is the material held in the pellets: thorium-uranium oxide instead of uranium oxide.

PWRs (pressurised water reactors) – a form of LWR – are the most popular reactor design. A major potential application for conventional PWRs is the light water breeder reactor. This uses a blanket of mainly thorium fuel rods surrounding a more-enriched seed element with U-235. The seed element supplies neutrons to the subcritical blanket. U-233 is produced in the blanket, where it also is burned.

But in principle, thorium can be used in all the major reactor types including light water and pressurised water reactors, heavy water reactors (HWRs), fast breeder reactors (FBRs), boiling water reactors (BWRs) and high-temperature and high-temperature gas-cooled reactors (HTRs and HTGRs) and even advanced-breeder molten salt reactors.

### ***ADS – ELIMINATING URANIUM AND PLUTONIUM?***

For new builds, a promising alternative to the seed-and-blanket approach eliminates the need for uranium and plutonium altogether. The accelerator driven system (ADS) can use thorium as the primary fuel. To get the thorium cycle going it uses a particle accelerator to fire protons at a lead target. The lead then releases neutrons that hit nuclei in the thorium fuel, starting the fuel cycle.

In the ADS, the protons cause the fertile (not fissile) fuel to fission. So, the fuel cannot sustain a nuclear reaction without the proton accelerator, and there is no radioactivity when the reactor is switched off.

"Thorium is considered by some as the nuclear fuel of the future."

The thorium core is held in a deep lead column in a high-melting point metal container. The particle accelerator fires a continuous proton beam down into the thorium core, which heats the surrounding lead and melts it with the heat-generating steam to drive a turbine.

### ***INDIA LEADS THE WAY***

In the last ten years, India's fast economic growth has doubled its electricity consumption – nuclear power supplies less than 5% of this, largely because the country's uranium reserves are small. India does, however, have large thorium reserves – about six times more than uranium. The country has therefore made thorium a major goal in its nuclear power programme.

India's Kakrapar-1 was the first reactor in the world to use thorium rather than depleted uranium to achieve power flattening across the reactor core. Both Kakrapar-1 and -2 units are loaded with 500kg of thorium fuel to improve their operation at start-up.

In 1995, Kakrapar-1 achieved about 300 days of full power operation and Kakrapar-2 about 100 days using thorium fuel. A 30kW mini-reactor has successfully operated at India's Kamini reactor at Kalpakkam. And the use of thorium-based fuel is planned in Kaiga-1 and -2 and Rajasthan-3 and -4 (Rawatbhata) reactors.

India has a three-stage plan for nuclear energy. Stage one uses uranium-fuelled PHWRs (pressurised heavy water reactors) and LWRs to produce plutonium. In stage two this plutonium-based fuel is used in FBRs to breed U-233, and more plutonium and thorium. Stage three uses advanced heavy water reactors to burn the U-233 and Pu-239 with thorium. The thorium will produce around 75% of the power, with the spent fuel being reprocessed to recycle fissile materials.

"Thorium is a much safer fuel source than uranium or plutonium."

India views ADS as a definite contender for power in the near term and for incinerating long-lived radioactive waste from the uranium fuel cycle. It has been studying all aspects of the ADS

subsystems and work is continuing on improvements to beam current from the driver accelerator and improve thermal hydraulics and materials compatibility.

### ***THORIUM – REACHING AROUND THE WORLD***

After India, the main countries driving thorium research are America and Russia with recent interest from Norway and Poland. Experiments involving thorium fuel have also been performed at a number of sites including Julich (Germany), Winfrith (UK), Peach Bottom (USA) and Kamini (India).

Russia has a long running thorium-uranium fuel project based at Moscow's Kurchatov Institute. Thorium Power is involved in this, along with the US government which is providing funding. The program should produce fuel for Russian VVER-1000 reactors instead of the standard enriched uranium oxide.

A demountable centre portion has the plutonium, and the blanket arrangement surrounding it has the thorium / uranium. Taken together, the seed and blanket are the same size as a normal VVER-1000 fuel assembly. The central seed fuel rods are based on extensive experience of Russian navy reactor design and are burned for three years (as normal for VVERs). The blanket material stays in the reactor for nine years. The process produces about half the spent fuel of MOX (mixed oxide) fuel plants and contains less fissile plutonium.

Thorium Power says it hopes for early thorium deployment in full-sized commercial reactors, the last major technical milestone before there is commercial deployment into power plants more widely. Existing reactors will need only small modifications to burn the fuel, and the fuel itself can be made in existing plants in Russia.

