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INTERVIEW – Sekhar Basu, AEC Chairman

Foreign Hand Trying to Stall India's Atomic Programme

With serious allegations of leaky nuclear reactors and poor security levelled against India's nuclear programme, Atomic Energy Commission (AEC) chief Sekhar Basu brushes aside these charges saying this is a "well designed agenda" to "stall or delay" the country's development. Journalist Adrian Levy, working for the Centre for Public Integrity in Washington, has levelled serious charges in a four-part investigative report against India's nuclear establishment. New chief of India's nuclear programme Sekhar Basu, also director of BARC, counters the allegations. Excerpts from an interview:

Q) How much of truth is there in the charges levelled by Adrian Levy against the nuclear establishment?

A) I do not consider these as charges; he has written a paper based on something somebody else has said elsewhere, which he has put into his account. It is not a scientific document, it is not a document based on facts, and it is based on comments of some people. I do not consider these as charges. It looks to us as a very well designed agenda for them whoever is funding him, to stall or delay the development of our country.

Q) So, who do you think is motivating Levy or

Indians will not stall the Indian programme, that I am confident. It will be somebody from a foreign country who thinks that India should remain poor and that India should remain poverty ridden, and that India should remain in darkness, so they are the people who are doing it.

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trying to stall the Indian nuclear programme?

A) Ok. Definitely, Indians will not stall the Indian programme, that I am confident. It will be somebody from a foreign country who thinks that India should remain poor and that India should remain poverty ridden, and that India should remain in darkness, so they are the people who are doing it.

Q) Levy says that in Jadugoda where India has its uranium mines, they leak, and that there is a lot of radioactivity that comes

out, and people are suffering because of that, you probably must have visited that area several times, what is your experience?

A) Whatever he has said is based on certain facts that earlier somebody has published. He must know that there was a *suo moto* case that was

taken up by the judge and to that, we have given a reply. The details are available he can see the reply to see that if there is anything to be talked about.

In summary, the judge had told us to form a committee, we had formed a committee and based on that committees conclusions it is very well established that nothing new has happened, there is no extra burden of diseases or no new types of diseases have come up or even that the number has not increased, nothing of that has happened. If you go there, I would request all other communities to go there and have a look if this is true or not. Children are moving around happily in their college and schools. This is an area where there is poverty, it is because of that, malnutrition or those type of problems that are there.

Q) So you are saying, there is no leak of radioactivity from the Jadugoda uranium mines of India. Is that the sum and substance?

A) Why should there be any leak, uranium is there in the soil, you are then taking the uranium out, at least part of it or most of it. If it was that much of concern we would have taken out even that uranium also.

Why is it being told as a leak, it is not a leak from a reactor, or a re-processing plant? In a mine, what is the leak that is possible? Anyway, there is an issue of 'tailing pond', and this tailing pond is one of the safest in the world, it is surrounded by hills on all the sides, there is a good fencing so that people cannot enter.

Q) Levy also says India's nuclear reactors, the power reactors and we have over 21 of them, they leak radioactivity, they don't function even Kudankulam is not functioning for the last six

months, so he says there is a lot of problem with our nuclear programme, you head the nuclear programme, do you think it is unsafe?

A) I would like to answer your question in two parts, Kudankulam is one of the best reactors in the world, one of the safest reactors in the world. Secondly, our operators are the best in the world, since people put jokes to us, saying you put PhD's as operators of nuclear reactors, it is that kind of a training that they have.

Why is it being told as a leak, it is not a leak from a reactor, or a re-processing plant? In a mine, what is the leak that is possible? Anyway, there is an issue of 'tailing pond', and this tailing pond is one of the safest in the world, it is surrounded by hills on all the sides, there is a good fencing so that people cannot enter.

Where is the question of a leak, we have never had any incident like that, in Japan at Fukushima, that kind of incident can never happen to us. Our things are taken care off, taken care off, everybody who comes including the director general of the IAEA who came after the Fukushima incident he went, to see even the Tarapur reactor, he found that this is one of the safest reactors.

Q) What is wrong with the atomic reactors at Kudankulam in Tamil Nadu? People say you have used wrong parts, shoddy parts and that is why it has failed for last six months it is not working? Even CM Jayalithaa has requested PM Modi to get it started

This is a new reactor started for the first time we had to show to the AERB so that we had to open up everything, even the reactor fuel assemblies had to be removed to show the inside of the vessel to show that everything is fine, only after that they are giving clearance.

A) See, saying that everything is wrong is not at all correct, just now as you say that the American's are writing our reactors are

not safe, so the very fact that we are taking lot of time to re-start the reactor is because of the fact that we want it to be super safe.

This is a new reactor started for the first time we had to show to the AERB so that we had to open up everything, even the reactor fuel assemblies had to be removed to show the inside of the vessel to show that everything is fine, only after that they are giving clearance.

This is for the first time and six months is not at all a big thing. Earlier reactors we have seen they have been shut down for two years also and then the same Tarapur reactor which was shut down for two years, today it gets shut down only for 20 days or a month.

Q) So is the Kudankulam reactor safe? Is there something wrong with the parts, have you been able to get the parts from Russia?

A) It is not something wrong with the parts, it is a normal procedure. Once you are boxing it up and it will be operational for one year continuously, you have to make sure that you inspect everything and where ever you have something or you suspect that [something] can go wrong or if some wearing has taken place, you replace it with a new one so that for the next one year you do not have any problems.

Q) So when can one expect the Kudankulam reactor to start again?

A) I am very sure that next month Kudankulam reactor will be going critical and towards the end of the month [January 2016] we should be able to synchronize it with the grid.

Q) Levy also says that we are making a secret nuclear city somewhere in Karnataka to make Hydrogen bombs? Is there fact in it and is it really secret?

A) As far as this secret bomb is concerned, I do not know what is this secret bomb? Is he aware what is required to make this secret bomb, yes uranium can be used theoretically to make bomb, but whether one should make bombs out of uranium is also something that I do not know.

See we have to supply uranium to our plants so if we do not make anything to process this uranium, how can we say that we will not do anything and keep quiet. The whole exercise to me is looking like an effort to slow down our programme. These types of things do not carry any meaning.

Source: <http://http://economictimes.indiatimes.com/>, 27 December 2015.

OPINION – The Times of India

Nuclear Power an Article of Faith for India

If the Modi government has its way, India could produce 14,500 mw of nuclear power by 2024, almost a three-fold jump from the current level of 5,700 mw. That is a far cry from the government's stated intent to reach 63,000 mw by 2032 but, nevertheless, underlines India's commitment to nuclear energy as a way of reducing its reliance on fossil fuel.

Simultaneously, the government has sought to focus on renewables with the Union Cabinet earlier this year clearing a proposal for a five-fold jump in solar power by increasing its capacity to 100,000 mw by 2022.

PM Narendra Modi, much like his predecessor Manmohan Singh, sees an essential role for nuclear

power in India's energy mix. After decades of discrimination and international technology denial regimes, India finally managed to turn the tables in 2008 when it managed to get a waiver from the Nuclear Suppliers Group to trade in nuclear equipment.

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Countries like the US, Russia and France – all with major stakes in India's nuclear energy market worth billions of dollars – helped India, a non-NPT signatory, get that waiver despite opposition from China. India continues to be the only country in the world to be able to carry out nuclear commerce despite not having signed the NPT. India believes it is an acknowledgement of its impeccable non-proliferation track record.

One reason why India got the waiver was a statement at the NSG by then foreign minister Pranab Mukherjee that the country would abide by its commitment to unilateral and voluntary moratorium on nuclear testing. Mukherjee had said the waiver to India to conduct nuclear commerce would also have positive impact on global energy security.

Apart from the US, Russia and France, India now has entered into cooperation for peaceful uses of nuclear energy with at least seven other countries. These include South Korea, Namibia, Canada, Australia and Kazakhstan. India also signed an MoU for the same with Japan. This is significant also because it will allow major US vendors to source equipment from their Japanese partners.

Japanese PM Shinzo Abe finally clinched the agreement with India after he expressed satisfaction with India's unilateral and voluntary moratorium on nuclear testing, as expressed before the NSG in 2008.

The agreement with Canada and Australia are also particularly significant for India as these countries are the main exporters of uranium to the world. To facilitate the deal with India, former Canadian PM Stephen Harper made an exception when his government agreed to go by IAEA assurances alone over any possible misuse of uranium supplies to India.

About 80 per cent of vital nuclear plant components are made in Japan meaning India is also dependent on Japan for nuclear deals concluded with other countries, such as with the United States and France. Once the Japan-India nuclear deal is concluded, India will be able to access huge energy resources.

In November, Australia too announced that it had completed negotiations with India for administrative arrangements required to bring into force its civil nuclear cooperation agreement with New Delhi. This again was an acknowledgement of India's non-proliferation credentials as Australia had long vacillated over whether or not it wanted to supply uranium to a country which had no intention of signing the NPT.

Source: The Times of India, 15 December 2015.

