Thorium Power News Update and 2008 Recap
December 31, 2008

Letter from the CEO

Dear Stockholders:

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

Corporate News

In December, we signed a Memorandum of Understanding with Punj Lloyd Group, and became the first U.S. company to enter India following the passage of the 123 Agreement. The joint venture with Punj Lloyd will consider deployment of Thorium Power's nuclear fuel technology in the country along with setting up an investment fund for investing in India and globally. We will also explore the establishment of an operating company in India. The new company would undertake fuel design for the reactors; provide services for building reactors for the nuclear power plants as well as advisory services in exploring development and investment opportunities in the nuclear energy sector.

2008 Recap

Our agreement with Punj Lloyd was just the latest milestone in a truly transformative year. From the UAE to India, we executed our business plan, achieved our targets and recognized our first revenues as a company. We also announced our plan to transition to Lightbridge Corporation, a new brand that fully captures our broadened (technological and advisory) capabilities while highlighting our commitment to creating a brighter, more prosperous future. Above all, the new brand reinforces our ongoing mission to realize the promise of safe, clean and responsible nuclear power.

In 2008, we formally launched our strategic advisory business, signed our first client and entered into two long-term agreements with the UAE. Our growing advisory services relationship with the UAE has led to multiple agreements and we take great pride in our ongoing role as the UAE's high-level strategic advisor. As we move into the New Year, we look forward to organically growing this relationship as the UAE continues to explore the feasibility of nuclear power. Our strategic advisory business is uniquely positioned to respond to the expanding global opportunities offered by new nuclear nations and we look forward to new milestones in 2009.

We also witnessed two major legislative developments in 2008 that helped to underscore the growing interest in non-proliferative nuclear fuels. The passage of the US-India nuclear cooperation pact and the 123 Agreement heralded a new era in India's burgeoning new nuclear market. Given India's longstanding interest in thorium fuel and Thorium Power's proven track record in researching and developing thorium fuels, we are uniquely positioned to play a critical role in the development of India's nuclear industry. Meanwhile, the introduction of the Hatch-Reid "Thorium Energy Independence and Security Act of 2008" in the U.S. Senate promises to pave the way for thorium-fueled reactors in the U.S. Of course, both legislative milestones directly reinforce Thorium Power's mission and business plan.

We also made considerable progress on the technological front and our fuel development work has now entered the qualification/pre-commercialization phase. In addition to initiating work on leading reactor designs, including the AP-1000 reactor (new Westinghouse design) and the EPR reactor (new AREVA design), we signed new agreements with the Kurchatov Institute, including the critical post-irradiation testing agreement, and secured exclusive worldwide rights to the technical data. Finally, we strengthened our senior technology business team and expanded the development scope with the addition of leading industry experts including Claudio Filippone, Robert Ihde and Richard Beake. In addition to strengthening our management team, we also

broadened our advisory corps and appointed globally renowned experts such as Dr. Hans Blix to provide key insights in support of our mission.

Given the various activities in 2008, we want to take this opportunity to reflect on just some of the major milestones:

- Successive Consulting and Strategic Advisory Services Agreements with the UAE
- Memorandum of Understanding with Punj Lloyd Group in India
- Post-irradiation testing agreement with the Kurchatov Institute
- Key Management Team Appointments – James D. Guerra as Chief Operating Officer, Robert Ihde as Director of Nuclear Fuel Technology, Dr. Claudio Filippone as Senior Director of Nuclear Technology Analysis, Richard Beake as Executive Vice President and Head of Advisory and Consulting Business
- Key Advisory Board Appointments – Dr. Hans Blix as Senior Advisor, General Charles Guthrie to International Advisory Board, Linda Byus as Investment Relations Advisor
- Keynote Address at the MENA Nuclear Forum in Doha, Qatar

We also secured a number of key milestones on the media front, including a feature article in *The Financial Times*, and key articles in *Forbes*, *The Wall Street Journal*, *US News & World Report* and many more. The ongoing and increasingly broadened media coverage reflects the timely relevance of our mission, capabilities and non-proliferative solutions:

> "The people who say they are going to bring us this renaissance are the people who brought us the Dark Ages," one industry critic told me. "This is Torquemada bringing us the idea of the Renaissance."…**Where, then, is nuclear's Leonardo da Vinci?** What if there was, say, a small technology company that claimed there was a different way of doing things? What if it was developing a nuclear fuel that produced 70 per cent less waste and nothing that you could use to make a bomb? Let's say it was chaired by one of the world's leading non-proliferation experts and advised by Hans Blix, former head of the International Atomic Energy Agency (IAEA) and UN weapons inspector. What if it had just been appointed consultant to the United Arab Emirates, which is expected to be the first Middle Eastern country, after Iran, to generate nuclear power? That might sound promising. But it would also probably sound too good to be true. The company is called Thorium Power…" ("New Power Generation" – Financial Times, May 31, 2008)

Industry Developments

In December, the World Business Council for Sustainable Development released a report titled *Power to Change: A business contribution to a low-carbon electricity future*. Authored by representatives from some of the leading utilities, the report concluded that "nuclear power is among the technologies ready to fight climate change and its wide deployment should be facilitated now" (WNN). Additionally, the UK's independent Committee on Climate Change concluded that "the economic case for new nuclear power deployment is strong and if the pace of renewable wind power should fail to meet targets the deployment of nuclear power should be accelerated to fill the gap."

Once again, these latest developments support our unique positioning as a source of solutions to address the major industry concerns – how to solve proliferation, reduce waste and improve profitability. As evidenced by the 2008 milestones, we are advancing the nuclear renaissance by leveraging our world class talent and by pursuing the right vision, strategy and solutions.

Very Truly Yours,
Seth Grae
Chief Executive Officer

Thorium Power News Update and 2008 Recap
December 31, 2008

Company News

McCloskey Nuclear Business – The MNB Interview with Seth Grae of Thorium Power (12.01.08) – Judith Perera of interviews Seth Grae, CEO of Thorium Power, in an extensive Q&A that covers the company's current and future business plans in the UAE, India and beyond: "Thorium Power has built up an expert team with global experience with people from all of the major nuclear companies. We have two advantages: We have nothing to sell but our advice, our intellectual property, and we don't have the conflicts of interest which the suppliers have. We offer a cross-cutting view – and understanding of various companies and processes around the world. We can help our clients to look at what is available and can truly help to match their needs."

Platts Nucleonics Week – GCC Nuclear Vision Challenges Arab World's Technology Focus (12.04.08) – Commenting on the UAE's ongoing exploration of nuclear power, Mark Hibbs notes that the country is implementing an entirely new model that relies on best practices, industry-leading experts and stringent non-proliferation measures. The article notes Thorium Power's key role in the UAE and quotes Seth Grae: "What the UAE has offered is nothing less than a brand new blueprint for how a country in this part of the world goes about doing nuclear energy."

Wall Street Journal – U.S. Plans to Sign Nuclear Pact with UAE (12.12.08) – The Journal comments on the Bush administration's plan to sign a nuclear cooperation agreement with the UAE. Reporter Jay Solomon briefly touches on some of the key legislative issues while highlighting the various measures the UAE has implemented to ensure the highest non-proliferation controls and mechanisms. Solomon notes the UAE's ongoing relationship with Thorium Power as well as the recent appointment of William Travers, a 30-year veteran of the U.S. Nuclear Regulatory Commission, to run the UAE's new nuclear regulatory body. Note: The article was also carried by other outlets including *AFP, Gulf News Report, and GulfNews*.

Forbes – Thorium Warms Up to Nuclear India (12.09.08) – Forbes reporter Vidya Ram comments on Thorium Power's Memorandum of Understanding (MoU) with Punj Lloyd, and notes that "Thorium Power has become the first American company to march into the Indian nuclear market after an agreement to collaborate on the energy was finally signed between India and the United States last month. The Virginia-based nuclear energy company struck a deal with Punj Lloyd, an Indian engineering firm, to create a 50-50 joint venture which it hopes to have in place by the end of March."

Businessworld – Friction in Fission Clubs (12.12.08) – Businessworld, one of India's leading business weeklies, reports on the prospects of a thorium-based nuclear industry and quotes Seth Grae: "As expected, the lobbies for and against thorium (which is on the verge of commercialisation) are going strong. "If anything is to be approved, it should be thorium…India should use local thorium reserves. Compared to other extractions, thorium extraction is a simple procedure."

The Hindu Business Line – Punj Lloyd signs pact with Thorium Power of US (12.04.08) – Business Line, one of India's leading business publications, reports on Thorium Power's landmark MoU with Punj Lloyd Group, and notes that it is the first agreement signed between an Indian company and a US nuclear power company since the Indo-US civil nuclear cooperation and the 123 agreement was signed: "The "joint venture" will combine Punj Lloyd's expertise in EPC contract work and Thorium Power's technological expertise in the use of thorium to generate nuclear power."