Recent emphasis on the project has moved to using weapons-grade plutonium in a thorium-plutonium fuel. This is an attractive possibility, allowing thorium reactors to accept highly enriched plutonium and uranium from decommissioned nuclear weapons to prevent it falling into the wrong hands.

"After India, the main countries driving thorium research are America and Russia."

There are enough stockpiled weapons to last for more than ten years with no other uranium mining.

Military plutonium can be blended with uranium oxide to form MOX fuel but thorium seems a safer alternative.

### ***WHEN WILL THORIUM MAKE AN IMPRESSION?***

Despite all of the positives, thorium does have its drawbacks. Thorium mining produces waste products like mill tailings which can escape into the environment and as with uranium, thorium mining produces radioactive mining residues containing natural long-lived natural decay products.

Monazites (rare earth phosphate materials) also contain varying amounts of uranium and there is a potential long term radiological impact. Studies suggest, though, that the risks are over an order of magnitude lower than for uranium.

Besides being relatively costly to produce, the thorium can be difficult to reprocess. The highly-radioactive U-233 has higher alpha activity than U-235 which makes it more dangerous, and separating it on its own still allows some weapons proliferation risk. U-233 can also be contaminated with U-232 traces, decaying to gamma emitters with very short half lives.

Thorium itself can be difficult to recycle because it is contaminated by highly radioactive Th-228 and despite the lower overall radioactivity, the waste from thorium plants will still take several hundred years to decay to safe levels.

### ***THE FUTURE FOR THORIUM***

So thorium still needs work before it is ready for commercialisation. And there is a risk that thorium may not be taken up by the broader industry at all. Industry observers believe that even India may not carry on with thorium reactors if it can obtain reliable uranium supplies. Uranium is

still relatively cheap, although the supply market is tightening – particularly with the massive nuclear programs underway in, for example, Asian countries.

Despite the fact that there is much more thorium available than there is uranium, uranium is not likely to run out, yet. Although there is only another 50 years for the relatively rich uranium ores, less-concentrated sources will then be attacked at the expense of higher extraction costs.

"To get the thorium cycle going an ADS uses a particle accelerator to fire protons at a lead target."

Granite and other rocks also hold uranium – it is even present in coal in trace amounts (the uranium is normally released into the atmosphere, although in theory fissioning even the trace amounts that are burned off could produce more energy than burning the coal itself). But these new sources may not even be needed as some fast reactors also breed more uranium-238 than they consume.

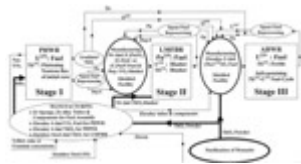
Thorium could be a major step towards making nuclear power cleaner, safer and more secure.

If ADS ever becomes viable, the technology could be used to burn off radioactive uranium and plutonium wastes, reducing them to isotopic elements that are easier to handle. But economic reasons alone will not lead to thorium adoption – in a lot of cases it will take the placement of a legal requirement by governments to for power companies to make this shift.

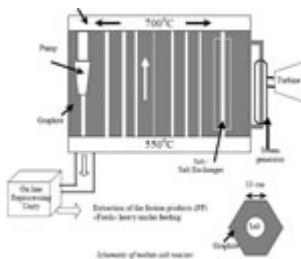
Given the new rising fear factor in regards to terrorism though, thorium adoption could meet other political needs by allowing uranium mining and plutonium production to be outlawed altogether. Without that, though, in the near future thorium's contribution to the world's power will be limited.



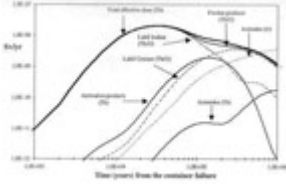
The thorium ADS (accelerator driven system) is under development in India. ADS can use thorium as its primary fuel.



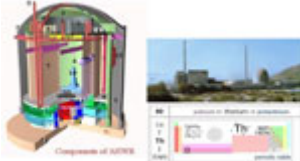
Thorium (atomic number 90) occurs naturally, with soil often containing above ten parts per million, and it is about three times more abundant than uranium. It is found in several minerals, most commonly the rare earth-thorium-phosphate mineral monazite.



Thorium can be used in all the major reactor types including light water and pressurised water reactors, heavy water reactors (HWRs), fast breeder reactors (FBRs), boiling water reactors (BWRs) and even advanced-breeder molten salt reactors.