OPINION – Satoru Nagao

The Significance of the Japan-India Nuclear Deal

On 12 Dec 2015, Japanese Prime Minister Shinzo Abe and Indian Prime Minister Narendra Modi inked a memorandum of understanding on the peaceful use of civil nuclear energy. Once the Japan-India nuclear deal is concluded it is likely to have important strategic ramifications for the

Indo-Pacific region.

The agreement indicates that the Japanese government has a strong will to support India's economic rise. Ever since India initiated favourable economic policies in the 1990s, its economy has seen unprecedented growth. But this rapid development is not without its weaknesses. The shortage of energy resources is one. India is even more reliant than Japan on oil imports, with the total amount of crude oil imported by India overtaking that of Japan in 2013. To maintain its rapid economic development, India needs more energy resources. Nuclear energy appears to be the only option that could fulfil India's energy needs without producing large-scale carbon emissions.

Japan's cooperation is crucial for exploring this option. About 80 per cent of vital nuclear plant components are made in Japan meaning India is also dependent on Japan for nuclear deals concluded with other countries, such as with the United States and France. Once the Japan-India nuclear deal is

concluded, India will be able to access huge energy resources. This should enable India to maintain rapid development and give it a valuable opportunity to make a positive impact on the region.

Despite some concerns otherwise, the India-Japan agreement is not a setback to the nuclear non-proliferation regime. While India is not a party to the NPT, given its past record there is no indication that India will proliferate or use its nuclear technologies against other countries. And, even if the international community officially recognises India as the 'sixth nuclear great power' – along with US, Russia, the United Kingdom, France, China – this will not necessarily prompt other great powers to claim the 'seventh' or 'eighth' position in the near future.

South Korea, Taiwan, Brazil, Argentina and South Africa were all in the past possibilities for another nuclear power. But they have already ceased their nuclear weapon development programs and are

unlikely to assert such claims. North Korea, Pakistan and Iran have been involved with the nuclear black market and as such the international community is now unwilling to accept them as recognised nuclear powers. Israel is also unlikely to push for legitimisation of its nuclear status as that could push neighbouring countries in developing their own nuclear programs.

The recently concluded civil nuclear deal is testimony to the fact that Japanese government has accepted India as a responsible nuclear power and that future Japan-India relations will be stable. There is also a strategic element to the India-Japan civil nuclear deal. The agreement provides a counter-balance to China's expanding activities in the Indo-Pacific region.

Historically, both Japan and India share a similar nuclear deterrence policy and a commitment to the total elimination of nuclear weapons. During China's nuclear tests in 1964, both Japan and India requested that the US extend its nuclear umbrella deterrence policy in Asia. While Japan's case was heard, India pleaded in vain. So, while Japan could afford to cease its joint nuclear development negotiation with West Germany, India could not cease their own nuclear development plans. Developing nuclear weapons was seen as the only strategic option left for India to mitigate nuclear risk. When viewed from this angle, both Japan and India shared a similar need for nuclear deterrence despite their wish for the global elimination of nuclear weapons.

Still there has been a relatively strong public opposition in Japan to India's nuclear policy and particularly its nuclear tests in 1998. But the recently concluded civil nuclear deal is testimony to the fact that Japanese government has accepted India as a responsible nuclear power and that future Japan-India relations will be stable.

There is also a strategic element to the India-Japan civil nuclear deal. The agreement provides a counter-balance to China's expanding activities in the Indo-Pacific region. Both Japan and India share similar anxieties about China's recent assertiveness. And both countries are concerned with the changing US-China power balance. Japan and India need to cooperate to fill the gap left by

Foremost among the potential economic risks is the possible cancellation of a \$22 billion nuclear deal signed between Ankara and Moscow – one that would see Rosatom, Russia's nuclear firm, construct the first Turkish nuclear plant in Akkuyu by 2020.

a declining US presence in the region. The urgency of this is underlined by the fact that China is exporting nuclear plants to Pakistan.

The only matter in the way of a burgeoning civil nuclear agreement in the future is Japanese concerns about the likelihood of another nuclear test by India. While another test might be a military requirement for India to maintain and update its nuclear

deterrence capability, it will undermine the agreement. In that case, Japan will need to cease nuclear cooperation with India. But if India respects Japan's unease towards nuclear testing then Japan-India nuclear cooperation could provide sustained benefits for India, Japan and the region.

Source: Nagao is a research fellow at The Tokyo Foundation and the Japan Forum for Strategic Studies and a lecturer in national security at Gakushuin University. East Asia Forum, 25 December 2015.

OPINION – Ian Armstrong

The Nuclear Implications of Turkey-Russia Tensions

In Nov 2015, a Russian Su-24 bomber aircraft was shot down by a Turkish F-16 fighter jet along the Syria-Turkey border. Now over a month removed, implications of the military dilemma are still

materializing. Analysts have already forecast a risk outcome based on carefully measured economic and diplomatic policy responses, and others have identified how visibly increased tensions will continue to inflict financial

consequences on both Ankara and Moscow across a range of projects.

Foremost among the potential economic risks is the possible cancellation of a \$22 billion nuclear

deal signed between Ankara and Moscow – one that would see Rosatom, Russia's nuclear firm, construct the first Turkish nuclear plant in Akkuyu by 2020.

At present, the Akkuyu plant is currently the subject of conflicting information. Though Russian media has reported that construction is still underway, Reuters asserts that Rostam froze the project on December 9th.

Regardless of accuracy, the opposing reports highlight both the increasing tensions between Russia and Turkey as well as the declining certainty of the nuclear agreement. With termination increasingly feasible, an untimely fate for the Russian-built Akkuyu Nuclear Power Plant presents a relatively broad range of risks for investors.

Turkish Energy and Economic Woes:

Much like the economic sanctions that Russia has already imposed against Turkey as punishment for the Su-24 debacle, freezing or cancelling Akkuyu's atomic energy contract would have immediate and important consequences for Turkish financial security.

Turkey is currently highly energy-dependent and is also facing the difficult challenge of providing enough energy for its rapidly maturing economy. The Russia-Turkey nuclear power contract would provide Turkey with an additional annual power output of 35 billion kWh per year – which some analysts have projected to amount to as much as 17% of Turkish electricity demand.

The cancellation of the Akkuyu plant would therefore deal a significant blow to Turkey's energy security and its strategic calculus as it anticipates shifting the energy burden towards nuclear in the medium term. The end of the contract would serve as unwelcome news for investors in Turkish industry across the board by representing an instantly less certain energy future, and could contribute to a brisk slowdown of the 4% economic growth seen out of Ankara in Q3.

In addition, the nuclear power plant promised by Rostam through the bilateral agreement is projected to result in the employment of roughly 10,000 people while also serving to reduce Turkey's negative balance of payments by 10%.

A terminated contract would erase this potential and contribute to a prolonged account deficit. This is significant considering that Turkey has recently overseen the highest negative balance of any G20 economy and has struggled with capital outflows.

These economic and energy-related risks would of course be less severe in the event that Turkey is able secure a replacement contract – a prospective economic opportunity for other aspiring nuclear exporters, like China, that Ankara has already begun considering. The same would hold in the event that the agreement with Russia is only frozen in the short-term and then resumed once tensions have simmered down.

The bottomline is that even these more favorable circumstances would still require costly delays in the development of Turkey's economy and energy profile.

Complications for Russia's Nuclear Empire:

While the premature termination of the Russia-Turkey atomic energy contract would naturally bring negative impacts to Turkey – and

would, in the most likely scenario, even come as an intentional act of spite from Moscow – it would also incur severe costs on Russian prestige and prosperity.

First and most forthright would be Rosatom's loss of a \$22 billion agreement, under which Russia has already accrued sunk costs totalling \$3.5 billion. These losses would come with particularly unfortunate economic blowback considering the already fragile state of the heavily sanctioned Russian economy.

However, the more remarkable consequences for Russia would come from the damage inflicted upon the future of Rosatom's emerging brand as the world's foremost global nuclear power provider – and with that, challenges to the international prestige, influence, and strategic calculus of Moscow.

Rosatom has currently secured contracts to construct roughly 30 nuclear reactors abroad, with plans to nearly triple that number within the next five years. The four prospective Akkuyu reactors ordained by the agreement with Turkey represent something of a watershed within Rosatom's

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international expansion, as the Turkish plant serves as the first to be contracted under the build-own-operate model.

Nuclear power plants constructed under the build-own-operate model involve Moscow financing, building and operating the plant – an enticing offer to countries previously barred from pursuing nuclear power due to the high buy-in costs. In exchange, Moscow acquires not only consistent, long-term financial dividends, but a permanent base of operations within a foreign country.

Russia's nuclear contract with Turkey thus stands as the litmus test for this incisive strategy – a business model that it seeks to employ across the developing world to bring nuclear power into henceforth untapped markets. The failure or cancellation of the Akkuyu contract would jeopardize Russia's ability to market its nuclear program, weaken its international prestige, and dampen its chances for bolstered influence.

In the coming weeks, the direction of relations between Moscow and Ankara will be an important indicator for whether the planned Akkuyu Nuclear Power Plant will be realized on schedule.