Hindustan Times – Punj Lloyd in tie-up with Thorium Power (12.04.08) – The Hindustan Times reports on Thorium Power's landmark MoU with Punj Lloyd Group: "Engineering procurement and construction major, Delhi-based Punj Lloyd Group and US-based Thorium Power Ltd on Thursday signed a memorandum of understanding (MoU) to set up thorium-based

nuclear power plants in India, Southeast Asia and other territories. This is the first agreement signed for establishing nuclear power plants in the private sector. The two companies will be equal partners in the joint venture."

Financial Express – Punj Lloyd inks MoU to set up N-plants (12.04.08) – The Financial Express reports on Thorium Power's landmark MoU with Punj Lloyd Group and quotes Seth Grae: "The JV will consider deployment of Thorium Power's nuclear fuel technology in the country along with setting up an investment fund for investing in India and globally. Also, it will be looking at setting up of operating company."

DNA (India) – Thorium Power, Punj Lloyd inks MoU to set up N-plants (12.04.08) – DNA reports on Thorium Power's landmark MoU with Punj Lloyd Group, and quotes Seth Grae: "Through this collaboration we will explore the full range of options available to both our companies in areas as diverse as marketing our non-proliferative fuel designs."

Business Standard (India) – Punj Lloyd, U.S.-based firm to form JV in March – DNA reports on Thorium Power's landmark MoU with Punj Lloyd Group and quotes Seth Grae: "We will explore full range of options available to both our companies in areas as diverse as marketing our non-proliferative fuel designs, providing advisory services to emerging national nuclear programmes and exploring development and investment opportunities in the nuclear industry."

NOTE: The MoU announcement was also covered by additional outlets including the *Deccan Herald, The Indian Express, Free Press Journal, The Tribune, Political and Business Daily, Pioneer, Financial Chronicle, Mail Today, Hindustan, Business Bhaskar*, Nasdaq.com, Economictimes.com,FoxBusiness.com, CNBC Network 18, NBC Awaaz, UTVi, Livemint.com, Sify.com, BusinessStandard.com and many more.

Industry News

World Nuclear News – EU pledges €25 million to nuclear fuel bank (12.09.08) – WNN reports that the "Council of the European Union will contribute up to €25 million ($32 million) towards an international nuclear fuel bank controlled by the International Atomic Energy Agency (IAEA), bringing the prospect a step closer."

World Nuclear News – India outlines nuclear power ambitions (12.02.08) – WNN reports that "India has reaffirmed its commitment to [the] thorium fuel cycle, proposing to construct a dozen indigenously-developed nuclear power reactors. These units will be supplemented by imported conventional reactors." This is part of the "Eleventh Five Year Plan" (2007-12) established by Nuclear Power Corporation of India Ltd.

Bloomberg – South Korea to Spend $28 Billion on New Power Plants (12.28.08) – Bloomberg reports that South Korea "plans to spend 37 trillion won ($28.5 billion) building more nuclear and gas-fired power plants by 2022 to reduce its dependence on oil and meet rising demand for energy." According to a report from the Ministry of Knowledge Economy, the country will "build 12 more nuclear-powered plants, seven coal-fired plants and 11 fueled by liquefied natural gas by 2022."

Reuters – Bush signs nuclear inspection pact U.N. watchdog (12.31.08) – Reuters reports that President Bush has signed a nuclear safeguard agreement with the International Atomic Energy Agency that the United States hopes will prompt other countries to follow suit.

World Nuclear News – Power executives' climate change proposals (12.09.08) – WNN comments on a new report from the World Business Council for Sustainable Development, which concluded that "nuclear power is among the technologies ready to fight climate change and its wide deployment should be facilitated now." The report authors represent 10% of global power generation capacity and supply over 300 million customers.

World Nuclear News – Nuclear power key to decarbonization of electricity (12.09.08) – WNN comments on a new report by the UK's independent Committee on Climate Change (CCC),

which concluded that “the economic case for new nuclear power deployment is strong and if the pace of renewable wind power should fail to meet targets the deployment of nuclear power should be accelerated to fill the gap.” The CCC concluded that “nuclear power is cost-competitive with conventional fossil fuel generation, even when decommissioning costs and fluctuations in uranium fuel process are allowed for.**”**

The MNB Interview – Seth Grae, Thorium Power
By Judith Perera
McCloskey Nuclear Business
Issue 15 – December, 2008

Seth Grae - President and Chief Executive Officer, Thorium Power

Earlier this year, US company **Thorium Power** won contracts to help the United Arab Emirates (UAE) develop a roadmap for its planned nuclear programme and to assist with the setting up of a nuclear energy programme implementation organisation (NEPIO) as well as an independent federal nuclear regulatory authority (NRA). *MNB* editor **Judith Perera** asked president and CEO **Seth Grae** about the problems facing countries embarking on new nuclear power development.

JP: What are the main challenges for a country embarking on a new nuclear programme?

SG: The growth of nuclear energy must have a focus on the highest standards and, in particular, regulatory independence. Achieving these standards requires an innovative approach starting with several months of planning. The major supplier companies are in marketing mode – as they should be. But they are less likely match a client's needs than to try to sell what they already have. Many issues need to be studied, such as the grid size, and any final choice must be based on unbiased advice. We are doing what no-one else is doing by offering this advice and reducing the time required for pre-planning.

JP: How long is this pre-planning stage?

SG: The International Atomic Energy Agency (IAEA) assumes many years of study are needed before a country can start to put in place any institutions. But if necessary, this can be done much more quickly by using existing institutions such as universities and by bringing in others.

We have innovative strategies matched to clients' needs. We speak to many stakeholders in the country and then develop a programme to utilise local capacity. This will shorten the time-frame and also build on existing capacity. It requires a few months of studies and interviews. Every country is different and the programme must meet the highest international standards.

JP: You are advising the UAE on its nuclear programme. Do you see nuclear power as appropriate for the Middle East region which has its own hydrocarbon resources?

SG: The nuclear renaissance in the Middle East makes sense because there are huge energy needs and growth and considerable experience in mega-projects in the energy area. It is a question of opportunity, costs and the alternatives to burning hydrocarbons. Many countries in the region also have produced excellent engineers and scientists.

I think Thorium Power is extremely well placed for the growth of nuclear power in the MENA (Middle East and North Africa) region and beyond. It is increasingly important to have an independent adviser on the client side of the table to help deal with vendors. No vendor will establish a regulator to oversee them – and even if they offered no country should allow it.

JP: It surprised many people when Thorium Power won the contract for the UAE since you are mainly associated with nuclear fuel development.

SG: Thorium Power has built up an expert team with global experience with people from all the major nuclear companies. We have two advantages: we have nothing to sell but our advice, our intellectual property, and we don't have the conflicts of interest which the suppliers have. We offer a cross-cutting view – an understanding of various companies and processes around the world. We can help our clients to look at what is available and can truly help to match their needs.

There is an assumption that most interest in nuclear will be in countries which already have nuclear plants. I don't think that is true. The biggest interest is in the developing countries, and we have designed our company specifically to advise those countries. We plan to change our name to Lightbridge Corporation to better reflect our activities. We will continue development of thorium fuel, but separate from our consultancy service.

JP: Given your interest in thorium, I assume you have strong relations with India

SG: India has always been interested in increasing its nuclear power without having to depend solely on an outside fuel supply. In India we are discussing both advisory services and new technology aimed at deploying thorium-based fuel for light water reactors.

Nuclear growth in India will be dramatic and opportunities there are among the biggest in the world. Thorium Power has been in discussions in India for many years and plans to be there for many more years – my first visit there for Thorium Power was in 1994. We have a long standing relationship which can now come to fruition.

The MNB Interview

JP: How do you generally view the future of nuclear power?

SG: In general, I think the projections for new nuclear power are too low. I think there will be more than suggested. Current analyses are based on the percentage of added capacity. However, they should be based on total capacity because nuclear will replace many existing plants. Nuclear power will be the baseload provider while others flip to peak load.

Projected electricity use is always underestimated. People have many more things today that use electricity. In the future, there will also be more plug-in hybrid cars, for example, which will be in addition to existing demand.

JP: And in the MENA countries?

SG: Nuclear growth may be more rapid in the MENA countries than was expected because of growing energy needs and the fact that the established nuclear countries tend to be more affected by the financial crisis. The MENA region was originally looking to about 2030 for the first nuclear plant, partly because of bottlenecks in components such as heavy forgings. But deployment may be slowing in the West. Some MENA states are more economically stable and it is possible to work more quickly. The nuclear renaissance is happening – but just not where some people thought it would.