**Radiological impact of the thorium fuel cycle. Thorium itself can be difficult to recycle because it is contaminated by highly radioactive Th-228 and despite the lower overall radioactivity, the waste from thorium plants will still take several hundred years to decay to safe levels.**



**The Indian Department of Atomic Energy (DAE) is developing a Thorium-based advanced heavy water reactor (AHWR).**

## **U.S., India overcome nuke deal squabbles**

**By Chris Nelson**

**IndUS Business Journal**

**August 1, 2007**

WASHINGTON — The U.S. and Indian governments have reached a compromise over key provisions of the civil nuclear-cooperation agreement the two nations have ratified, putting an end to a stalemate that started late last year.

Negotiators for both countries issued a short, guarded statement July 20 indicating that after meeting for more than 300 hours over four days to finalize the deal, they had reached a compromise on sticking points of the U.S.-India Civil Nuclear Cooperation Initiative, called the 123 Agreement.

"The discussions were constructive and positive, and both U.S. Under Secretary of State Nicholas Burns and Indian Foreign Secretary Shivshankar Menon are pleased with the substantial progress made on the outstanding issues in the 123 Agreement," the statement read. "We will now refer the issue to our governments for final review. Both the United States and India look forward to the completion of these remaining steps and to the conclusion of this historic initiative."

The meetings, which took place from July 17 through July 20 in Washington, involved high-ranking U.S. and Indian officials and notable contributors such as Indian national security advisor M.K. Narayanan, U.S. Vice President Dick Cheney, U.S. Secretary of State Condoleezza Rice, and U.S. Secretary of Defense Robert Gates.

Details are yet to be released, and a formal announcement is contingent on the "final review" of political leadership from both nations. But any compromise would likely involve the thorniest issue between the two countries: whether the United States should recognize India as a nuclear weapons state — one that retains the right to test its arsenal and reprocess spent nuclear fuel. The latter can be used in nuclear weapons.

"The biggest roadblock in the negotiations was whether India should be able to reprocess the spent fuel from its nuclear reactors," Sanjay Puri, chairman of the Washington-based U.S.-India Political Action Committee, said.

The Henry J. Hyde United States and India Peaceful Atomic Energy Promotion Act of 2006 opened the door for India to buy fuel, reactors and other technology for its aging civilian nuclear program for the first time in 35 years

The act amended a law that barred U.S. companies from selling nuclear material to India for its failure to ratify the 1970 Nuclear Non-Proliferation Treaty. India has been an international nuclear pariah — unable to buy nuclear fuel, parts or equipment from most nations — since it refused to sign the treaty and went on to develop a nuclear bomb in 1974.

Though India agreed in principle to a joint statement on nuclear cooperation signed by U.S. President George W. Bush and Indian Prime Minister Manmohan Singh in 2005, the country has bitterly opposed provisions of the revised agreement that would prohibit it from reprocessing spent nuclear fuel and from conducting future nuclear weapons tests.

The U.S. Congress approved the agreement on Dec. 8, 2006 and President Bush signed it into law eight days later. Securing the civil nuclear deal has long been one of Bush's top priorities, as a strategic partnership with a large country that is seen as a counterbalance to China in Asia would be a foreign policy success.

U.S. officials have consistently expressed frustration over what they saw as India's stubborn approach to the talks. Specifically, India has tried to get Washington to climb down from its insistence that all civil nuclear cooperation would be suspended if India conducted another round of nuclear weapons tests.

The Bush administration argued that the reprocessed fuel could be used to produce weapons-grade plutonium for advanced nuclear warheads. The impasse disrupted negotiations over key details of the pact, which is commonly referred to as the "123 Agreement."

(Section 123 of the United States Atomic Energy Act of 1954 — which the Hyde Act amended — establishes an understanding for cooperation as a prerequisite for nuclear deals between the United States and other nations. Such an understanding is called a 123 agreement. To date, the U.S. has entered into roughly 25 123 agreements with various countries.)

The economic incentives for the United States are huge: as the Indian government gradually relaxes controls over the country's vast economy, American companies stand to reap tremendous gains, from investments in Indian real estate to selling designer jeans and military hardware.

The Heritage Foundation, a conservative research group based in Washington, describes India as a "vibrant democracy with a rapidly growing economy," and predicted that improved relations with India "will provide a stabilizing influence in Asia."