Source: <http://globalriskinsights.com/2015/12/the-nuclear-implications-of-turkey-russia-tensions/>, 28 December 2015.

OPINION – Brian Padden

Obama's N. Korea Strategy Leaves Nuclear Issue for Successor

Even though US President Barack Obama reached historic diplomatic breakthroughs with other longtime adversaries of the United States, it is unlikely he will realize any progress in limiting North Korea's nuclear program during the remaining year of his presidency. The Obama administration's persistent diplomatic outreach paved the way for normalizing relations with communist Cuba and a deal to limit Iran's nuclear program. But on North Korea the US has not shown any urgency to restart negotiations to end Pyongyang's nuclear program, relying instead on sanctions and containment strategies.

Now with US lawmakers focused on recent terrorist attacks and the growing threat from Islamic militants in the Middle East, analysts say, there is little political will in Washington to try to deal with North Korea. ...

Collapse 'Inevitable': North Korea's belligerent behavior, which includes renegeing on a nuclear deal in 2008 and provocations, including a 2013 nuclear test that even drew protests and sanctions from its key ally China, has made any outreach difficult. The change in North Korean leadership that occurred during Obama's time in office was also a factor. Kim Jong Il, who exercised absolute control over the government and the country for decades suffered a debilitating stroke in 2008 and died in 2011. At the time it was

unclear whether his heir, the young and inexperienced Kim Jong Un, could gain control over rival factions in the Kim family and the government. ...

Sanctions: And he remains defiant and belligerent in the face of international sanctions, travel restrictions, and the United Nations' efforts to prosecute North Korea for widespread human rights violations. North Korea's poverty rate remains high. The UN reported this year that 84 percent of households have "borderline or poor food consumption." Still, the country's economy is improving thanks to agriculture and other incentive-based, market-oriented reforms, as well as increased trade and assistance from China. ...

Failure to Engage: While there is an international consensus that North Korea's growing nuclear arsenal threatens regional stability and world peace, there is division among key players on how to persuade Pyongyang to abandon its nuclear ambitions. The Obama administration has repeatedly called upon the international community to increase pressure on North Korea to restart talks to dismantle its nuclear weapons in exchange for ending sanctions and increasing aid and assistance. Washington and Seoul both hold that Pyongyang must first halt its nuclear program before formal talks can occur. China supports talks without conditions and has been

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reluctant to further press North Korea out of concern that might increase instability at its border. However recent failed attempts to engage North Korea by China and South Korea illustrate how difficult it is to deal with the unpredictable and confrontational state.

Source: <http://http://www.voanews.com/>, 10 December 2015.

NUCLEAR STRATEGY

INDIA

Russian Nuclear-Sub Deal Runs into Hurdle

India has been forced to keep on hold a plan to acquire a second nuclear submarine from Russia on lease after talks during Prime Minister Narendra Modi's visit to Moscow failed to reach a compromise over new conditions. Shortly before Modi's departure for Moscow, Russia had linked the Indian request for the submarine to the purchase of other naval platforms, such as three stealth frigates and two deep submergence rescue vessels (also called submarine rescue vessels), one of which was to be made in India.

India's navy is unhappy about keeping the acquisition of a second nuclear attack submarine from Russia in abeyance because it upsets a revised plan to shore up its depleted underwater fleet. Moscow, too, has acknowledged that talks to lease the submarine to India are yet to be conclusive. A Russian official, briefing journalists, said Moscow was still waiting for clarity from New Delhi on proposals involving an Akula-class submarine.

When talks began under the Manmohan Singh government in 2013, it was assessed that the contract would be signed by the end of 2015. The Russians would then take three years to retrofit

the Akula II-class submarine at their Amur shipyards. As with the only nuclear submarine in operation with India's navy, also an Akula II-class vessel named the INS Chakra, the Russians were to train a crew for the second boat by the time it was to be deliverable in 2018. That date now seems an impossibility.

Earlier too, Russia had linked military purchases to the sale of a strategic platform - India's flagship aircraft carrier, the INS Vikramaditya. That upset timelines and resulted in huge cost overruns, prompting a navy chief to urge the Centre to cancel the contract. But India went ahead with the Gorshkov

for about \$2.4 billion after a decade of negotiations. Gorshkov is now the INS Vikramaditya. The INS Chakra, originally the K-152 Nerpa, too had been leased by Russia - in 2012 for 10 years for an estimated \$900 million. The cost has never been officially confirmed.

Source: Excerpted from article by Sujan Dutta and Charu Sudan Kasturi. *The Telegraph*, 28 December 2015.

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After INS Arihant, Indian Navy Considering Nuclear Propulsion for Aircraft Carriers

Although the final decision is yet to be taken, reliable sources told *India Strategic* that the navy and the country's nuclear scientists have drawn sufficient experience from their success in installing nuclear propulsion in Arihant, the country's first SSBN submarine, which is currently undergoing sea trials, and that is encouraging them to replicate the technology for indigenous aircraft carriers.

Right now, according to the navy chief, Admiral Robin

According to the navy chief, Admiral Robin Dhowan, the Naval Design Bureau (NDB) is working towards designing a 60,000–65,000 tonne aircraft carrier – which will be the biggest vessel to be constructed in the country – and that two major systems under consideration are nuclear propulsion and the new generation aircraft launch system, EMALS from the US General Atomics.

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propulsion and the new generation aircraft launch system, EMALS (Electromagnetic Aircraft Launch and Recovery System), from the US General Atomics. But there is no final decision yet on either.

India's first aircraft carrier, aircraft carrier, IAC-I or Vikrant, is under construction at the Kochi Shipyard for delivery by end-2018 and it is to be propelled by four LM2500 gas turbine engines from the US GE. Nuclear power is being considered for the second, called IAC-II and likely to be named Vishal. It is planned for induction in 2029. There is also a strong possibility of another indigenous carrier, IAC-III. The Indian Navy is looking at three aircraft carriers to ensure 24x7 operations with two CBGs. Three carriers are required as one of them will be under periodic maintenance and refits, and accordingly, unavailable.

At present, the Indian Navy has Russia-supplied INS Vikramaditya since 2013, and it should be in service for about 30 to 35 years. India will need its third indigenous carrier by then, and it takes some 10 years to build one, even with new modular construction practices. Both INS Vikramaditya and IAC-I share the ski-jump system to launch Russian-made MiG 29K aircraft. The EMALS will be much more efficient and powerful to launch different aircraft in moments with the flick of a switch. The US Navy is using the system for its new generation carriers, the Gerald R. Ford (under construction) and John F Kennedy.

As for the IAC-2, sources told *India Strategic* that the MoD is set to initiate the first formal step towards according its official sanction by allotting funds to authorize and complete a study on

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The US carriers use bomb-grade HEU after mastering the technology decades ago. The US Navy is the only one to do so, and apparently will be unwilling to share this expertise. The HEU-propelled vessels have a big advantage as they can go on for 20 to 40 years or more while LEU- propelled ships have to be refuelled every five years or so.

requirements. The second step, a big one, is likely within 2016 in the form of Acceptance of Necessity (AON). That will mean the official go-ahead from the government to start work and funding will be allotted in accordance with the pace of development and construction.

Notably, while the US government is already working on sharing the EMALS technology with the Indian Navy, development and complex installation of nuclear propulsion will have to be done by the Indians themselves. That is where the success in installing nuclear propulsion in Arihant using LEU offers the incentive and inspiration. The NDB and scientists from DRDO and BARC are systematically coordinating on this. Notably again, the US carriers use bomb-grade HEU after mastering the technology decades ago. The US Navy is the only one to do so, and apparently will be unwilling to share this expertise. The HEU-propelled vessels have a big advantage as they can go on for 20 to 40 years or more while LEU- propelled ships have to be refuelled every five years or so.

Significantly, Arihant has successfully completed several propulsion and diving trials, and right now, is conducting a series of final tests to launch unarmed missiles from different depths before its likely induction in the coming few weeks. Subject to the success, it will be given a warship pennant number, declared it is operational, and then be cleared for participation in the International Fleet Review (IFR) scheduled for February 2016. Admiral Dhowan has expressed hope on this, but understandably has been non-committal as even minor tests on board nuclear vessels are critical and nothing is accepted

without total success, notwithstanding any time delays.

The Indian Navy already has clearance to build six SSN submarines and indications are that two to three more SSBN Arihant class vessels are also under different stages of construction – and that they will be larger, and with more powerful nuclear reactors than that of Arihant.

Progression to building nuclear reactors for aircraft carriers is logical, particularly as fossil fuel-powered vessels are dependent on a continuous supply of oil irrespective of the growing cost factors as well as the emerging threats in the Indian Ocean. China, for instance, has acquired Gwadar from Pakistan to serve both as a commercial port and a naval base, becoming the first foreign power to have this facility so near the Indian shores and the strategic Strait of Hormuz, from where nearly half the world's oil comes through. The US also has a major base at Diego Garcia in the Indian Ocean, but about 2,400 km from India's southern state of Tamil Nadu.

Source: <http://economictimes.indiatimes.com/>, 14 December 2015.