Biography

Seth Grae, born in 1963, obtained his BA from Brandeis University cum laude, JD from American University, LLM in international law with honours from Georgetown University, and MBA from Georgetown University. In 1992 he assisted with the formation of Thorium Power, set up to develop and deploy nuclear fuel designs developed by Dr Alvin Radkowsky, which would not produce weapons suitable plutonium in nuclear waste. He went to Russia in 1994 when Thorium Power began co-operation with the Kurchatov Institute. The company is now focused on advanced testing and commercialisation of the technology and in 2007 announced a strategic alliance with Russian government-owned Red Star nuclear design bureau for this purpose. Seth Grae has also been spearheading Thorium Power's work in the UAE. He is a member of the board of directors of the Bulletin of the Atomic Scientists and has served as co-chair of the American Bar Association's Committee on Arms Control and Disarmament.

GCC Nuclear Vision Challenges Arab World's Technology Focus
By Mark Hibbs
Nucleonics Week
December 4, 2008

Wylfa in Wales, Oldbury in Gloucestershire and Bradwell in Essex (NW, 2 Oct., 13),

As part of an agreement with the UK government when it signed its takeover bid for British Energy, EDF committed to sell land it owns at Wylfa near the NDA site, under the joint marketing arrangement with the NDA.

However, the NDA document published this week contains several exceptions and conditions on the sale or lease of the EDF property at Wylfa.

EDF's sale of its Wylfa land is contingent on its getting approvals to build four EPRs at its preferred sites on land BE owns at Sizewell and Hinkley Point.

If it is unable to build at those two sites, EDF has identified Bradwell and Wylfa as potential fallback sites for the planned EPRs.

Under its agreement with the government, EDF may sell separate BE-owned land at Bradwell, which is not part of the NDA auction. Alternatively, it may bid for the NDA land there.

EDF may not bid on the NDA land at Oldbury or Wylfa, since the government policy is to have more than one nuclear operator in the country.

The NDA's document says that the sale of EDF's land at Wylfa is subject to, among other things, an effective endorsement by the government that two EPRs can be built at either Sizewell or Hinkley Point and one EPR at Bradwell. That endorsement would come through the government's Strategic Siting Assessment and National Nuclear Policy Statement.

Another condition for the sale of EDF's land at Wylfa as part of the NDA land auction is that a wind farm planned on land adjacent to the Hinkley Point site either doesn't receive planning consent or "has otherwise ceased to be an impediment" to the construction and operation of two EPRs there.

A further condition is that there are no pending legal challenges to the government Strategic Siting Assessment or National Nuclear Policy Statement within 100 days after those documents are issued (Inside NRC, 23 June, 12).

The government plans to ask potential nuclear plant operators to nominate sites for new reactors and review them for approval under the Strategic Siting Assessment. They will then be included in the National Nuclear Policy Statement for approval by parliament. After that, only local issues will remain for planning consents before an Infrastructure Planning Commission (Inside NRC, 23 June, 12).

Finally, the Secretary of the Department of Energy and Climate Change has to approve all sales or leases.

—David Stellfox, Barcelona

GCC nuclear vision challenges Arab world's technology focus

If experienced foreigners hired by Persian Gulf states succeed in setting up and then managing nuclear power plants on their territory, the geographic center of the Arab nuclear world will shift to the east, according to analysts and participants in energy programs in the region.

That shift may leave behind countries that for decades have concentrated on developing indigenous nuclear technology but that have not succeeded in generating any nuclear electricity, they said.

Unlike for most other Arab states currently interested in nuclear power, money appears to be no object for wealthy members of the Cooperation Council of the Arab Gulf States, or GCC. One of these states, the United Arab Emirates, or UAE, may even self-finance a nuclear power investment program quickly, some experts said last month.

But the recent crisis of the global financial system — and the collapse of oil prices it triggered — has prompted caution in the GCC about whether to proceed with nuclear power, or how soon, according to government officials in the region. However, the UAE has shown no signs it is reconsidering nuclear power.

"What the UAE has to offer is nothing less than a brand new blueprint for how a country in this part of the world goes about doing nuclear energy," said Seth Grae, head of Thorium Power, a US-based firm hired by the UAE earlier this year to help it set up power reactors and amass supporting experts and infrastructure.

Egypt claims lead

Beginning in the 1960s and, according to some regional experts, continuing today, Egypt claimed the Middle East's nuclear leadership. Over four decades, Egypt set up an indigenous research and development program, built research reactors, learned how to separate plutonium, and established itself as a critical player in international nuclear diplomacy. And three times — most recently in 2006 — it launched official programs to build and operate power reactors.

So far, however, Egypt has failed to put together a nuclear power program and, in the meantime, two non-Arab states grabbed the lead in the Middle East in developing nuclear technology. Israel, at its Dimona complex, became an undeclared nuclear weapons state. More recently, Iran began centrifuge uranium enrichment at a plant under construction at Natanz and, after nearly 40 years of construction, is poised to operate its first power reactor, at Bushehr.

Regardless of Egypt's aspirations, so far the Arab world's contribution to nuclear development has in large part been furtive and non-peaceful. Until war halted its efforts, Iraq in the 1980s tried to equal Israel's nuclear capability. Beginning in the late 1990s, Syria may have been building a plutonium production reactor before it was destroyed by an Israeli air strike in 2006. After decades of clandestine activity, Libya in 2003 abandoned an uranium enrichment program that was based on gas centrifuges similar to Iran's.

Shortly after the GCC, a six-country trade bloc, announced in 2006 it was investigating nuclear power generation, the UAE began taking steps that may culminate in a decision in 2012 to assign a consortium of companies to build and then operate power reactors (NW, 24 Jan, 1). If all goes well, officials leading that project said last month, the

UAE will begin generating nuclear power in 2017.

The biggest difference between previous nuclear power development efforts in the region — beginning with Egypt and ending with Iran — and the GCC's current ambitions, said Mahmoud Nasreddine, the Director General of the Arab Atomic Energy Agency, or AAEA, is that the GCC countries "have no real interest in nuclear technology."

The AAEA had been set up in Tunisia by the Arab League in 1988 with the mission of promoting and coordinating nuclear science R&D in its member states. Speaking at the MENA Nuclear Energy Forum conference held in Qatar last month, Nasreddine said that the AAEA has an operating budget of US$2 million per year.

"If they want to do nuclear power, that [amount] won't get them very far," one European Union country diplomat attending the meeting said. "If that's all the money they have, you can bet that the GCC states aren't heavily supporting them, and that they aren't interested in doing nuclear that way." A study published this May by the UK-based International Institute for Strategic Studies described the AAEA as having not been an effective driver of nuclear power development in the region.

Old model

"The old nuclear model for the Arab states was South Korea," one consultant said. "You set up a national R&D center and you try to do as much technology development on your own, you dabble in the fuel cycle, you might occasionally get in trouble with the IAEA, and after 20 [to] 30 years, you have some power reactors. The new way is a clean break with that path. There's no technology to develop. There's no proliferation. The people you hire have been doing it for years. And you can get nuclear energy faster."

The MENA Nuclear Energy Forum was held in Qatar after it had been originally planned to convene in Egypt and was postponed. Some diplomats attending the meeting said they detected a competitive, even frosty, atmosphere between parties who have traditionally looked to Egypt and the Arab League for nuclear leadership, and the handful of tiny, super-rich and worldly Gulf states. Sources at the event said the well-to-do Gulf states are now preparing to spend as much as $10 billion for infrastructure per reactor constructed, and their well-paid US advisers are busy drafting business plans for making it all happen as fast as possible.

"They're the new kids on the block," the EU diplomat said. "They've got money, they've got oil and gas, and they've got firm support from the West." By contrast, many or most of the other Arab states have "huge developmental headaches, no resources, and a legacy of secret nuclear weapons programs in their neighborhood," he said.

The UAE has gone far to dispel any notion that its atomic aims have anything to do with secret nuclear arms ambitions, announcing this spring that it would renounce both domestic uranium enrichment and spent fuel reprocessing. Since 2005, it has joined several US-sponsored non-proliferation initiatives aimed at enhancing nuclear materials accountability and port and cargo security.

According to a US official in the region last month, the UAE, followed by other GCC states, made those commitments after the US began pressing the UAE to put an end to decades of virtually unbridled activities of international nuclear procurement operators. Until 2003, those operators were transshipping sensitive materials and equipment through UAE ports to clandestine nuclear projects worldwide (NuclearFuel, 1 Dec., 1).

The UAE has recently completed a bilateral nuclear cooperation agreement with the US, but it will not go ahead with the agreement unless it is supported by the US Congress. Some US lawmakers are preparing to challenge the agreement on grounds that the UAE is not effectively regulating its trade with Iran (NW, 20 Nov., 1).

Oil price and risk

But executives and officials in the region last month said that the largest uncertainty surrounding the budding nuclear programs in the GCC states has nothing to do with Iran or proliferation. Regardless of these countries' extreme wealth, they said, national governments are not yet convinced that making a long-term commitment to nuclear power is justified by economics and considerations about how to best allocate resources to national economic development plans.