The U.S.-India Business Council projects bilateral trade between the United States and India — worth approximately \$27 billion in 2006 — will increase rapidly as a result of the legislation, but won't come close to America's \$300 billion trade relationship with China.

India's economy has more than doubled in size over the last 16 years, and it continues to expand by approximately 9 percent annually. But that growth requires energy, and India's unstable power-generating capacity can barely keep up with the current demand.

India's current power-generating capacity stands at 132,000 megawatts; the Indian government is looking to boost it to 232,000 megawatts from conventional energy sources.

Additionally, India's nuclear power industry has announced plans to expand the nation's 2006 installed capacity from a mere 3,200 megawatts to more than 60,000 megawatts over the next several decades.

The Indian Atomic Energy Commission values such an expansion at more than \$150 billion; scores of U.S. energy and infrastructure companies are clamoring to be part of it. The list includes such heavyweights as General Electric Co., Westinghouse Electric Corp., Bechtel Corp., United Technologies Corp., U.S. Enrichment Corp. and Thorium Power Ltd.

Aside from the joint statement that the U.S. and Indian negotiators released July 20, the only official comment to come out of either camp was from Indian external affairs minister, Pranab Mukherjee, who told reporters, "The work of the negotiators is over. Now, they will let us know what transpired. The government will then decide."

Bush administration officials are expected to brief key lawmakers and their aides on the agreement and bring it up for a final vote soon.

The vote in Congress will be a straight up-down, yes-no vote with no amendments allowed, so the administration expects to get it done without too much trouble.

"With the signing of the nuclear deal now just a formality, USINPAC has underlined the need for a sustained, long-term multi-sector dialogue between the two nations," Puri said. "Both the U.S. and India will have the common goal of energy independence. More importantly, however, the document will build a strategic partnership between two of the greatest democracies in the world that could well redefine the 21st century."

**US nuclear neighbours not Nimby**  
**World Nuclear News**  
**August 21, 2007**

Eighty-two per cent of people living close to US nuclear power plants are in favour of nuclear energy and 71% would be willing to see a new reactor near them, a new public opinion survey has found.

The telephone survey polled 1100 adults across the USA, all living within 10 miles (16 km) of a nuclear power plant but not employed by electric companies. Eighty-six per cent of respondents gave their local nuclear plant a 'high' safety rating and 87% declared their confidence that the operating company could run the plant safely.

The survey was carried out by Bisconti Research, whose president Ann Bisconti noted: "Nimby (not in my back yard) does not apply at existing plant sites because close neighbours have a positive view of nuclear energy, are familiar with the plant, and believe that the plant benefits the community."

When faced with the question: "If a new power plant were needed to supply electricity, would it be acceptable to you... to add a new nuclear reactor at the site of the nearest nuclear power plant?" 71% of all respondents said it would be acceptable. Twenty-six per cent felt it would not be acceptable and three per cent voted 'don't know'. These figures changed to 77% in favour and only 20% against in communities where steps are already underway to build new reactors.

The strong support for new reactors among residents already living near nuclear plants was welcomed by Scott Peterson, Vice President for Communications at the Nuclear Energy Institute (NEI), the US nuclear industry policy organization. "This bodes well for the prospect of new plant construction, particularly for those companies considering adding new reactors at existing nuclear plant sites," he said.

The survey, which included adults living near each of the 64 nuclear power plant sites in the USA, was commissioned by the NEI, and comes at a time when US power companies are embarking on a new regulatory process for licensing new plants. Seventeen companies have announced plans to file licence applications for up to 31 reactors to be built over the next 10-15 years. Four applications for Early Site Permits (ESP) have already been submitted to the US Nuclear Regulatory Commission (NRC), all to assess the suitability of existing reactor sites for possible new construction projects. The NRC received the first part of the construction and operating licence (COL) application for a new reactor at the Calvert Cliffs site in Maryland in July and anticipates up to another seven applications covering 12 units by the end of 2007.

**Epri: invest in low-carbon technology immediately**  
**World Nuclear News**  
**August 15, 2007**

The USA could save \$1 trillion in its fight against carbon emissions if it 'aggressively' deployed advanced technologies - including nuclear power.

That was the conclusion of a discussion document written by the Electric Power Research Institute (Epri), and to which Idaho National Laboratory contributed nuclear expertise.

The study, entitled *The Power to Reduce CO2 Emissions*, considered seven carbon saving technologies for which a development path was known (renewables, nuclear, advanced coal, carbon capture and storage, plug-in hybrid vehicles, distributed energy sources and efficiency). It said: "The strategy for reducing sector emissions will be technology-based."