RUSSIA

Russia will Develop, Not Use, Nuclear Weapons: Putin

President Vladimir Putin says Russia will continue to develop nuclear weapons but doesn't intend to use them. The Russian leader made the comment in a documentary called "World Order" that was aired on state television.

"Russia as a leading nuclear country will be improving this weapon as a containment factor; the nuclear triad is the basis of our nuclear

security polices," he said, referring to the three main delivery systems for nuclear warheads a" bombers, intercontinental ballistic missiles and submarine-launched ICBMs. "We have never brandished or will brandish this nuclear club, but our military doctrine allocates it a place and role," he said, according to excerpts reported by the state news agency Tass.

Source: *The Times of India*, 23 December 2015.

Russia's New Underwater Nuclear Drone Should Raise Alarm Bells

...The atomic bomb as a city-buster has always inspired terror. Fortunately, in the past two decades, these massive stockpiles have been radically reduced. So why would anyone want to go back to the era of nuclear fear? That is the question that hangs over the disclosure that Russia has been developing a nuclear-armed, underwater, unmanned drone. The new weapon was revealed when Russian President Vladimir Putin met with military chiefs in Sochi in November and television news footage captured a page being used in the briefing. The Kremlin later said the video showing "Ocean Multipurpose System 'Status-6' " should not have been broadcast, and the video was deleted, but by that time it had gone viral – and global.

Russia appears to be creating a tactical nuclear weapon that could be slipped into a harbor, unleashing a tidal wave as well as the devastating effects of a nuclear explosion. It might be used to attack a military target, such as a submarine or

naval base, but cities and industry could also be hit. According to the video, the mission of the proposed system is: "Damaging the important components of the adversary's economy in a coastal area and inflicting unacceptable damage

The Indian Navy already has clearance to build six SSN submarines and indications are that two to three more SSBN Arihant class vessels are also under different stages of construction – and that they will be larger, and with more powerful nuclear reactors than that of Arihant.

That is the question that hangs over the disclosure that Russia has been developing a nuclear-armed, underwater, unmanned drone. The new weapon was revealed when Russian President Vladimir Putin met with military chiefs in Sochi in November and television news footage captured a page being used in the briefing.

to a country's territory by creating areas of wide radioactive contamination that would be unsuitable for military, economic, or other activity for long periods of time." There are no arms control treaties in place to stop this; smaller tactical nuclear weapons have never been limited by treaty. And it is true that the United States, Russia and China are all modernizing nuclear and conventional forces.

The Russian drone now on the drawing board may reflect Mr. Putin's oft-expressed desire to counter the US antiballistic missile system with an asymmetric weapon. If so, this is a particularly dangerous choice. It could expand the threat of nuclear weapons into a whole new area. Unfortunately, there won't be much debate about the drone in Moscow, where the news media and parliament are largely under Mr. Putin's control and little scrutiny exists of his military adventures.

Source: The Washington Post, 27 December 2015.

NUCLEAR ENERGY

CANADA

Darlington Nuclear Plant Gets 10-year License Renewal

The Darlington nuclear station has been granted a 10-year operating license, the Canadian Nuclear Safety Commission announced on Dec 23. Ontario Power Generation's licence for the Darlington Nuclear Generating Station will be valid from Jan. 1, 2016 until Nov. 30, 2025. With this licence renewal, the CNSC authorizes OPG to undertake the refurbishment and life extension of the four reactor units.

"This is the longest licence ever granted to a Canadian nuclear power plant," Glenn Jager, OPG's nuclear president said in a press release. "The licence term reflects the strong performance of the Darlington station and the preparations OPG has made for refurbishment."

OPG's request for an unprecedented 13-year extension of its Darlington licence and approval to rebuild and extend the life of reactors garnered major interest at the Canadian Nuclear Safety

Commission hearings this fall in Courtice. OPG said the long licence period is the safest way to manage refurbishment because it means all four reactor units will be under the same regulations. As with earlier CNSC hearings in Darlington's refurbishment process, safety and emergency planning topped concerns raised by numerous environmental groups and individuals.

The CNSC has full-time staff at the Darlington site who will provide annual regulatory oversight reports on the performance of Darlington and on the status of the refurbishment project and emergency planning. After the first reactor unit is refurbished, the Commission wants OPG and CNSC staff to provide a more comprehensive update on the status of the refurbishment project. This update will be considered in a public proceeding of the CNSC Commission, with public participation.

"OPG has been preparing for the refurbishment since 2009," said Mr. Jager. "Detailed planning is essential for a project of this size and duration. We've planned, practised and prepared and now we're ready to deliver this important clean power project on time and on budget."

Refurbishment of the Darlington nuclear generating station could boost Ontario's nominal gross domestic product by \$14.9 billion from 2010 to 2026 and create an average of 8,800 jobs in Ontario over the same 17-year period, according to a Conference Board of Canada report released in November. Early in the new year, OPG is expected to announce the refurbishment of reactors at Darlington.

Source: Jennifer O'Meara, <http://www.durhamregion.com>, 28 December 2015.

CHINA

China's \$1 Trillion Nuclear Plan

China, still the world's largest consumer of mineral and energy commodities despite lagging economic growth, appears to have one foot in the past and another in the future as it embarks on an ambitious plan to install nuclear power stations while at the same time committing to

over 100 coal-fired power plants that may never burn a single tonne of the widely-condemned fossil fuel.

The disconnect is a bit of a puzzle, but the evidence lies in a recent report by Greenpeace indicating that in the first nine months of this year, Chinese central and provincial governments issued environmental permits for 155 new coal plants. That's four new plants a week.

Greenpeace not surprisingly paints an alarmist picture of what would happen should all these plants go into production (their annual carbon emissions would equal that of Brazil) but then goes on to make the startling conclusion that none will probably get built.

That's because China will have no need for the energy they would produce. According to the report, coal use in China hasn't increased in four years and coal plant utilization is declining. More than half of China's coal plant capacity is sitting idle.

So why build the plants? According to Greenpeace, it's because China in March decentralized authority for making environmental assessments to the provinces, which have an economic interest in keeping coal plants in their jurisdictions despite concerns over air pollution. The plants give provincial state-owned enterprises a guaranteed source of income, and building new ones raises local economic growth, an important measure by which provincial officials are evaluated, the *New York Times* reported in November. Importantly, coal-fired power plants provide a steady source of provincial tax revenue, while renewable-energy projects cannot be taxed.

The huge capital spend on new coal plants, estimated at \$74 billion, is part of the Chinese economy's "addiction to debt-fuelled spending," notes Greenpeace. Investment makes up nearly half of China's GDP. The environmental group

quotes research stating that nearly \$7 trillion of capital spending was wasted between 2009 and 2014 on projects with low or no efficiency. The poor investments were driven by easy access to capital and low interest rates.

It's not just Greenpeace that posits the idea of a "coal power bubble" in China. Chinese officials and scholars are also saying it's true. "China already has more coal capacity than it will ever need," Zhang Boting, vice chairman of the China Society for Hydropower Engineering, told the *Times*. "A few years down the road, we'll see what a waste the plants are. We have seen this happen to the steel and cement industries."

China is big on Five Year Plans, and its latest one, which covers 2016-2020, has the government investing \$78 billion to build seven new reactors a year from 2016 for the next five years. According to the plan, the country will reach 88 gigawatts of nuclear power by the end of 2020. By 2030 China is expected to have 110 reactors in operation and by 2050, the country will need around \$1 trillion to expand its atomic capacity by up to 250 gigawatts, which would account for a quarter of the world's nuclear power.

Instead of coal being burnt to meet increases in Chinese electricity demand, the more likely scenario is for renewables to add to the grid. The government has stated that by 2020, only four years away, 15 percent of energy consumption will be met by non-fossil fuel sources. That brings us to nuclear.

While some nations in the wake of the Fukushima disaster in 2011 have turned their backs on

nuclear power plants, China has embraced them. China is big on Five Year Plans, and its latest one, which covers 2016-2020, has the government investing \$78 billion to build seven new reactors a year from 2016 for the next five years. According to the plan, the country will reach 88 gigawatts of nuclear power by the end of 2020. By 2030 China is expected to have 110 reactors in operation and by 2050, the country will need around \$1 trillion to expand its atomic capacity by up to 250 gigawatts, which would account for a quarter of the world's nuclear power, according to the International Energy Agency.

The goals dwarf China's current nuclear fleet, which includes just 27 operating reactors and 24 under construction. Will it happen? The plan

certainly seems to be taking shape. The government has approved the building of six Chinese-designed Hualong-1 nuclear reactors, while an American rival has also entered the nuclear construction race. Bloomberg reports that Westinghouse Electric will, after years of delays, finally fire up its first AP1000 reactor in China in 2016. To be located in Zhejiang province on China's east coast, the AP1000 is a pressurized water reactor that will output 1,110 megawatts of electricity, ideal for baseload generation, according to the Pennsylvania-based company.