"Despite all the money out here," said Alan Paic, an economist at the Paris-based consulting firm Stratorg who was in Qatar last month, this fall's international financial crisis "is having an effect on plans for these countries' infrastructural investment." Mohamed Wehbe, a business development manager for Alstom in Sharjah, a UAE port city, said that in GCC states that so far have been less committed than the UAE to developing nuclear power, "governments seem to be reacting to the financial crisis by taking a more critical look at whether diversification investments are justified." Nuclear plans in these countries — such as Qatar, Kuwait, and Oman — took off "when the price of oil and gas started going up," Wehbe said.

The financial crisis "has suddenly made it a lot more difficult for countries like Egypt and some northern African states to afford nuclear power," said Kenneth Apt, a scientist from the US firm E2 Consulting, which is involved in nuclear material management issues in some of these states.

Hassan Younes, Egypt's Minister of Electricity and Energy, said last month that Egypt will rely on financial institutions for a significant share of any future nuclear power investments, but added that Egypt has not devised a post-crisis nuclear investment plan.

Some observers in the region have expressed the view that the UAE could finance nuclear power plant construction without any outside financing whatsoever. However, GCC executives and officials last month suggested that even in the UAE, the repercussions of the global financial crisis could still set back the UAE nuclear investment project.

Abdullah bin Hamad al-Attiyah, Qatar's deputy prime minister and the energy and industry minister, said that if the price of oil remains indefinitely below $70 or $75 per barrel, diversification investments in the energy sector — such as nuclear power — will be dropped. "None of us will

invest in non-economical projects," he said.

Potential GCC investors in nuclear power are reassessing their options, in response to decisions by companies elsewhere, including international oil majors, to put on hold some important energy projects in Brazil, Canada, and the Gulf region, al-Attiyah said.

According to UAE government officials last month, as of mid-November the UAE government has had to provide about $35 billion to shore up stressed UAE banks. For the next two to three years, one said, the country's economic growth rate could be halved. "If that happens we'll have to recalculate what our medium-term power demand will be," he said.

Regardless of some GCC states' immense wealth, some experts suggested that they would not go through with a commitment to nuclear power unless the economics would be self-sustaining. Last year, Khalid Al-Maadheed, head of Qatar's environment and natural resources agency, said, "We're not just going to throw a lot of money at a nuclear project because there is a lot of money to spend."

Geoffrey Rothwell, an economist at Stanford University who has investigated international nuclear financing, argued that the long-term microeconomics of a nuclear boom in the Persian Gulf "don't make any sense." The UAE "could go ahead and pay cash out of pocket for maybe an initial one or two reactors, but after that they're going to be looking at the same decisions on capital cost and comparative risk, and so the economics don't look any more favorable there than they do anywhere else in the world."

Cost

Consultants employed by the UAE are now crunching the numbers to find out what the cost of nuclear power investments for the UAE would be. If the UAE makes a firm decision in 2009 to deploy reactors, Grae said, "that would happen after they did all the math and then drew the appropriate conclusions."

At the Qatar meeting last month, however, there was no agreement about what nuclear power plant investments in the Persian Gulf would cost.

Moustafa Bahran, the vice-chairman of Yemen's Atomic Energy Commission — who last year had piloted a failed attempt to set up power reactors in Yemen in a hurry — claimed that the cost of nuclear power investments in the Middle East might be below US$1,500 per installed kilowatt. Executives and officials at the Qatar meeting said that they believed Bahran was wrong.

More realistic, they said, was the prediction by a Palestinian expert, Adnan Shihab-Eldin, who has served both as a former secretary general of OPEC and as an official in the IAEA Department of Technical Cooperation. Shihab-Eldin said that the overnight cost for a nuclear reactor in the region would "almost certainly" be in excess of $2,500 per installed kilowatt and that it could be as high as $4,000 per installed kilowatt. In this anticipated cost range, he said, nuclear power plant investments for GCC states like the UAE "would likely be economically justified provided oil price was at least $60 per barrel."

A UK consultant said that this break-even cost projection may be "too optimistic" to impress cautious government planning bureaucrats in the UAE and, especially, the other GCC states. "They got excited about nuclear power only when the price of oil climbed above $100 per barrel. When the UAE people started hiring their foreign consultants, they were looking at a barrel of oil pricing at something like $140," he said.

Heshim Al Ghamdi, an executive at Rihadh-based Acwa Power International, an engineering and plant-building company that is currently involved in about $5 billion worth of power generation and desalinization plant ventures in Saudi Arabia, expressed caution about how the repercussions of the global financial crisis would affect GCC investment decisions in nuclear power. "So far, we haven't had to pull the plug on any of our projects," Al Gahmdi said. Regardless of the crisis, he said, investors in the region "have still been able to find financing." Echoing remarks made by Rothwell, the Stanford economist, however, Al Ghamdi said, for any future nuclear investments in the region, "the issue [will not be] lack of financing but the price of financing."

A crash program by the UAE begun earlier this year, to hire experienced foreign personnel to staff nuclear regulatory and nuclear safety-related positions at an oversight agency it is creating from scratch, has prompted debate in advanced nuclear power generating states whether relying on outside experts will be sustainable (Inside NRC, 24 Nov., 8).

But another potentially looming safety and security problem, suggested Paic, the Paris consultant, may be the dwindling share of the UAE's native population.

About 85% of the country's population consists of foreign resident aliens. About one-fourth of the population of Dubai, its largest city of 1.5 million, are citizens of Iran.

UAE and Qatari planners say that a main reason for looking into nuclear power is the expectation that power demand growth will be driven by rapid population growth during the next 20 years. "And so if they build reactors to meet the demand of a bigger population," Paic said, "nearly all of that population will be comprised of foreign aliens."

Some experts watching the UAE nuclear program assert that this won't be a problem. Said a German nuclear engineer now living and working in Dubai, "their entire economic growth model is based on foreigners doing everything."—*Mark Hibbs, Doha, Qatar*

Germany sets criteria for countries seeking its aid on nuclear power

Any country wanting cooperation from Germany in the field of nuclear power must first have undertaken a feasibility study on non-nuclear methods of power generation, according to a German administration official.

Martina Palm of the Federal Ministry for the Environment and Nuclear Safety told a conference in Brussels November 27 that German federal ministries have

U.S. Plans to Sign Nuclear Pact with UAE – Proposed Cooperation With Middle Eastern Nation Would Face Hurdles in Congress on Proliferation Fears
By Jay Solomon
Wall Street Journal
December 12, 2008

WASHINGTON -- The Bush administration plans to sign its first nuclear-cooperation agreement with a Middle Eastern nation within the next few weeks, according to a senior U.S. official, raising concerns among congressional critics who say the deal could fuel nuclear proliferation in the region.

The proposed deal with the United Arab Emirates has attracted attention because the U.A.E.'s largest trading partner is Iran. The U.A.E. has served in the past as a transshipment point for technology with military applications headed to Iran.

The move could place President-elect Barack Obama in a political tight spot with a Middle East ally by forcing him to decide whether to push Congress to ratify the agreement. He hasn't taken an official position on the deal. An Obama spokesman declined to comment. The Bush administration has championed the nuclear agreement with the U.A.E. as a model for promoting peaceful nuclear energy while guarding against weapons proliferation.

Rep. Ileana Ros-Lehtinen of Florida, ranking Republican in the House Foreign Affairs Committee, introduced legislation this week that would set conditions before Congress could approve the agreement. It would require that the next president certify the U.A.E. has taken extensive measures to cut off the flow of financing and sensitive technologies into Iran.

The U.A.E. says its nuclear-power program will have extensive safeguards to protect against nuclear materials being diverted. It has pledged to purchase nuclear fuel for its reactors from outside suppliers, rather than developing its own fuel. It says it would store nuclear waste externally. Also, it has agreed to allow monitoring and snap inspections by the United Nations' International Atomic Energy Agency.

In recent months, the U.A.E. signed agreements with two American engineering companies -- Thorium Power Ltd. of Virginia and CH2M Hill of Colorado -- to oversee the development of its nuclear-power program. The U.A.E. has also hired a 30-year veteran of the U.S. Nuclear Regulatory Commission, William Travers, to help run the U.A.E.'s nuclear regulatory body.

"This is a real counterexample to what Iran is doing," said the senior U.S. official Thursday. "We're seeking commitments from nations within the Middle East that they're going to rely on the markets for nuclear fuel."

The Bush administration also is working on nuclear-cooperation agreements with the governments of Saudi Arabia, Jordan and Bahrain. The pacts require Washington to share nuclear fuels, technologies and know-how on the condition that the countries commit to abiding by the Nuclear Nonproliferation Treaty and IAEA safeguards.

The U.A.E. sits on some of the world's largest energy reserves, but its leaders say the country's natural-gas resources are inadequate to match rising demand. "We have determined that nuclear energy is an option the U.A.E. cannot afford to ignore," said Hamad Ali Al Ka'abi, the head of the U.A.E.'s nuclear program, in an interview earlier this year.

The Bush administration initially hoped to sign the nuclear accord with the U.A.E. last month, when Abu Dhabi's crown prince, Sheikh Mohammed bin Zayed Al Nahyan, met President George W. Bush at Camp David, according to people familiar with the visit.