Relative to the base case put forward in the Energy Information Administration's *Annual Energy Outlook 2007*, Epri proposed that by 2030 nuclear power could grow by 64 GWe instead of EIA's conservative 12.5 GWe projection. Currently, applications to build around 38 GWe in new nuclear capacity are under development by utilities.

Epri also proposed that: Renewables could grow by 70 GWe instead of 30 GWe; Efficiency could reduce load growth by 0.4% to 1.1% per year; And distributed energy could account for 5% of baseload instead of less than 0.1%. The EIA's figures on advanced coal and plug-in hybrid vehicles were also optimistically revised while carbon capture and storage (CCS) was proposed to be widely deployed after 2020 whereas did not appear at all in the EIA's base case.

But much research, development and demonstration work would be required to achieve those improved deployment rates, and that would incur significant advance costs. For nuclear power, Epri's goals foresaw only the use of light water reactors (LWRs) as in widespread use today, and advanced LWRs such as a few that have been built and are currently commercially available, which would also need construction optimization over the years. All existing US plants would have to be relicensed for a total lifetime of 60 years by 2016 and higher burnup nuclear fuel would be developed by 2030.

That nuclear research program would cost the US commercial nuclear industry \$430 million per year, of a total required for all technologies of \$1.4 billion per year shouldered mainly by the private electricity sector.

However, if all segments of Epri's plan were carried out, the combined effect would be to remove \$1 trillion from the cost of the USA's possible climate policy. That compares to the \$1.5 trillion cost of a less comprehensive plan, which Epri said could require large reductions in electricity demand and place severe constraints on economic growth.

If strong action were taken to promote large-scale low-carbon electricity supply, such as increased nuclear power and CCS, Epri said the electricity market would be preserved and growth constraints limited. As a consequence, Epri said, the future price of electricity could be reduced from \$160 to \$65 per MWh.

However, given lead times of 20-30 years, Epri emphasised, serious investment in all low-emissions technologies must begin immediately. The body will produce an action plan to achieve substantial CO2 cuts in the electricity sector following its 2007 Summer Seminar.

**US reactor gets go-ahead for completion**  
**World Nuclear News**  
**August 02, 2007**

Thirty-five years after construction began on Watts Bar unit 2, the board of the Tennessee Valley Authority (TVA) has unanimously approved its completion in a five-year project costing an estimated \$2.49 billion.

Construction of two 1270 MWe pressurized water reactors (PWRs) began at Watts Bar in 1972 but was suspended in 1985. Work on unit 1 recommenced in 1990 and it eventually started up in 1996, but unit 2 was left 60% complete. In 2001 TVA wrote off \$1.72 billion spent on building the unit. Now, following studies of future power needs, cost and schedule, environmental impact, and financing and risks, "completing this unit is without a doubt TVA's best option to help meet the region's growing power needs," according to TVA chair Bill Sansom.

The studies found that completion of Watts Bar 2 would reduce TVA's overall power production costs, while avoiding the emission of 6-8 million tonnes of carbon dioxide per year. It was the lowest fuel cost option and the fastest option to meet baseload power needs, at a 35% lower cost than the next alternative.

With electricity demand in the region growing at nearly 2% a year, TVA is stepping up its efforts on energy conservation and demand reduction and is committed to providing renewable energy, but this would not be enough to meet the growth on its own, according to TVA President and CEO Tom Kilgore. "Adding Watts Bar Unit 2 to TVA's generation portfolio will go a long way toward meeting the growing demand for power in the region," he said.

The project could still face some licensing hurdles. The unit has a current construction licence which is due to expire at the end of 2010, but will need to obtain an operating licence before it can start up. TVA is required to notify the US Nuclear Regulatory Commission (NRC) 120 days in advance of the restart of construction work. However, TVA can draw on the experience of completing and operating Watts Bar 1 and also of Browns Ferry 1, restarted in May 2007 after 22 years.

TVA is the largest public power provider in the USA and operates six nuclear units: three boiling water reactors (BWRs) at Browns Ferry in Alabama, and three PWRs at Watts Bar and Sequoyah in Tennessee.

**India must use thorium-based nuclear reactors: Kalam**  
**The Hindu**  
**July 27, 2007**

Chennai, July 27 (PTI): India has to take up nuclear power generation in a big way with thorium-based reactors to meet its growing energy needs, former president, A P J Abdul Kalam, said Thursday.