Westinghouse Electric CEO Daniel Roderick says China will decide to build 10 Westinghouse-designed AP1000's over the next 10 years. But China isn't content to just accept technologies from other countries in its quest for nuclear dominance; the country wants to be the number one nuclear power exporter. In October President Xi inked a deal with the UK to help build nuclear reactors in England. The agreement has the China General Nuclear Power Corporation (CGN) acquiring a 33.5 percent stake in the Hinkley Point nuclear power plant. The GBP 18 billion plant will be the most expensive ever built, and will provide seven percent of the UK's electricity.

Argentina is also looking to China to supply technology for construction of a nuclear reactor to be built by CGN, the same state-owned company that will build the Hinkley Point reactor. In November the two countries signed an agreement that could result in \$4.7 billion worth of equipment exports to the South American nation, and the construction of its fourth reactor.

More Chinese nuclear technology transfers are likely to follow. The country plans to export up to eight domestically-designed nuclear reactors

including the Hualong-1, by 2020. Forbes reports that China has an advantage over its competitors in the global race to build new nuclear power plants because it has more forges than anyone else. Forges are

used to make pressure vessels, the steel cylindrical vessels that enclose the reactor core.

Forbes writer James Conca also notes that China has been able to build nuclear reactors at a fraction of the cost of western countries. For example six Chinese-designed reactors at Yangjiang, in southern China, will cost \$11.5 billion, a third less than in the west, while two

600-megawatt units on Hainan Island, also in the south, are being built for just \$3.15 billion. Analysts quoted by Bloomberg say that China's Hualong-1 reactor is about 30 percent cheaper to construct than the average US nuclear reactor. In May China started building its first Hualong-1 unit, in Fujian province.

Source: Article by Andrew Topf, <http://oilprice.com/Alternative-Energy/Nuclear-Power/Chinas-1-Trillion-Nuclear-Plan.html>, 27 December 2015.

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The proposed power plant in Gujarat will accelerate country's plans to build roughly 60 reactors, which would make it the world's second-biggest nuclear energy market after China. Government wants to dramatically increase its nuclear capacity to 63,000 MW by 2032, from 5,780 MW, as part of a broader push to move away from fossil fuels, cut greenhouse gas emissions and avoid the dangerous effects of climate change.

INDIA

Govt. Says Closing in on Westinghouse Deal to Build 6 Nuclear Reactors

Government expects to seal a contract with Westinghouse Electric Co LLC to build six nuclear reactors in the first half of next year, a senior official said, in a sign its \$150 billion nuclear power programme is getting off the ground.

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...Officials have been trying to assuage suppliers' concerns, including by setting up an insurance pool with a liability cap of Rs 15 billion (\$226.16 million). A final hurdle – ratification of the IAEA's Convention on Supplementary Compensation for Nuclear Damage (CSC) – is expected within weeks, the government official said. The CSC requires signatories to shift liability to the operator and offers access to relief funds.

In a statement, Westinghouse said it expected the government would move towards a framework that satisfies the CSC and channels accident liability exclusively to the operator. The statement made no reference to ongoing negotiations. A deal with Westinghouse, a unit of Toshiba Corp, could also put pressure on General Electric Co, whose nuclear energy venture with Hitachi was offered a site six years ago to build reactors. GE has still not decided whether it would move ahead with the plan, the official said, adding that the government was keen for a decision from the company soon. Government's plans for ramping up nuclear capacity have in the past fallen far short of targets and industry officials say that the aim to lift the share of nuclear power to a quarter of its energy mix, from barely 3 percent now, is very ambitious.

No More Technical Hurdles: Later, Government is expected to offer Russia a site in its southern state of Andhra Pradesh to build six reactors, on top of the six it is already expected to build in

Government is expected to offer Russia a site in its southern state of Andhra Pradesh to build six reactors, on top of the six it is already expected to build in neighbouring Tamil Nadu.

neighbouring Tamil Nadu, officials from both sides have said. Separately, India expects Japan, which supplies components used in most reactors, to ratify an agreement sometime in the second quarter of 2016 to support its nuclear programme, another senior government source said. "There are

no more technical hurdles in the development of nuclear energy for peaceful purposes," the source said. French nuclear company Areva, which uses Japanese components, also has a deal to build six reactors

here, although restructuring within that company was likely to delay construction until 2017, the first official said. French utility EDF agreed earlier this year to buy a majority stake in Areva's reactor business. Areva has been in price negotiations with NPCIL for several months now, company officials said in November. Areva did not immediately respond to a request for comment.

Westinghouse Deal: Negotiators from Westinghouse and NPCIL have held several rounds of talks on the nuclear plant in Mithi Viridi, the government official said. ... Federal minister for Atomic Energy Jitendra Singh told parliament that talks were going on with French and US firms to arrive at project proposals. The government source said Westinghouse and NPCIL were negotiating all six reactors in one go, instead of an earlier plan to strike deals for two at a time. Construction of the roughly 1,100 MW reactors could begin later in 2016, the official, who is close to the negotiations, added. "This is a train that is moving soon," the official

said.

Source: [http://http://www.financialexpress.com/](http://www.financialexpress.com/), 23 December 2015.

SOUTH AFRICA

South Africa Initiates Nuclear Power Procurement Process

South Africa has started a process that could lead to it adding up to 9,600 megawatts of nuclear

power to its national grid, the department of energy said. The department said the cabinet had earlier in Dec 2015 given the green light to issue a request for proposals from the nuclear industry, which would be put to the cabinet for approval before a request was issued for formal bids. It gave no timeframe for the process but the broader plan to boost nuclear power extends over the coming 15 years.

Africa's most industrialised economy, which relies heavily on coal for electricity, has been grappling with power shortages that have curtailed economic growth, and the Treasury in October set aside 200 million rand to consider the costs, benefits and risks of building more nuclear power stations. Yet the costs of nuclear power make it a controversial option.

Analysts estimate the nuclear project will cost as much as 1 trillion rand (\$66 billion), sparking criticism from opposition parties of the expense and of construction agreements being made behind closed doors. Former Finance Minister Nhlanhla Nene pledged that the nuclear programme would be transparent and his successor Pravin Gordhan has said his office would ensure that South Africa stuck to fiscal prudence, including on any deals relating to the building of nuclear power stations.

In 28 Dec 2015 statement the department of energy said it was committed to cost effectiveness and transparency, adding it would ensure that the process is done within the government's fiscal policy framework. ...

Source: Reuters, 28 December 2015.

RUSSIA

Russian Nuclear Corporation Plans to Boost Foreign Contracts to \$160 bln

Russia's national nuclear corporation Rosatom plans to boost its portfolio of foreign projects to \$160 bln within 2 years, a source in the company said 28 Dec 2015. "Within the next 2 years [we

plan - TASS] to boost our portfolio of foreign orders to \$160 bln," he said, adding that in 2015 the company's portfolio of foreign orders has exceeded \$110 bln.

As Rosatom's First Deputy CEO for Corporate Development and International Business Kirill Komarov said the company plans to sign overseas contracts on construction of new energy blocks within the next 5 years, which will top up to 30-40 new nuclear energy blocks.

As of early 2015, Rosatom's 10-year foreign contracts portfolio totaled \$101.4 bln. Apart from contracts for construction of new nuclear power stations, the portfolio also comprises contracts in the area of nuclear fuel cycle, maintenance service and modernization of nuclear power stations, equipment supplies and other areas. As of today the volume of contracts on construction of energy blocks being constructed now, exceeds \$300 bln.

Source: <http://tass.ru/en/economy/847361>, 28 December 2015.

URANIUM PRODUCTION

GENERAL

Better Technique to Extract Uranium from Sea in the Offing

An ultra-high-resolution technique used for the first time to study polymer fibres that trap uranium in seawater may lead to better methods to harvest this potential fuel for nuclear reactors, scientists say. The study led by Carter Abney, from the US Department of Energy's Oak Ridge National Laboratory, in collaboration with University of Chicago, shows that the polymeric adsorbent materials that bind uranium behave nothing like scientists had believed.

"Despite the low concentration of uranium and

An ultra-high-resolution technique used for the first time to study polymer fibres that trap uranium in seawater may lead to better methods to harvest this potential fuel for nuclear reactors, scientists say. The study led by Carter Abney, from the US Department of Energy's Oak Ridge National Laboratory, in collaboration with University of Chicago, shows that the polymeric adsorbent materials that bind uranium behave nothing like scientists had believed.

the presence of many other metals extracted from seawater, we were able to investigate the local atomic environment around uranium and better understand how it is bound by the polymer fibres," Abney said. Surprisingly, the spectrum for the seawater-contacted polymer fibres was distinctly different from what was expected based on small molecule and computational investigations.

Researchers concluded that for this system the approach of studying small molecule structures and assuming that they accurately represent what happens in a bulk material simply does not work. It is necessary to consider large-scale behaviour to obtain the complete picture, highlighting the need for developing greater computational capabilities, Abney said. "This challenges the long-held assumption regarding the validity of using simple molecular-scale approaches to determine how these complex adsorbents bind metals," Abney said. "Rather than interacting with just one amidoxime, we determined multiple amidoximes would have to cooperate to bind each uranium molecule and that a second metal that isn't uranium also participates in forming this binding site," he said. An amidoxime is the chemical group attached to the polymer fibre responsible for binding uranium.