U.A.E. officials decided to delay the official signing over uncertainties about Mr. Obama's position and possible negative reaction from Congress, according to these officials. In 2006, the U.A.E.'s state-owned DP World had to scrap a plan to purchase the U.S. port holdings of Britain's P&O because of opposition in Congress.

The nuclear trafficking network run by Pakistani scientist A.Q. Khan used Dubai in the U.A.E. as one of its major bases, according to investigations of the Khan network. U.S. officials, however, say the U.A.E. has taken major steps to better manage its export controls and guard against money laundering.

—Margaret Coker in Abu Dhabi contributed to this article.

UAE Still Keen on Nuclear Pact
By Erika Niedowski
The National (UAE)
December 14, 2008

WASHINGTON // UAE officials said last night they remained eager to sign an agreement with the US permitting the trade in nuclear materials, despite some resistance in Congress, but emphasised that plans to develop a peaceful civilian atomic programme were not dependent on any single foreign partner.

The Bush administration's plan to sign a nuclear co-operation agreement with the UAE faces resistance from some congressional lawmakers who insist that the Government introduce tougher controls on trade with Iran.

The officials in Abu Dhabi noted that both the US and the UAE had much to gain from signing the agreement, including the active participation of American companies in what is expected to be a multibillion dollar programme stretching over decades, as well as further cementing strategic ties between the two countries.

The Federal Government is negotiating similar pacts with several other foreign partners, including the United Kingdom, France, Japan and Russia, in anticipation of a decision to go ahead with a multibillion dollar nuclear power programme as early as next year.

The Government has renounced enrichment or reprocessing of nuclear fuel, and has already engaged the International Atomic Energy Agency to strengthen its formal safeguards.

Last April, the Government published a policy document outlining its intention to develop a peaceful, civilian nuclear energy programme that would set a new "gold standard" for transparency, safety and non-proliferation.

Officials say nuclear power offers the best solution to growing electricity demand.

New questions, however. were raised this week by US lawmakers including Ileana Ros-Lehtinen of Florida, the senior Republican on the House Foreign Affairs Committee, who introduced a bill outlining new conditions before the so-called 123 agreement with the UAE could take effect.

Under Mrs Ros-Lehtinen's bill, the Obama administration would have to certify that the UAE is taking effective action to quash the transfer of illicit goods to Iran and to fully implement United Nations Security Council sanctions against that country.

Mr Obama would also have to certify that the UAE "has developed and fully implemented an export control regime in accordance with international standards" and implemented a system "to target the logistical and financial networks that support terrorist organisations".

The US and the UAE signed a memorandum of understanding on nuclear co-operation in April as a precursor to the 123 agreement. Sheikh Abdullah bin Zayed Al Nahyan, the Minister of Foreign Affairs, said at the time the UAE "really wants to be a good example for the region".

The UAE's ambassador to the US, Yousef Al Otaiba, reiterated in a recent interview in Washington that the UAE is creating a "gold standard" for civilian nuclear programmes, emphasising both security and transparency.

"We're creating an entire industry from scratch based on best practices," he said.

"We support UN sanctions that limit Iranian access to sensitive nuclear technologies and strongly

urge the Iranian programme to be transparent to assure future regional peace and security," he said in a recent speech.

"There are far too many dangers in a programme based on uranium enrichment, from the obvious fears of proliferation to the less obvious fears of potential harm to our shared environment, particularly the waters of the Gulf from which we draw our water."

The 123 agreement had been expected to be signed before George W Bush left office. Ben Chang, a spokesman for the National Security Council, said Mr Bush approved the agreement on Nov 14 for the signature of the US secretary of state, Condoleezza Rice.

That was two days before he met with Sheikh Mohammed bin Zayed, Crown Prince of Abu Dhabi, at Camp David, Maryland.

The intention was to sign the agreement during that visit, but it was delayed in part because of concerns that lawmakers on Capitol Hill had not been adequately consulted. The UAE, along with the Bush administration, was caught off guard in 2006 when legislators vigorously objected to an already-approved plan to hand operations of several US ports to DP World, citing concerns over national security.

That plan was ultimately scrapped, but US officials have expressed regret over the incident.

If the 123 agreement is not signed by Mr Bush before the end of his term, its fate under the next administration is not clear, said Sharon Squassoni, a senior associate in the non-proliferation programme at the Carnegie Endowment for International Peace in Washington.

"It's anybody's guess how the Obama administration will view the promotion of nuclear energy," she said. "It's unlikely to be quite so enthusiastic as the Bush administration."

Some of the same sentiments and concerns that fed the DP World controversy remain in Washington. And discussion by Congress of the UAE nuclear programme – which would be the first in the Middle East – will effectively test whether, and how much, the climate has changed. Some lawmakers, sceptical of the UAE's relationship with Iran, one of its biggest trading partners, say they oppose any nuclear pact until the UAE becomes more aggressive in enforcing export controls.

Once a 123 agreement is signed, it must be formally submitted to Congress, triggering the start of a review period on Capitol Hill of 90 consecutive session days. The agreement automatically goes into effect at the end of that period unless a joint resolution of disapproval is passed.

Sean McCormack, a spokesman for the US state department, urged lawmakers on Friday to engage in "rational, factual, informed discussion".

"We have engaged the UAE on this topic because we think it is an important way for countries in the region to potentially realise peaceful uses of nuclear energy," Mr McCormack said. "If you encourage states, whether they're in the Middle East or elsewhere around the globe, to engage in responsible behaviour, realise the benefits of peaceful nuclear energy while carefully prescribing the uses" of the technology in formal agreements, "that's a good thing", he added.

Thorium Warms Up to Nuclear India
By Vidya Ram
World Nuclear News
December 9, 2008

It has become the first U.S. nuclear energy company to enter India after the nations' civil energy agreement.

Thorium Power has become the first American company to march into the Indian nuclear market after an agreement to collaborate on the energy was finally signed between India and the United States last month. The Virginia-based nuclear energy company struck a deal with Punj Lloyd, an Indian engineering firm, to create a 50-50 joint venture which it hopes to have in place by the end of March, Seth Grae, chief executive of Thorium Power, told Forbes.com.

Through the joint venture, **Thorium Power** (nyse: THPW - news - people) is planning to set up an investment fund for the nuclear energy industry, act as a consultancy to support other firms entering the Indian market and develop thorium fuel.

The use of thorium fuel for nuclear energy is still being tested, but Thorium Power believes positioning itself in India as quickly as possible could prove lucrative. "India has either the most thorium or second-most thorium after Australia," said Grae. (As there is no large industrial use of thorium, the size of reserves have to be estimated.)

Grae believes that there could be a fourth prong to his company's India venture eventually: "We are also looking at creating a nuclear operating company that would start up new reactors in countries that have never had them before."

Nuclear energy suppliers have been racing to enter the Indian market after the Nuclear Suppliers Group, an international organization representing companies that supply the energy, lifted its nuclear trade embargo on India in August. The embargo had been in place for the past thirty years, since India's first nuclear test.

So far the influx has been headed by Russia: last week India and Russia signed a nuclear agreement on civil nuclear cooperation, and Russia's nuclear energy conglomerate Rosatom will begin by building a reactor in the southern state of Tamil Nadu.

In October, the U.S. Congress finally gave its approval to legislation that would enable American companies to participate in India's civil nuclear energy program. The recent terrorist attacks on Mumbai, however, seem to have had an impact on the plans: an official trip for companies considering investing in the Indian nuclear sector that was due to take place last week was postponed to January.

ENERGY – Frictions in Fission Clubs
By Rajeev Dubey
Businessworld
December 12, 2008

The unusual lull after the storm kicked up by the Indo-US nuclear agreement was disconcerting for India's long-time ally Russia — until India appeased Moscow with a $8-billion order for four new nuclear reactors last week. That signalled New Delhi's intent to slowly open up its nuclear power generation to the private sector — something that will principally benefit Russia's rivals, the US, the UK, France, Germany and Japan, all among the world's leading nuclear-reactor builders and suppliers.

Now India must introspect on which nuclear fuel it will choose to achieve its goal of generating 20,000 MW of nuclear power by 2020 — uranium, which the whole world uses, or thorium, a fuel India can source locally and has technical capabilities in, but which remains unproven commercially? The choice will determine over Rs 1 lakh crore of immediate orders for equipment and project management services, a lifetime of maintenance services contracts and an opportunity to stamp the future of India's ambitious civil nuclear energy programme with the technology's supremacy.

URANIUM VS THORIUM

Unlike uranium, thorium cannot be readily used as weapon-grade fissile material

Thorium reactors produce 70 per cent less nuclear waste compared to uranium reactors

Spent fuel from thorium reactors is 90 per cent less radioactive than uranium spent fuel

Thorium fuel is 5-10 per cent cheaper and less price-volatile than uranium fuel

Thorium is three-four times more abundant on Earth than uranium

As expected, the lobbies for and against thorium (which is on the verge of commercialisation) are going strong. "If anything is to be approved, it should be thorium," says Seth Grae, president and CEO of US-based nuclear power consulting firm thorium Power. "India should use local thorium reserves. Compared to other extractions, thorium extraction is a simple procedure."