Thorium, a non-fissile material, is available in abundance in India. Intensive research is needed to convert thorium to maximise its use and to generate electricity with thorium-based reactors, he said while addressing professors at the Anna University here, where he has taken up a teaching assignment.

Referring to regions in India that periodically face earthquakes, he said it was essential to work on mission mode research to forecast temblors.

Multiple parameters should be used with "precursors like pre-shock conditions and electromagnetic phenomena prior to the final rupture and atmospheric and ionosphere anomalies," he said.

"Earthquakes can be forecast...if somebody tells you it cannot be done, tell them it can be (done)," he said.

"Between now and 2050, two important events will take place in our country. India would have become a developed nation by 2020 through an integrated development plan in five key areas where we have core competence," Kalam said.

"We would have also realised energy independence by 2030. During this period, the number of youths, accounting for 54 per cent of the total population, will continuously grow till 2050, which will be unique to India."

This will provide an opportunity to develop a "Global Human Resource Cadre" that will be an essential resource for India and many other countries, he said.

## **Indian cabinet backs nuclear deal**

**The Indian government says that it has reached agreement with the United States on implementing a controversial civilian nuclear co-operation accord.**

**BBC News**

**July 25, 2007**

Foreign Minister Pranab Mukherjee said all of India's concerns had been met following talks between the two sides.

He spoke after the cabinet had approved technical aspects of the deal, which gives India access to US technology.

The agreement was reached in principle two years ago but has been mired in negotiations over the details.

### **Nuclear tests**

The final agreement must still clear several hurdles before it takes effect.

Correspondents say India's government must also persuade its left-wing allies to back the deal, although formal approval by parliament is not required.

The communists - who are not in the cabinet but support the government of Prime Minister Manmohan Singh - have been bitterly critical, as have India's opposition parties.

### **NUCLEAR POWER IN INDIA**

India has 14 reactors in commercial operation and nine under construction

Nuclear power supplies about 3% of India's electricity

By 2050, nuclear power is expected to provide 25% of the country's electricity

India has limited coal and uranium reserves

Its huge thorium reserves - about 25% of the world's total - are expected to fuel its nuclear power programme long-term

Under the deal, India would get access to US civilian nuclear technology if it opens its facilities to inspection.

Critics say the accord will encourage India to develop its nuclear arsenal.

They also say it sends the wrong message to countries like Iran, whose nuclear ambitions Washington opposes.

But supporters of the accord say it will help India meet its soaring energy demands by reversing three decades of US sanctions imposed after nuclear tests carried out by India in 1974 and 1998.

Negotiations over the fine print of the deal have been going on in Washington and Delhi for months.

### **COUNTDOWN TO AGREEMENT**

July 2005: India and the US announce the deal

March 2006: Deal 'finalised' in Delhi during visit of US President George W  
Bush  
July 2006: US House of Representatives approves deal  
November 2006: US Senate votes in favour of deal  
July 2007: Indian cabinet approves the deal

Correspondents say the final details were hammered out last week in Washington in negotiations attended by the Indian national security adviser, MK Narayanan, and Foreign Secretary Shivshankar Menon.

The implementation agreement, or "123 agreement", is designed to include all operational aspects of the deal, which its supporters say will galvanise strategic ties between the world's two biggest democracies.

Delays in finally agreeing the deal have been attributed to concern in India over the possibility of Washington suspending co-operation and demanding the return of atomic fuel if Delhi tests nuclear weapons in future.

Before it takes effect, the finalised deal must be approved by the US Congress, while India needs clearance from the Nuclear Suppliers Group of countries.

## **India splitting atoms over nuclear deal**

**By Zorawar Daulet Singh**

**Asia Times**

**August 22, 2007**

NEW DELHI - Just at the apogee of the India-US nuclear agreement saga, Indian domestic politics are condemning its final conclusion to another round of contentious debate. The outcome of this eleventh-hour stumble, however, goes beyond simply evaluating the technical parameters of the recently negotiated bilateral agreement with the United States over civilian nuclear cooperation. The issue at stake is nothing less than redrawing the fundamental premise of Indian grand strategy and the role New Delhi seeks to carve out for itself in the emerging international system.

An August 18 resolution by the left-wing parties - vital allies for the ruling United Progressive Alliance central coalition in New Delhi - exemplifies the domestic political divide: "The politburo decided to take the issue of the nuclear agreement and the dangers of the strategic alliance with the United States to the people through a nationwide mass campaign."