The researchers plan to use this knowledge to design adsorbents that can harness the vast reserves of uranium dissolved in seawater. The payoff promises to be significant. Abney said, "there is approximately 1,000 times that amount dissolved in the ocean, which would meet global demands for the foreseeable future."

Source: <http://timesofindia.indiatimes.com/>, 18 December 2015.

NUCLEAR COOPERATION

CHINA-CANADA

China Secures Canadian Uranium Supply Amid Nuclear Expansion

China plans to take a stake in Fission Uranium Corp. that includes a supply deal allowing it to buy up to 35 percent of the Canadian mining

company's annual uranium production. CGN Mining Co., a unit of state-owned China General Nuclear Power Corp., will invest C\$82.2 million (\$59 million) for a 19.99 percent stake in British Columbia-based Fission, which specializes in exploration and development of the Patterson Lake South uranium deposit in Canada's Athabasca Basin.

"It signals to the market that China is still committed to nuclear energy as it continues to add investments in uranium as fuel, despite the poor global economy," Rob Chang, managing director of metals and mining research for Canada at Cantor Fitzgerald LP, said by e-mail. "It's China's first foray into Canada, which marks a departure from most of its uranium supply investments, which have been primarily in the less stable African nations."

China is aiming to have 58 gigawatts of nuclear-generating capacity by 2020. Of the 64 reactors currently under construction globally, 21 are in China, according to the International Atomic Energy Agency. "China is the leader, by far, of new nuclear power plants," Fatih Birol, executive director of the Paris-based International Energy Agency, said during a

briefing in Tokyo. "China is opening a new chapter in the nuclear industry."

Source: <http://www.bloomberg.com/>, 22 December 2015.

INDIA-CANADA

First Tranche of Canadian Uranium for India's Nuclear Reactors Arrives after Four Decades

Four decades after civil nuclear cooperation was suspended following the test at Pokhran the first consignment of uranium from Canada for India's nuclear reactors has arrived in Dec 2015 following conclusion of commercial pact between the two sides during PM visit last April.

This is the first tranche of uranium for India as committed under five year contract and launch of implementation of civil nuclear deal, Canadian

It signals to the market that China is still committed to nuclear energy as it continues to add investments in uranium as fuel, despite the poor global economy, It's China's first foray into Canada, which marks a departure from most of its uranium supply investments, which have been primarily in the less stable African nations.

High Commissioner to India Nadir Patel told days after the consignment arrived. Canada, following the contract, will supply 3,000 metric tonnes of uranium to energy-hungry India beginning this year under a \$254 million five-year deal to power Indian atomic reactors.

"This consignment is first tangible result of the deal and has set the stage for partnership across full spectrum of nuclear energy ecosystem," Patel pointed out. A Canadian nuclear mission comprising nuclear firms and officials visited India in October and both sides have explored cooperation in Pressurized Heavy Water Reactors, training, capacity building and nuclear waste management, informed the Canadian envoy. ...

An Indo-Canadian government to government Joint Working Group is holding discussions on expanding civil nuclear cooperation including further deliberations on Nuclear Liability Law. ...There has been no discussion yet on the allotting any site for setting up nuclear power plant by a Canadian firm but such a possibility is not ruled out. ...

Source: Dipanjan Roy Chaudhury, The Economic Times, 19 December 2015.

INDIA-RUSSIA

Russia Offers New Reactors for Kudankulam Units

Russia has offered India a new range of reactor units – the VVER-Toi (typical optimised, enhanced information) design – for the third and fourth units of the Kudankulam project in Tamil Nadu. The Russians have also indicated that its state-owned nuclear utility Rosatom is open to shortlisting a handful of Indian equipment vendors in a bid to move towards a

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serial construction model in India, starting with the localisation of mechanical engineering production to produce components and equipment here to avoid time and cost overruns, as experienced with the first two units of the Kudankulam project.

Negotiations for the design contract for units 3 and 4 are already underway and these new reactors, expected to be supplied with far greater

local inputs than was used for the initial set of two VVER-1000 reactor units at Kudankulam, are likely to require just a four-year construction period between first pour

of concrete and commissioning.

Russia and India had agreed to actively work on projects deploying 12 additional nuclear reactors, for which the localisation of manufacturing in India under the NDA government's flagship 'Make in India' initiative and the commencement of serial construction of nuclear power plants was flagged as a joint initiative. In this context, the Programme of Action for localisation between Rosatom and India's Department of Atomic Energy was finalised during Prime Minister Narendra Modi's recent Moscow visit.

At the Kudankulam site, where the two Russian-designed VVER-1000 series reactors are being installed, nearly 100 Russian companies and organisations are involved in documentation, supply of equipment and controlling construction and equipping process. This has been cited as one of the reasons for the delays and localisation is being considered for quicker project execution at

cheaper costs Russia has been working hard on increasing its competitive edge in the nuclear plant construction market through the serial production of new reactors across markets.

An integrated Russian nuclear company formed

Rosatom is open to shortlisting a handful of Indian equipment vendors in a bid to move towards a serial construction model in India, starting with the localisation of mechanical engineering production to produce components and equipment here to avoid time and cost overruns, as experienced with the first two units of the Kudankulam project.

in 2012 to consolidate Russia's nuclear power engineering expertise into a single division, something that has enabled Rosatom to move towards a serial production option in the different countries that it is supplying projects to. The umbrella firm – NIAEP-JSC ASE – comprises over 20 entities, with the major players being Atomstroyexport, which specialises in the construction of overseas nuclear power plants; NIAEP, which builds units in Russia; and design company Atomenergoproekt. NIAEP-JSC ASE had a portfolio in 2014 worth about \$60 billion.

Russia is also learnt to have reiterated its proposal for potentially involving India in building Russian-designed nuclear power stations in third countries. The cooperation is to be extended to the area of joint extraction of natural uranium and the production of nuclear fuel and atomic waste elimination. The Russian proposal to jointly build nuclear power plants is significant, considering that Rosatom has 29 nuclear reactors in various stages of planning and construction in more than a dozen countries (the largest internationally). These include in Jordan, Hungary, Egypt, Iran, Finland, Turkey and Argentina. ...

Source: Anil Sasi, The Indian Express, 26 December 2015.

Russian Nuclear-Reactor to India Rated Higher than Others

The VVER 1200 reactor that Russia would supply to India is rated higher than the reactors that India has bought and is planning to buy, a senior official of the NPCIL said. In a statement after talks with Prime Minister Narendra Modi in Moscow, Russian President Vladimir Putin had said: "We have agreed on India's assigning another plot for the

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construction of Russian power units, where we intend to use the latest WWER-1200 reactors built with the application of the latest and safest technologies."

The WWER-1200 reactor is also known as VVER 1200 reactor. "The VVER-1200 reactors are said to be the upgraded and up-rated version of VVER-1000 reactors," the NPCIL official told IANS preferring anonymity. He said the VVER-1200 reactor has a rated capacity of 1,200 MW. Russia is setting up two VVER-1200 reactors at its Novovoronezh nuclear power plant complex and at two other locations.

Officials at the Novovoronezh nuclear plant complex told IANS the VVER-1200 units will use 163 fuel assembly bundles similar to the VVER-1000 model. However, the fuel weight and the length of the fuel assembly would be longer than what is being used in VVER-1000 model, the officials said.

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According to Russian nuclear power sector officials, once the first unit goes on stream, it will be the largest unit functioning in the country. The

Novovoronezh plant director told visiting international journalists in June that the average investment per kwh of the unit will be around \$3,000. But this will not be the reference cost point for foreign clients. The cost for foreign clients will be much less, around \$2,500 per kwh, the official said. ...

Source: <http://economictimes.indiatimes.com>, 29 December 2015.

India to Offer Site in Andhra Pradesh to Russia for Nuclear Power Plants

India is expected to offer a site in Andhra Pradesh to set up units five and six of Kudankulam nuclear

power plant by Russia in sync with broad principles of 'Make in India' initiative and a decision in this regard is likely to be finalised during Prime Minister Narendra Modi's visit to Moscow. The two countries have agreed for the two units with provisions for involvement of India's private sector in the project including in supply of various components. "We will follow principles of 'localisation' as per Make in India initiative for setting up Kudankulam nuclear power plant five and six," sources told PTI.

They said a site in Andhra Pradesh has been finalised for the project in line with government's policy for ensuring optimum use of the available nuclear sites in various states to accommodate more atomic reactors. Incidentally, Centre has already shortlisted the Kovvada site to build a project with the assistance of US-based nuclear vendor, GE-Hitachi Nuclear Energy.

Russia has been a key partner of India in the civil nuclear energy sector. In the last summit between Modi and Putin, it was decided that Russia will build at least 12 nuclear reactors in India by 2035. In April 2014, India and Russia had signed an agreement to build units 3 and 4 of the Kudankulam project at a cost of Rs 33,000 crores. However, work on the ground is yet to start. The units 3 and 4 will be coming up in Tamil Nadu's coastal district of Tirunelveli.