But as Grae admits, there are equally strong lobbies for uranium reactors that compel him to travel to India and neutralise their influence on the government every other month. Governments and regulators are often averse to new technologies in sensitive areas such as nuclear power because of apprehensions about the fallout of a mishap. The offices of Anil Kakodkar, chairman of the Department of Atomic Energy, and Kapil Sibal, minister for science and technology, did not respond to BW's queries on the issue.

The other lobby working against thorium is that of the established reactor builders, technology providers and nuclear-plant operators, who would rather milk their investments in uranium fuel technology they are currently using rather than spend millions on learning and ratifying a new technology. Areva India and GE India, subsidiaries of two of the world's largest nuclear-

equipment suppliers, refused to comment on the ‘sensitive’ nature of the queries about which technology they would back.

The Thorium Edge

Developments in nuclear technology have been static globally for nearly three decades. The US, for instance, has not set up a new nuclear plant in 29 years. But India’s new-found interest and China’s plan to raise its nuclear power generation target from 40 GW to 70 GW by 2020 have livened up the international nuclear industry. And thorium is back in nuclear debates almost 50 years after it was banished as an unviable technology. Ironically, the world’s first nuclear power plant at Pennsylvania in the US was built using thorium fuel.

Although thorium is three-four times more abundant in nature than uranium, the West embraced uranium as the programme could double up for nuclear weapons too. Thorium, though, has several advantages (see ‘Uranium Vs Thorium’). In an environment of growing terrorist threats, its biggest advantage is that it cannot be readily used as nuclear weapons material.

Who wants thorium reactors?
Countries such as India and Australia, which have nearly 50 per cent of the world’s thorium reserves **New technology suppliers and consultants** **Countries that wish to use nuclear technology for non-weapon use**
Who does not want thorium reactors?
Governments and regulators unwilling to try out new technologies **Incumbents and established nuclear reactor builders and technology providers** **Existing nuclear-plant operators who will need to spend more on learning and vetting technology**

In India, diehard nationalists fear the Indo-US nuclear deal could reverse over five decades of indigenous technology development, and shift the domestic nuclear programme’s focus from self-reliance to what could, in future, be a debilitating dependence on western technology. Their fear stems from the concern that the US and most other countries will sell light-water reactors (80 per cent of the world’s reactors run on light water) and related technology, while the entire Indian nuclear programme is built around the heavy-water technology that is better suited for thorium use. More than five decades ago when Homi Bhabha conceived the nuclear programme, it was tailored to eventually use thorium because India has 290,000 tonnes of thorium reserves — the world’s second largest behind Australia’s 300,000 tonnes.

“There appears to be a deliberate move to scuttle the thorium-breeder programme because if we establish the commercial use of the thorium cycle, India would be a tremendous technology and fuel powerhouse for nuclear energy,” says former chairman of the Atomic Energy Regulatory Board A. Gopalakrishnan, who had opposed the Indo-US nuclear deal.

The US, at whom this volley is directed, applied the brakes on the heavy-water technology development more than three decades ago because it found light-water reactors more efficient. But India continued with the heavy-water reactors because they use natural uranium, while light-water reactors consume enriched uranium, which requires another set of complex processing. No other nation, except Russia and, to an extent, Germany, has since worked on heavy-water technology development. This is a fact that scientists believe, rather jingoistically, gives India an edge. After all, India is the only country to be setting up a 300-MW plant at Kalpakkam near Chennai that will be a stepping stone to commercial thorium power generation. It had been

conceived after a trial-run in a 30-KW reactor, also at Kalpakkam. As the next step, a thorium reactor is currently being vetted at Bhabha Atomic Research Centre (Barc) in Mumbai for technology and design.

The Indian Edge

"India is ahead of the curve of almost everybody in thorium-fuel reactors," says D.V. Kapur, director of Reliance Industries and former power secretary. "But, at what stage thorium reactors will be possible is still a question."

Thorium backers, however, believe that the Kalpakkam project, scheduled for commissioning in 2010-11, will be the first major technology demonstrator, and that India can begin developing larger commercial thorium reactors within 8-10 years. A two-year wait from now for a nuclear project that has an average lifecycle of 60 years is fair, they say. Besides, the Kalpakkam plant is being designed for an astonishing 100-year lifetime. The next best: a thorium plant is being trial-run in Russia for nearly five years. "Thorium utilisation was never a short-term option; 30 have been spent in developing an entire nuclear-fuel cycle all by ourselves under embargos," says A.N. Prasad, a former director of Barc. "But the opportunity to lead the world will be gone if resources and infrastructure get diverted (towards uranium and light-water reactors). Though the government has not explicitly indicated it, but look at the implications."

The case being built up by the pro-thorium lobbies would be hard to set aside for its indigenous implications. Not to forget that the scorching global metal prices have already raised the cost of setting up a nuclear plant by up to 30-50 per cent in the past two years. With metal prices softening, that cost may come down a bit now but, for the moment, fully imported uranium reactors at a rupee-dollar rate of nearly Rs 50 per dollar will be nearly 20 per cent more expensive than normal. With the rupee continuing to slide, this will dissuade imports in any immediate nuclear reactor orders, hurting the uranium lobby for the moment.

Punj Lloyd signs pact with Thorium Power of US
Hindu Business Line
December 4, 2008

Joining hands: Mr Atul Punj, Chairman, Punj Lloyd Group, and Mr Seth Grae, President and CEO, Thorium Power Ltd, exchanging documents after signing a memorandum of understanding in the Capital on Thursday. - Kamal Narang

Punj Lloyd Ltd will form a 50:50 joint venture company with US-based Thorium Power Ltd for building nuclear power plants.

The new company will combine Punj Lloyd's expertise in EPC contract work and Thorium Power's technological expertise in the use of thorium to generate nuclear power.

A memorandum of understanding (MoU) for this was signed between the two companies here today.

"The working groups are being put in place that will work out the finer details of the agreement and we will be forming the company by March 2009," the Punj Lloyd Chairman, Mr Atul Punj, told reporters here after the MoU signing ceremony.

"Ideally, I would look at building up around 4,000 MW thorium fuel based power generating capacity four to five years down the line for the power utilities that would be coming up," Mr Punj said.

This is the first agreement signed between an Indian company and a US nuclear power company since the Indo-US civil nuclear cooperation and the 123 agreement was signed, he pointed out.

The President and CEO of Thorium Power, Mr Seth Grae, said that "the new company will undertake fuel design for the reactors, provide [services] for building reactors for the nuclear power plants as well as advisory services in exploring development and investment opportunities in the nuclear energy sector."

"The new company could even undertake operating the reactors also at a later stage," he said.

Punj Lloyd in tie-up with Thorium Power
Hindustan Times
December 4, 2008

Engineering procurement and construction major, Delhi-based Punj Lloyd Group and US-based Thorium Power Ltd on Thursday signed a memorandum of understanding (MoU) to set up thorium-based nuclear power plants in India, Southeast Asia and other territories.

This is the first agreement signed for establishing nuclear power plants in the private sector. The two companies will be equal partners in the joint venture.

“We are looking at exploring opportunities to establish light water reactors-based nuclear power plants that can act as a bridge in the nearer term for India’s growing energy needs,” Seth Grae, president and chief executive officer of Thorium Power Ltd said. “Thorium-based power plants have several advantages over the conventional heavy water reactors as they reduce dependence on uranium, and are safer, cleaner and less toxic.” According to Seth, thorium as a fuel cannot be used for manufacturing conventional nuclear weapons.

“India has the largest deposits thorium in the world and the successful launch of thorium technology will make India self reliant for fuel in the long-run,” Atul Punj, chairman, Punj Lloyd, said.

India has 17 nuclear reactors and produces about 4200 mega watts (MW) of electricity. It has a largely indigenous nuclear power programme and expects to have 20,000 MW nuclear capacities on line by 2020, subject to an opening of international trade.

Thorium Power, Punj Lloyd inks MoU to set up N-plants 1
Financial Express
December 4, 2008

Infrastructure major Punj Lloyd and the US based Thorium Power inked a memorandum of understanding (MoU) to form a joint venture company to set up and operate nuclear power plants in India.

“The JV will consider deployment of Thorium Power's nuclear fuel technology in the country along with setting up an investment fund for investing in India and globally. Also, it will be looking at setting up of operating company,” said Seth Grae, president and CEO, Thorium Power, while announcing the JV.

“The JV agreement is likely to be signed by March next year. The ratio of investment in the JV company has not yet been decided. We will try to be a majority stakeholder in the JV firm,” said Atul Punj, chairman Punj Llyod.Punj Lloyd plans to use its shipyard facility at Pipavav to help set up the nuclear facility.