At the outset, it is useful to reflect on the original logic of engagement with the US and specifically on what the nuclear deal was meant to achieve for Washington and for New Delhi.

Until the July 18, 2005, India-US joint statement on the nuclear agreement, India's status in the global non-proliferation system was that of a pariah state. Since the 1974 nuclear test (Pokhran-I) and the ensuing sanctions regime imposed on India, New Delhi's goal was in essence one of preserving its strategic weapons program and insulating itself from an adverse external diplomatic assault, prosecuted largely by the US.

Finally, in May 1998, India chose to abandon its ambiguous posture by demonstrating a declared nuclear-weapons capability (Pokhran-II). This was a point of no return, and indeed India in the ensuing couple of years endured yet another US diplomatic onslaught, manifested in automatic sanctions to compel New Delhi to reverse course.

Suffice it to say, New Delhi stayed the course and by the early 2000s, most pragmatic voices in Washington had accommodated themselves to an India that would be permanently nuclear.

As the primary enforcer of the non-proliferation regime, Washington chose to pursue the next logical step of identifying a solution to the Indian nuclear question - enabling India to enter the nuclear system on an exceptional basis and thus eliminating the most contentious obstacle to the normalization of US-India relations. But why would the US choose to bestow such an extraordinary gesture on India? Students of realpolitik and US foreign policy would be acutely aware that altruism in international affairs is as absurd as "to ravish a woman for a purely moral reason".

This is where the timing of the nuclear deal becomes important. By 2005, it had become clear in Washington that the fantasy of reshaping the security structure of the Middle East had reached an impasse. Geopolitical developments elsewhere were equally disconcerting for Washington. Russia, after more than a decade of internal upheavals, was displaying signs of breaking free of the shell that Washington's cold warriors had confined it to since 1991. It will also be recalled that China had gained from the strategic surprise of the terror attacks of September 11, 2001, which had diverted US strategic attention to the West Asian theater, from President George W Bush's pre-September 11 national-security goal of expanding the scope of its East Asian containment strategy.

In sum, by mid-2005, with the US bogged down in Iraq and the two primary Eurasian land powers, Russia and China, rapidly accelerating their geo-economic profiles and influence, America's unipolar triumphalism appeared all but over. Indeed, China was seeking to refurbish its own equation with India, manifested most importantly by Premier Wen Jiabao's April 2005 visit to New Delhi and the mutual declaration of a "strategic partnership".

Russia's expanding military-technical market share in India's modernization drive in the same year again suggested that the US was being excluded from a growing arms bazaar. Within South Asia, too, there was a sense of *deja vu*. After the initial exhilaration of New Delhi's elite in the aftermath of September 11, one that had anticipated a natural elevation of India-US ties, the United States' geopolitically expedient decision to ally with Pakistan as its frontline state in Afghanistan implied that the India-US honeymoon was over.

It is in such a structural flux that Washington's subsequent engagement with India must be considered. In retrospect, the timing of Washington's decision to revolutionize its relationship with New Delhi appears to have immense geostrategic and geo-economic logic, the latter arguably a critical parallel driver for Washington eager to gain the fruits of a belated Indian economic renaissance.

By dangling the nuclear deal, it offered an irresistible instrument to New Delhi's strategic elite and re-altered the incentives for subsequent Indian foreign policy. The above perhaps succinctly capture the larger US incentives for the nuclear deal - gain a vital strategic foothold in South Asia, one that it had unsuccessfully sought over the entire course of the Cold War.

What were the Indian motives for the nuclear deal? This was obvious. As a nuclear-weapon state, but one outside the international system manifested in great-power arrangements, New Delhi's security elite was acutely aware that until its pariah status was transformed, one that had lasted more than three decades, India would remain condemned to the periphery of the international system, without access to high-technologies in the nuclear sphere, and excluded from any subsequent modifications to such arrangements.

Also cognizant of the reality of India's lack of system-shaping capabilities, Indian foreign policy chose to engage with the primary manager of the contemporary system, the US, to alleviate its "status discontent" with the prevailing reality.

Of course, negotiating the terms of such an entry into the system of non-proliferation was imperative too. Thus preserving the essence of India's strategic weapons development and its indigenous three-stage reactor program rightly became a vital goal in itself. Indian political and intellectual discourse over the past two years has vividly reflected this imperative and has arguably contributed to New Delhi adopting appropriate negotiating positions.