Earlier in Dec 2015, Nikolai Spasskiy, Deputy Chief Executive Officer of Rosatom, the Russian counterpart of the India's Department of Atomic Energy, visited India and he is believed have discussed with DAE brass about various aspect of the proposed pact for Kudankulam 5 and 6. Units 5 and 6 of VVER technology are expected to be of the same MW like units 1-4, but the cost details of the project are yet to be finalised.

The government is constructing six reactors in new

projects like Jaitapur (EPR 1000x6) in Maharashtra built with French technology, Kovvada in Andhra Pradesh (1000MW x 6) and Mithi Virdhi in Gujarat (1000MW x 6).

Source: <http://http://www.asianage.com/>, 21 December 2015.

PAKISTAN-USA

No India-type Nuclear Agreement with Pakistan: US

The Obama Administration ruled out any India-type nuclear agreement with Pakistan as top American lawmakers expressed serious concerns over the growing Pakistani nuclear arsenal. "We are not negotiating a 123 agreement with Pakistan,"

Richard G Olson, Special US Representative for Afghanistan and Pakistan, told lawmakers during a hearing on Pakistan convened by the powerful House Foreign Affairs Committee.

"We had a very candid discussion with Pak about some of the concerns that

we have including about short range nuclear weapons. Pakistan is prepared to have discussions with us," he said in response to a question. Olson said Pakistan is well aware of the extremist and insurgent threats to the security of its nuclear weapons and has a professional and dedicated security force. "As with all nuclear-capable states, we have urged Pakistan to restrain its nuclear weapons and missile development and stressed the importance of avoiding any developments that might invite increased risk to nuclear safety, security, or strategic stability," he said.

Congressman Ed Royce, Chairman of the House Foreign Affairs Committee, in his remarks alleged that Pakistan's nuclear arsenal is on a track to be the third largest. "It's addition of small tactical nuclear weapons in recent years is even more

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troubling. This is a country which spends a fifth of its budget on the military, from long-range missiles to F-16s, but under 2.5 per cent on education," he said. "Through all of the double-dealing, US policy has essentially stood still. Security assistance, cash, and arms has continued to flow under the occasional temporary delays," Royce said. "Indeed, despite some Department of Defence assistance for Pakistan being held because of inadequate efforts against the Haqqani network, the State Department is currently seeking more arms for Islamabad," Royce said.

"We have a very stringent end use monitoring requirements with security co-operation with high tech. The results have been satisfactory. The end use monitoring systems have been effective," Olson said in response to a question.

Source: <http://http://economictimes.indiatimes.com/>, 17 December 2015.

UKRAINE-AUSTRALIA

Ukraine to Sign Agreement on Nuclear Energy with Australia in 2016

Ukraine plans in 2016 to sign an agreement with Australia on cooperation in the field of using nuclear energy for peaceful purposes, Director of the Department of Strategic Planning and European Integration at the Energy and Coal Industry Ministry of Ukraine Mykhailo Bno-Airriian has said.

"One of the main tasks for 2016 is the signing of an agreement between the government of Ukraine and Australia on cooperation in the field of using nuclear energy for peaceful purposes," he said at a briefing in Kyiv. According to the department, the agreement has been agreed with the Australian government and is

currently undergoing national procedures for its signature and ratification.

Source: <http://en.interfax.com.ua/news/general/314722.html>, 29 December 2015.

NUCLEAR NON-PROLIFERATION

GEORGIA

Georgia Ships Breeder-1 HEU to Russia

The IAEA has announced "another achievement in global nuclear non-proliferation efforts", with the shipment of HEU from Georgia. The 1.83 kg of HEU was removed from the Breeder-1 Neutron Source at Tbilisi State University in Georgia to a secure storage facility in Russia.

The Georgian government in June requested assistance from the IAEA for the HEU removal operation. The IAEA subsequently contracted LUCH, a subsidiary of Russian state nuclear corporation Rosatom, and the Tbilisi State University's Andronikashvili Institute of Physics in Georgia for the removal. Maia Bitadze, Georgia's deputy minister of environment and natural resources protection, said in the IAEA statement that successful accomplishment of this shipment operation was due to "the effective cooperation of all parties".

The Breeder-1 Neutron Source facility was used to carry out activities involving neutron activation methods for, among others, substance element composition analysis, geological surveys for exploring minerals, agricultural studies, and criminal investigations. It also generated short-lived isotopes used for research and educational purposes.

The IAEA said that HEU can be a nuclear proliferation and security concern because it can eventually be used for producing material used for nuclear weapons. "The IAEA is supporting its member states in their efforts to replace HEU with low

This is a country which spends a fifth of its budget on the military, from long-range missiles to F-16s, but under 2.5 per cent on education. "Through all of the double-dealing, US policy has essentially stood still.

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enriched uranium in research reactors and neutron source facilities worldwide. The IAEA also provides technical knowledge, research support, and equipment," the Vienna-based agency said.

Source: <http://www.world-nuclear-news.org/>, 23 December 2015.

IRAN

UN Ends Probe into Iran's Past Nuclear Activities, Moving International Accord Closer to Implementation

On 15 December, 2015, the United Nations nuclear watchdog closed the book on the possible military aspects of Iran's nuclear programme, finding that they were limited to feasibility and scientific studies and did not proceed beyond 2009, bringing an international nuclear accord with Iran a step closer to implementation.

"My final assessment gives clear answers to two very important questions: did Iran engage in activities relevant to the development of a nuclear explosive device? And, if it did, is it still doing so?" IAEA Director General Yukiya Amano told the IAEA Board of Governors in Vienna before it adopted a resolution closing the long running investigation. "The Agency assesses that a range of activities relevant to the development of a nuclear explosive device were conducted in Iran prior to the end of 2003 as a coordinated effort, and some activities took place after 2003," he said, stressing that while the IAEA could not reconstruct all details of Iran's past activities, it could clarify enough to assess the whole picture.

"The Agency also assesses that these activities did not advance beyond feasibility and scientific studies, and the acquisition of certain relevant technical competences and

On 15 December, 2015, the United Nations nuclear watchdog closed the book on the possible military aspects of Iran's nuclear programme, finding that they were limited to feasibility and scientific studies and did not proceed beyond 2009, bringing an international nuclear accord with Iran a step closer to implementation.

Iran dispatched a shipment of more than 25,000 pounds of low-enriched uranium to Russia on 28 Dec 2015, clearing an important hurdle in the implementation of a historic nuclear deal with the US and five other world powers. The shipment was one of the most significant milestones yet for Iran as it works to fulfill its commitments under the July deal.

capabilities. The Agency has no credible indications of activities in Iran relevant to the development of a nuclear explosive device after 2009."

..."JCPOA Implementation Day will occur when the Agency has verified that Iran has implemented measures specified in that agreement," Mr. Amano said. "I will inform the Board promptly when the Agency has verified that the preparatory steps have been completed." He also called for

addressing the issue of funding the additional IAEA activities in Iran under the JCPOA, noting that verification and monitoring require predictable funding. "Significant progress has been made on the Iran nuclear issue, but now is not the time to relax," Mr. Amano concluded. "This

issue has a long and complex history, and the legacy of mistrust between Iran and the international community must be overcome." "Much work lies ahead of us. All parties must fully implement their commitments under the JCPOA. Considerable effort was required in order to reach this agreement. A similar and sustained effort will be required to implement it," he stressed.

Source: <http://www.un.org/>, 15 December 2015.

Iran Ships Off Uranium as Part of Nuclear Agreement

Iran dispatched a shipment of more than 25,000 pounds of low-enriched uranium to Russia on 28 Dec 2015, clearing an important hurdle in the implementation of a historic nuclear deal with the US and five other world powers, Secretary of State John Kerry said. The shipment was one of the most significant milestones yet for Iran as

it works to fulfill its commitments under the July deal, Mr. Kerry said in a statement. It included Iran's uranium enriched to 20%, except for fabricated fuel plates at a research reactor in Tehran. The lower the purity of the nuclear fuel, the less dangerous it is. Nuclear fuel enriched to around 90% is necessary to make weapons.

In order for the nuclear agreement to take effect and for Iran to win widespread sanctions relief, Tehran had to carry out a series of steps to wind down its nuclear program and infrastructure. The aim is to ensure that even if Iran were to stop abiding by the agreement, it would be at least one year away from acquiring enough nuclear fuel for a weapon: the so-called breakout time. "The shipment today more than triples our previous two- to three-month breakout timeline for Iran to acquire enough weapons-grade uranium for one weapon, and is an important piece of the technical equation that ensures an eventual breakout time of at least one year" by the time the deal is finally implemented, Mr. Kerry said. Ali Akbar Salehi, the head of the Atomic Energy Organization of Iran, had said earlier in December 2015 that the country would soon export a large amount of enriched uranium to Russia.

Russia in turn had sent about 137 tons of minimally processed yellowcake uranium to Iran, he said. Shipping low-enriched uranium abroad to reduce its stockpile to no more than 300 kilograms is one of several steps Iran must take before it receives relief from the sanctions that have crippled its economy. Other mandatory steps include taking out thousands of enrichment centrifuges from its nuclear facilities and removing the reactor core at its Arak nuclear facility, near the capital Tehran.