“By March next year, our shipyard at Pipavav would be ready. We will use it for fabrication of the nuclear plant,” Punj added.

Thorium Power, Punj Lloyd inks MoU to set up N-plants 1
DNA (Daily News & Analysis)
December 4, 2008

Punj Lloyd in pact with Thorium Power

MUMBAI: Engineering and construction firm Punj Lloyd Thursday said it has entered into an agreement with US-based Thorium Power for consulting activities in the development of nuclear power generation in India, South Asia and other territories.

The company has signed a memorandum of understanding with Thorium Power to expand consulting activities for the development of nuclear power generation regionally and worldwide, Punj Lloyd said in a filing to the Bombay Stock Exchange.

"The Indo-US civil nuclear deal has opened up investment opportunities which will make the Indian industry robust and competitive. The nuclear space is very promising and with this partnership we aim to take forward India's long-standing commitment to the thorium fuel cycle," Punj Lloyd Group Chairman Atul Punj said.

Thorium Power is a US-based nuclear energy company. The company develops non-proliferative nuclear fuel technology and provides comprehensive advisory services for emerging nuclear programmes.

"Through this collaboration we will explore the full range of options available to both our companies in areas as diverse as marketing our non-proliferative fuel designs," Thorium Power President and CEO Seth Grae.

Shares of Punj Lloyd were trading at Rs 148.25, up 3.67 per cent on the BSE.

Punj Lloyd, U.S.-based firm to form JV in March
The Hindu
December 4, 2008

New Delhi, Dec 4 (PTI) Engineering and construction firm Punj Lloyd and U.S.-based Thorium Power would form a JV company by March 2009 to provide consultancy service for setting up nuclear power plants in India, Southeast Asia and other regions and operating them.

Both the firms on Thursday signed a Memorandum of Understanding for setting up a joint venture company and to explore and identify the strength of the American partner in areas of deployment of Thorium Power's nuclear fuel design in India, Southeast Asia and other territories.

"We would enter into the JV agreement by March next year. The quantum of investment in the JV company has not decided, but it is most likely to be on 50:50 basis. However we try to hold more than 50 per cent of equity in this company," Chairman Punj Llyod Atul Punj told reporters.

"The JV company would have 2-3 arms to provide expertise on thorium fuel technology, consultancy services for setting up thorium-based power plants and for operating such power plants," said Thorium Power President and CEO Seth Grae.

"Our shipyard at Pipavav in Gujarat would be ready by March next year. This would be used for nuclear power plant fabrication," Punj added.

India has the second largest thorium reserves in the world and the successful launch of thorium technology would make the country self reliant.

Thorium Power develops non-proliferative nuclear fuel technology and provides advisory services for emerging nuclear programmes.

Punj Lloyd joins hands with US-based Thorium Power
Business Standard
December 4, 2008

BS Reporter / New Delhi December 4, 2008, 11:51 IST

In what could be termed as the direct outcome of the Indo-US civil nuclear deal, engineering and construction conglomorate Punj Lloyd has joined hands with US based Thorium Power Ltd, the leading provider of non-proliferative nuclear fuel technology, to explore nuclear fuel generation possiblities in India.

The agreement signed between the two companies today will help Thorium Power and Punj Lloyd set up joint venture projects in the area of nuclear fuel in India and neighbouring regions.

"We will explore full range of options availble to both our companies in areas as diverse as marketing our non-proliferative fuel designs, providing advisory services to emerging national nuclear programmes and exploring development and investment opportunities in the nuclear industry", Seth Grae, president and CEO, Thorium Power said.

Atul Punj, chairman Punj Lloyd Group said that the nuclear space is very promising and the partnership aims to take forward India's long standing commitment to the Thorium fuel cycle, notwithstanding the opening up of trade in conventional uranium technology. "India has the second largest deposit of thorium in the world and the successful launch of the thorium technology will make India self reliant with its own fuel in the long run", Punj said.

Power executives' climate change proposals
World Nuclear News
December 9, 2008

Nuclear power is among the technologies ready to fight climate change and its wide deployment should be facilitated now, according to top electricity companies.

The report authors represent 10% of global power generation capacity and supply over 300 million customers

The conclusion comes in a new report from the World Business Council for Sustainable Development (WBCSD), released today alongside the UN climate change talks in Poznan, Poland.

Asserting that there is no single solution to climate change problem, *Power to change: A business contribution to a low-carbon electricity future*, gives a technology-by-technology analysis of what governments and businesses must do in order to make best use of current and future equipment.

The report was compiled by executives from power companies including Electricité de France, Eskom, GdF Suez, Kansai Electric Power Company, Statkraft and Tokyo Electric Power Company. The CEOs said their firms bear a "front-line responsibility in the urgent global struggle against climate change" and called for progressive decarbonisation of power supplies, more efficient end use and the substitution of electricity for fossil fuels.

Working towards emissions reductions of 14 to 18 billion tonnes of carbon dioxide per year by 2050, the report specified that governments and businesses act together to facilitate technologies that are ready for use now as well as those that are sometimes competitive and those that may be ready only in decades to come. This would provide a "continuum of support... and certainty" for technology vendors, power sector planners and policy-makers into the middle of the century.

Current and future power technologies are placed into four groups. The first contains existing mature and competitive generation methods. Nuclear power features in this category, along with large hydo, combined-cycle gas turbines and energy saving devices like compact fluorescent lamps. The report says these technologies "urgently require regulation that builds public acceptance and fosters successful implementation at a larger scale."

For nuclear power, standardization of reactor design is seen a a key to competitiveness, and steps are already underway to achieve this in industry. Allowing utilities to use suitable business models for new developments should be enough to incentivise nuclear deployment, the report said, in the context of an implicit or explicit price on carbon dioxide. Meanwhile, governments must maintain stable and predictable licensing and safety regimes. Nuclear power could provide 14-15% of the emissions savings that are required, while producing 19-23% of electricity, under the report's scenarios.

In the second group are technologies that would be competitive, were costs for carbon dioxide emissions included in power prices. This includes ultra-supercritical pulverized coal and wind power in the best locations.

A third group contains technologies like onshore wind power and ground-source heat pumps that are currently far from competitiveness and need support from mass-deployment schemes, and feed-in subsidies.

Lastly are technologies with great promise which are as-yet far off. This includes carbon capture and storage, which could become competitive around 2023, and Generation IV nuclear power which could come in after 2030. These require direct and coordinated public research and development.

Regarding the deployment of existing technologies, the report praised the Clean Development Mechanism under the Kyoto Protocol. This allows countries with emissions reduction commitments to invest in projects that reduce emissions in other countries. Currently nuclear power projects are excluded from the CDM, but the report called for change after the 2012 commitment period: "There should be no exclusions of low-carbon technologies from the CDM or future mechanisms," it said.

Nuclear power key to decarbonization of electricity
World Nuclear News
December 2, 2008

A report by the UK's independent Committee on Climate Change (CCC) concludes that the economic case for new nuclear power deployment is strong and if the pace of renewable wind power should fail to meet targets the deployment of nuclear power should be accelerated to fill the gap.

The committee's report also says that to reduce greenhouse gas emissions by 80% by 2050 implies the almost total decarbonisation of electricity by 2030.

The CCC concludes that nuclear power is cost-competitive with conventional fossil fuel generation, even when decommissioning costs and fluctuations in uranium fuel process are allowed for. The main constraints on new nuclear capacity are likely to be the rate at which new plants could be built, given limited supply of technically competent nuclear specialist engineers and the demanding regulatory frameworks.

In contrast, fossil fuel generation incorporating carbon capture and storage (CCS) would always be more expensive that conventional fossil fuel generation, according to the committee, because of the additional process steps required, although the committee thought CCS was 'technically feasible'.

The cost of deploying low-carbon technologies in the UK would be higher than the world average, according to the CCC, because of higher construction costs, higher costs and time involved in land acquisition and planning procedures. These higher costs affected all technologies, including wind, nuclear and new fossil fuel plant. Over the last three years, there had been large rises in the cost of wind turbines and of solar photovoltaic cells, as well as significant cost overruns in new build nuclear reactor investments. These increases have resulted from a combination of increases in material costs (e.g. steel, which in turn is driven by fossil fuel prices), skill shortages and by bottlenecks in supply chains.

The CCC did not believe that supplies of fuel would not place serious constraints on the growth of nuclear power, given proven and likely uranium supplies, alternative fuel sources and the long-term potential of fast breeder fuel recycling.

One potential issue raised by the CCC was that a greater reliance on nuclear and renewables could lead to an excess of generation capacity on some summer nights. However, the committee envisioned that this excess in supply could find new uses, such as being used to recharge batteries in electric cars. The committee states that it is likely that cost economics will argue for a significant nuclear role within the generation mix, particularly if and when greater use of battery electrical storage (for instance for electric cars) increases the demand for predictable off peak (e.g. overnight) capacity.