That New Delhi was largely able to reach a more or less acceptable bilateral agreement last month was as much the result of internal checks and balances as it was to Washington's larger grand strategy (ie, India as the strategic prize), extending the United States' maritime *cordon sanitaire* around the East Asian landmass and thus achieving dominant control over the vital sea lanes from the Persian Gulf to the Sea of Japan.

Returning to domestic political events, it should be clear that the nuclear deal was a means to an end. That end was the much-belated acknowledgment of India's nuclear status and, by extension, its entry into an important multilateral arena of great-power commerce, namely the market for dual-use technologies that would enable India to augment its socioeconomic and military potential.

Up to this point, I suspect there would be little bipartisan objection in India for such a strategy, for it preserves the fundamental premise of Indian foreign policy, one that lays an exceptional premium on independence and autonomy, and an aversion to extra-Indian evaluations of Indian national interest. Suffice it to say only by the successful adherence to these principles can India achieve its great-power aspirations.

The ongoing discord, however, arises from certain domestic political quarters that have viewed or are now viewing the nuclear deal as a stepping-stone to an open-ended strategic alignment with the United States, especially in the military sphere. For such ideologues, the nuclear deal has paved the way for the emergence of a natural relationship between two great democracies that were separated only by the contradictions of the Cold War. In many ways, these ideologues are the mirror-image of the Indian left, which is ideologically anti-American. As usual, India's international salvation lies in the middle path.

Again, it must be emphasized that constructive engagement with the US is in India's interest. As is evident from the extraordinary record of Beijing's own open-door policies since 1978, cultivating economic linkages with the US offers enormous developmental advantages.

At the geostrategic level, too, with all major powers continuing to place a premium on their relationship with the United States, India by disengaging only loses out. Yet the major powers are also adopting omni-directional, non-exclusive relationships.

The patterns of interaction between today's actors are a critical element of the evolving order that deserves some elaboration. The international political economy and its globalizing forces are compelling actors to pursue multi-vector foreign policies - the core thrust of foreign policies of the major states is being driven by non-exclusive engagement. It is useful to recall that the bipolar division of the past system was geopolitical and geo-economic. Both blocs were self-sufficient and inter-bloc trade and investment were irrelevant. Today's system is clearly more interdependent than during the Cold War.

To be sure, this interdependence is state-driven, and the economic division of labor is nowhere near as efficient as in national economies. In an anarchic world, it never will be. But certainly, trade and investment are becoming both the means and ends of state power and leverage. India's primary goal must be to assume a growing share of this international division of labor, one that is gradually decoupling from the United States, as the industrial revolution across the Eurasian geo-economic space attests to.

Thus India's US policy must operate in a multi-vector framework. It is only by engaging all major actors that India can achieve strategic flexibility to leverage its foreign and economic goals, and simultaneously preserve the ideational foundations of Indian foreign policy.

The ideological discord within Indian foreign policy has also manifested recently in debates over New Delhi's military diplomacy. India's decision to participate in the quadrilateral - US, Japan, Australia and India - naval exercises in the Bay of Bengal next month, while remaining ambivalent to developments in the Eurasian land space exemplified by the recent Shanghai Cooperation Organization military exercises, illustrates New Delhi's inability to implement a multi-vector policy, and indeed is a futile attempt at ignoring its own geography.

Thus while naval cooperation among the quadrilateral group would in principle be defensible, when seen in conjunction with India eschewing other multilateral developments in its periphery, it certainly arouses suspicion toward New Delhi's exclusive outlook. Surely there's more to India's "Look East" policy than naval cooperation? At a time when China is rapidly integrating the 10-member Association of Southeast Asian Nations into the Chinese economy, New Delhi is engaging with extra-regional actors in the military sphere, and yet achieving little influence in its extended neighborhood.

The geopolitical pluralism today is heading one way - a multipolar world - with the underlying fundamentals arguably already in place. In such a scenario of systemic change, and given that the redistribution of power is accruing to the Eurasian geopolitical space, one where India resides, is it wise to pursue an uncritical path toward bandwagoning with an offshore power in relative decline?

**Zorawar Daulet Singh**, who holds a master's degree in international relations from the School of Advanced International Studies, Johns Hopkins University, is an international-relations analyst based in New Delhi. He can be contacted at [zorawar.dauletsingh@gmail.com](mailto:zorawar.dauletsingh@gmail.com).