... In the end, while the material shipped on 28 Dec 2015 is headed to Russia, Kazakhstan, a country with strong ties to Tehran and Washington and long experience with nuclear programs, will play a significant role in the removal of Iran's stockpile. Mr. Kerry said Kazakhstan was providing some of the natural uranium that Iran will receive in return for shipping out its stockpile. It is also helping facilitate the shipment of the material.

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A Western official said on 28 Dec 2015 that Norway has paid upfront for the natural uranium that Kazakhstan has supplied. Iran will repay that amount over time. Officials said the final details of these commercial arrangements were still being nailed

down over the last few days.

Source: The Wall Street Journal, 28 December 2015.

New Tensions Over the Iran Nuclear Deal

Newspapers in Tehran have been filled recently with reports of foreigners visiting Iran to discuss the opportunities that will open up once economic sanctions related to the nuclear deal are lifted, presumably early next year. There is a sense of excitement that after years of international isolation, better days await.

Congress shook that optimism when it approved new restrictions prohibiting foreigners who have visited Iran, Syria, Iraq or Sudan in the last five years from entering the United States under a visa-waiver program. Before this move, prompted by the terrorist attacks in Paris and California, citizens of 38 countries, mostly in Europe, could enter the United States without a visa regardless of where they had previously traveled.

Iranian officials have argued that the new restriction will discourage business with Iran by causing people to think twice about visiting the country and that hence it violates the nuclear agreement, which promises sanctions relief in return for sharp curbs on Iran's nuclear program. Washington contends that this is not technically a sanction. It is clear, however, that it is not in keeping with the spirit of the historic agreement.

Restricting visas for people who travel to Iraq and Syria makes sense, given that both are home turf for the Islamic State, and Sudan has been a transit point for extremists heading to Syria and Iraq. It is hard not to view Iran's inclusion as another attempt by Congress to sabotage the nuclear deal, which most lawmakers opposed.

While Shiite-led Iran is on the terrorism list because of its support for Hezbollah and Hamas, it is fighting the Islamic State, a Sunni group, in Iraq. Meanwhile, Saudi Arabia, home of 15 of the 19 hijackers on Sept. 11, was not included in the new travel rules, nor was Pakistan, a caldron of jihadist groups, nor Turkey, a well-known transit point for fighters, including those of the Islamic State.

Some American officials say that Iran's concerns are overblown. Still, Secretary of State John Kerry wrote a letter to Mohammad Javad Zarif, Iran's foreign minister, to assure him that the administration can waive the restrictions and "will implement them so as not to interfere with legitimate business interests of Iran."

Hard-liners in Iran and the United States still want to torpedo the nuclear deal. Iran certainly has done things that merit vigorous pushback, including unjustly holding a *Washington Post* reporter, Jason Rezaian, an Iranian-American, for over a year. And recently, it conducted two ballistic missile tests. Though the tests do not violate the nuclear deal, they violate United Nations sanctions on Iran's missile program. They are particularly damaging when Iran is working to reintegrate with

the international community, and they merit some response.

It would be folly for the United States and other major powers to refuse to lift sanctions as promised under the nuclear deal, which 36 Republican senators have demanded. That would kill the deal, which, Iranian and American officials say, Tehran is starting to carry out. For example, it is about to ship most of its stockpile of enriched uranium to Russia. It will take strong, committed leadership in both countries to keep the deal on track and fend off the saboteurs.

Source: The New York Times, 28 December 2015.

NUCLEAR SAFETY

INDIA

13,500 MW Nuclear Power by 2020, Safety Aspect Taken Care Of: Govt.

As far as the risk of accident is concerned, a reactor is designed after full technical and cost viability tests. As regards hazard, I think it is more an apprehension of the hazard about which we need to create awareness...rather than the hazard per se.

Stating that the country would have 13,500 megawatts of nuclear power "which would become a major source of electricity and energy" by 2020, the government allayed apprehensions over the safety aspect of this

energy source as the Lok Sabha passed a bill that will allow state-run NPCIL to collaborate with other PSUs in the nuclear field.

"As far as the risk of accident is concerned, a reactor is designed after full technical and cost viability tests. As regards hazard, I think it is more an apprehension of the hazard about which we need to create awareness...rather than the hazard per se," Minister of State Jitendra Singh said during the discussion over the passage of the Atomic Energy (Amendment) Bill 2015.

"If it was actually hazardous, you would agree with me that over the last 60 years not a single scientist has been affected by nuclear radiation. Many scientists have spent most of their lifetime inside BARC, but nothing happened to them.... There have been hardly about 20-odd unnatural deaths and most have happened because of

accidents, suicides, poisoning, etc., but none of them due to nuclear radiation."

Singh said while the 2011 Fukushima disaster in Japan was a dreadful one, "there were certain inherent defects.... It was, in the first place, wrongly located in a seismic zone. When the earthquake took place, there was a huge inflow of water...and this water choked everything else, even the outlets."

He added that under the leadership of "eminent scientists like Homi Bhabha, Satish Dhawan, and their successors up to this date", India has had "some of the best scientific teams, who have taken care of this part also". "Most of our plants are located or set up after taking care of all these possible risk factors," the minister said. Singh said the first unit of Kudankulam Phase I is under shutdown "for checks and other things, but we are sure by January we will start it.... As far as the second unit of Phase II is concerned, that also would be made functional by March or April of 2016."

Source: Raghvendra Rao, The Indian Express, 15 December 2015.

JAPAN

Animal Spotted Prowling Inside Fukushima Nuclear Plant's Reactor Building

A fox appears to have been traipsing around a highly radioactive area inside a reactor building at the crippled Fukushima No. 1 nuclear power plant, Tokyo Electric Power Co. said Dec. 28. The plant operator said a security camera mounted at a section next to the containment vessel of the No. 2 reactor captured footage of the animal around 6 a.m. on Dec. 21. It said the creature appeared intermittently for seven to eight minutes.

Although the animal's den and current whereabouts remain unknown, a TEPCO official

said the intrusion is unlikely to adversely affect work being done in preparation for decommissioning the reactor. According to TEPCO, the security camera showed the 1.3-meter-long animal wandering back and forth near the carry-in entrance to the reactor's containment vessel. The area where the animal was spotted is highly radioactive, with a maximum of 10 sieverts of radiation per hour being detected. Entry by humans is strictly restricted.

Decontamination work in the area is being done using robots. Although the infiltration route has not yet been determined, the official said: "It is possible the animal entered via a gap through which cables are passed or a damaged door

which has remained unrepaired since the Fukushima nuclear disaster (in 2011)."

Source: http://ajw.asahi.com/article/behind_news/social_affairs/AJ201512290056, 29 December 2015.

NUCLEAR WASTE MANAGEMENT

USA

In Death Knell for MOX Project, US to Deem 6 Tons of Plutonium Nuclear Waste

The US government plans to designate six metric tons of surplus plutonium now stored in South Carolina as waste and ship it to a storage facility in New Mexico, according to a preliminary notice filed on a federal website on 23 December. The notice, to be posted on 24 December by the US DOE, says its "preferred alternative" for disposal of the 6 metric tons of surplus plutonium would be to turn it into nuclear waste and store it in New Mexico.

Critics said the notice was a sign that DOE could decide to scrap a multibillion-dollar project in South Carolina that will mix 34 tons of surplus plutonium with uranium to form safer fuel pellets for use in commercial nuclear reactors. The facility, begun under a 2000 treaty with Russia to dispose

of nuclear weapons, is years overdue and billions of dollars over budget. It is being built by CBI-Areva MOX Services, a joint venture of US-based Chicago Bridge & Iron NV and Areva SA, a French state-owned nuclear group.

“This decision is a fatal blow to the mismanaged MOX project at the (Savannah River Site), as it will set the precedent that plutonium is waste and not a commercial product to be used as nuclear fuel,” said Tom Clements, director of SRS Watch, a public-interest organization based in Columbia, South Carolina. A National Nuclear Security Administration spokeswoman said the notice pertained to only six of 13.1 tons of surplus plutonium addressed in a recent environment impact statement, and did not signal a change in DOE’s plans for disposal of the 34 tons of plutonium.

In the notice, DOE said moving the waste to New Mexico was part of the US policy of ensuring “that surplus plutonium is never used in a nuclear weapon, and to remove surplus plutonium from the state of South Carolina.”

DOE says it is continuing work on MOX, but officials say several analyses have shown that diluting the plutonium covered under the treaty with Russia, and disposing of it in New Mexico would cost less than half of the MOX approach. Russia has its own program to eliminate its reciprocal 34 tons of plutonium under the treaty. A fiscal 2016 spending bill enacted in Dec 2015 includes \$340 million for continued construction of the MOX project, and bans use of the funds for dilution of any plutonium that could be used for MOX.

Source: <http://www.japantimes.co.jp/>, 24 December 2015.



Centre for Air Power Studies

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