In the longer term, the committee concludes that an 80% cut in the UK's greenhouse gas emissions by 2050 is achievable at a relatively small cost to GDP and that that cost can be appreciably reduced by keeping all technology options for electricity generation open, including renewables, nuclear and CCS.

To facilitate new investment in nuclear energy the CCC states the key public policy priorities will be:

- A clear commitment to the principle of nuclear power deployment if and when cost justified, with supporting licensing and planning policies.

- Clear and radical long-term emission reduction objectives, such as the committee's proposed 80% by 2050 target, which will only be achievable if electricity generation is almost completely
  decarbonised by 2030.
- A clear commitment to keep tightening EU Emission Trading Scheme (ETS) caps and to appropriately limit the use of offset credit purchased within the EU ETS, to the extent required to meet long-term emission reduction targets.

The committee, chaired by Lord Adair Turner, advises the UK government on how it can meet its greenhouse gas emission goals. The committee was established in March 2008 after publication of the government's climate change bill, which set a target of a 60% greenhouse gas emissions reduction by 2050 for the UK. The government will report next year on how it intends to meet those targets.

EU pledges €25 million to nuclear fuel bank
World Nuclear News
December 9, 2008

The Council of the European Union will contribute up to €25 million ($32 million) towards an international nuclear fuel bank controlled by the International Atomic Energy Agency (IAEA), bringing the prospect a step closer.

The rationale behind the proposed nuclear fuel bank is to offer a secure supply of nuclear fuel, vital for countries developing a nuclear power program. International efforts to establish multilateral mechanisms to provide countries with increased energy security "may also offer a credible alternative to the development of national enrichment and reprocessing facilities," the council noted in its 8 December statement. The EU funding is contingent on the IAEA defining and approving "conditions and modalities" for the bank.

The nuclear fuel bank will be part of a broader effort to provide multilateral fuel supply mechanisms, and the EU intends to pursue in-depth third-party discussions on the development of different solutions for different needs "in the near future".

The IAEA fuel bank is one of several proposals for providing countries that wish to start using nuclear power with a mutually assured nuclear fuel supply while preserving the best possible safety, security and non-proliferation conditions. The US-based Nuclear Threat Initiative (NTI) organization pledged $50 million of funding for the bank in September 2006, conditional on nations providing a further $100 million. The EU's $32 million joins Norway's February pledge of $5 million, and pledges from the USA ($50 million) and the United Arab Emirates ($10 million) made in August.

Enrichment is a vital step in the manufacture of the low-enriched uranium fuel used in nuclear power reactors, but enrichment technology can also be used to produce highly-enriched uranium suitable for use in nuclear weapons, and is therefore seen as a nuclear proliferation risk. Likewise, reprocessing facilities can be used to recover uranium and plutonium from spent reactor fuel for re-use in power generation but could also be used to recover the materials for military use. Iran is currently under United Nations sanctions because of its refusal to halt the development of a domestic uranium enrichment program which it claims is meant for civilian use.

The IAEA has been considering possible multilateral approaches to the civil nuclear cycle for a number of years, with several proposals on the table including, Russian-led plans to set up an International Enrichment Centre under IAEA supervision at Angarsk in Eastern Siberia.

India outlines nuclear power ambitions
World Nuclear News
December 2, 2008

India has reaffirmed its commitment to thorium fuel cycle, proposing to construct a dozen indigenously-developed nuclear power reactors. These units will be supplemented by imported conventional reactors.

As part of the Eleventh Five Year Plan (2007-12), Nuclear Power Corporation of India Ltd (NPCIL) will start site work next year for 12 indigenously-developed reactors, including eight pressurised heavy water reactors (PHWRs) of 700 MWe each, three 500 MWe fast breeder reactors (FBRs) and one 300 MWe advanced heavy water reactor (AHWR). This will take forward India's long-standing commitment to the thorium fuel cycle, notwithstanding the opening up of trade in uranium and conventional nuclear technology.

The eight PHWRs were supposed to have been in the last five year plan, but constraints on uranium mining in India delayed them and set back the overall schedule, according to NPCIL Chairman, S K Jain.

This week he said that "India is now focusing on capacity addition through indigenisation" with progressively higher local content for imported designs, up to 80%.

Looking ahead, NPCIL's augmentation plan includes construction of 25-30 light water reactors of at least 1000 MWe by 2030, and NPCIL is currently identifying coastal sites for the first of these, both 1000 and 1650 MWe types.

Speaking to an industry forum in August, but in anticipation of the easing of trade restrictions, Dr Anil Kakodakar, Chairman of the Indian Atomic Energy Commission (AEC) outlined his vision for India becoming a world leader in nuclear technology due to its expertise in fast reactors and thorium fuel cycle.

Long term, the AEC envisages its fast reactor program being 30 to 40 times bigger than the present PHWR program, which has some 4.4 GWe operating or under construction and 5.6 GWe planned. This will be linked with up to 40 GWe of light water reactor capacity, the used fuel feeding ten times that fast breeder capacity, thus "deriving much larger benefit out of the external acquisition in terms of light water reactors and their associated fuel." This 40 GWe of imported LWR multiplied to 400 GWe via FBR synergy would complement 200-250 GWe based on the indigenous programme of PHWR-FBR-AHWR. Thus, AEC is "talking about 500 to 600 GWe over the next 50 years or so" of nuclear capacity in India, plus export opportunities.

The AEC also said that India now has "a significant technological capability in PWRs, and NPCIL has worked out an Indian PWR design" which will be unveiled soon. The main commercial experience has been building the two Kudankulam VVER reactors under Russian supervision.

South Korea to Spend $28 Billion on New Power Plants
Bloomberg News
December 28, 2008

Dec. 28 (Bloomberg) -- South Korea plans to spend 37 trillion won ($28.5 billion) building more nuclear and gas-fired power plants by 2022 to reduce its dependence on oil and meet rising demand for energy.

The country will build 12 more nuclear-powered plants, seven coal-fired plants and 11 fueled by liquefied natural gas by 2022, the Ministry of Knowledge Economy said in a statement today. The projects are part of a government power supply-and-demand plan that outlines investment for the next 15 years.

South Korea, which imports almost all its oil, is trying to cut reliance on crude and diversify energy sources after oil prices in New York climbed to a record $147.27 a barrel in July. By the end of 2022, power-generating capacity in Asia's fourth- largest economy will rise to 100.9 gigawatts from the current 65.9 gigawatts, the ministry estimates.

"By building more nuclear plants, the most economical and cleanest energy, South Korea can cope with high oil prices and reduce greenhouse-gas emissions," said Yun Hee Do, an analyst at Korea Investment & Securities Co.

The cost of nuclear power generation is 3 won per kilowatt compared with 22 won at coal-fired plants and 89 won for gas, according to the ministry.

Nuclear plants will provide 48 percent of generating capacity by 2022, up from 34 percent this year, the ministry said in its statement. The country will reduce reliance on oil-fired plants to 0.2 percent from 1.9 percent.

South Korea's plans are based on estimates that electricity demand will increase an average 2.1 percent annually through 2022. Currently, the country has 20 commercial reactors, 40 coal-fired plants and 45 gas-fired plants.

Renewable Energy

Asia's third-largest buyer of crude oil also plans to expand the use of alternative energy. Under the government's long-term plan, renewable-energy sources including solar, wind and water, should account for 11 percent of power consumption by 2030 from the current 2.2 percent.

To achieve its goals, South Korea will invest 100 trillion won in alternative energy by 2030. The country targets a 44-fold increase in the supply of solar power to 3,504 megawatts, a 37- fold gain in wind power to 7,301 megawatts, and a 19-fold increase in biofuels supply.

To contact the reporter on this story: Shinhye Kang in Seoul at skang24@bloomberg.net.

Last Updated: December 28, 2008 02:33 EST

Bush signs nuclear inspection pact U.N. watchdog
Reuters
December 31, 2008

CRAWFORD, Texas (Reuters) - President George W. Bush signed a nuclear safeguard agreement on Tuesday with the International Atomic Energy Agency that the United States hopes will prompt other countries to follow suit.

Mohamed ElBaradei, director of the IAEA, said earlier this year that the U.N. nuclear watchdog was hampered in its duties by the failure of countries like Syria to ratify the "Additional Protocol" that would allow short-notice visits to ensure no bomb-related work was taking place at secret sites.

The pact was signed in Vienna on June 12, 1998, and the U.S. Senate approved it on March 31, 2004. To date, 118 countries have signed the protocol with the IAEA and 89 countries have ratified, the White House said.

The pact improves the IAEA's ability to detect clandestine nuclear weapons programs in non-nuclear weapons states, the White House said.

The United States as a nuclear weapons country and party to the Nonproliferation Treaty was not obligated to accept IAEA safeguards on its nuclear activities, the White House said.

But wide acceptance of the protocol would contribute significantly to U.S. nonproliferation objectives, it added.