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## MONITORED THIS ISSUE:

## SARKOZY'S "TOUR DE NUCLEAIRE"

The sales tour of the French nuclear industry and its EPR's (European Pressurized Reactor) is at full speed, with president Nicolas Sarkozy flourishing as the main salesman. This month the spotlights are on India, Slovakia and the UK, but others are waiting to join in.

**(677.5891) Greenpeace International** - The approval of the US-India deal in the Nuclear Suppliers Group in the beginning of September was the start of a race between numerous nuclear technology vendors aiming for a slice of India's nuclear market. The NSG clearance is believed to open up business opportunities worth US\$26.5 billion (18 bn euro) in the next 15 years. Not surprisingly, France's Areva backed by its presidential salesman Sarkozy is one of the frontrunners. A major French-Indian nuclear trade pact is ready to be signed at the end of September, once the US-India deal has been ratified by the US Congress.

Already in 1998, France and India signed a 'strategic partnership' and president Jacques Chirac suggested 'a special status' for India to enable the country to access nuclear supplies from abroad. In a visit to New Delhi in January this year, Sarkozy and his nuclear co-workers initiated an extensive cooperation agreement, covering scientific research, training, safety and industrial collaboration. Including Areva and EDF, 35 French companies are eager to get involved in the Indian nuclear business. Areva hopes to sell up to six EPRs to Nuclear Power Corporation of India Ltd. (NPCIL).

But not only the sales of reactors is being discussed, France is also willing to provide fuel supply guarantees and reprocessing technology, understandably a rather sensitive issue in the NSG discussions. France refuses to clarify

whether these fuel guarantees would continue if India resumes nuclear weapons testing. France believes India has the capability and the right to reprocess spent fuel.

The French-Indian deal has been largely finalized and only needs to be signed. Indian Prime Minister Manmohan Singh travels to France on 29-30 September, where the topic of nuclear cooperation is said to be 'at the center of discussions' with President Sarkozy.

### Slovakia

Meanwhile, on 18 September a cooperation agreement on nuclear energy was signed between Sarkozy and the Slovak Prime Minister Robert Fico. The agreement is seen to direct towards the construction of at least one EPR in Slovakia. The country already gets 50% of its electricity from nuclear power. A tender procedure for a new reactor in Bohunice is expected to be launched by the end of 2008. All five current nuclear power reactors (three in Bohunice, two in Mochovce) are of the Russian VVER design. The Slovak Prime Minister was impressed by Sarkozy's hospitality and aims to obtain 'a state of the art and safest possible reactor'.

### French British Energy

Even the UK seems to be turning into a billboard for the French government's nuclear sales program. The French company has signed off on a takeover of British Energy on September 24. The merger brings eight UK nuclear power stations in French hands, including

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adjacent land suitable to build new reactors. EDF is said to pay a total of BP12.4 billion (15.6 billion euro, US\$23 billion) for British Energy, after raising its offer to meet the requirements of BE's current shareholders. The takeover was pushed by Gordon Brown's government, in order to hasten his proposed nuclear expansion. EDF is eager to use BE's nuclear sites for the construction of at least four EPRs. Simultaneously, also the German energy giant E.ON is interested in building an EPR in the UK.

Currently, nuclear power provides 3.6 % of UK's total energy, while building 10 new nuclear power stations would only cut the UK CO<sub>2</sub> emissions by 4%. Whether Brown's nuclear obsession is linked to his brother Andrew's position as EDF Energy's Head of Media Relations has not been confirmed.

#### South Africa

The South African power utility Eskom is expected to announce its choice between Areva's EPR and Westinghouse's AP1000, who have been shortlisted for the planned expansion of nuclear capacity in the country. Areva leads a consortium of the South African engineering company Aveng and the French constructors Bouygues and EDF. The current decision concerns two 1650 MW EPR's (or three 1140 MW AP1000's) to start in 2010, to be followed by a further 10

EPR units by 2025. It shows the absurdity of how they want to tackle the current electricity blackouts with massive spending on reactors that will, in the best case, deliver electricity in 10 years from now.

#### Ongoing EPR troubles

Construction of the EPR in Flamanville, France, is troubled by delays very similar to the ones in the EPR construction in Finland. End of August, the French newspaper Le Canard Enchainé reported a nine month delay in the project. EDF keeps up appearances by maintaining its 2012 target for the start-up of Flamanville-3, but this now refers to initial criticality rather than commercial operation. Connection to the grid could well be delayed into 2013.

Excavation of the land-based access shaft of the future discharge tunnel has progressed too slow, there were problems with the quality of the poured concrete, welding techniques were used non-conforming technical specifications, and in May concrete pouring operations were suspended for 23 days after the discovery of missing steel bars in part of the concrete basemat. However, according to a statement by the French nuclear safety authority ASN the problems have now been resolved. Tests on the concrete are said to reveal that the concrete has now 'satisfactory mechanical

resistance' and an analysis of the consequences of the missing bars is believed not to compromise the mechanical strength of the structure, 'given design margins'.

An Areva official said in the beginning of September that the price of a new EPR today is "closer to €4.5 billion" than to the original price for the EPR showcase in Olkiluoto, Finland, of €3.2 billion, due to rising costs of materials and manpower. Areva denied earlier reports that the final price of Olkiluoto-3 (OL-3) would be €4.5 billion, but has announced a new provision against potential losses on the OL-3 turnkey contract in the presentation of its half-year financial results. The construction of OL-3 is two years behind schedule and believed to be about €1.5 billion over budget. Areva has initiated an arbitration process on the payment of cost overruns, some of which are directly attributable to the Finnish utility TVO, according to the French. TVO recently increased the amount of its counter claim. Areva is not expected to build any more EPR's on a turnkey basis in the future.

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## INDIA, U.S. & NSG: BLOW TO NON-PROLIFERATION

**The special waiver granted to India by the Nuclear Suppliers' Group (NSG) from its nuclear trade rules is being seen as a massive setback to the cause of global nuclear non-proliferation and disarmament. The NSG's waiver will allow India to resume nuclear commerce with the rest of the world with very few restrictions although India is not a signatory to the Nuclear Non-Proliferation Treaty (NPT) and has refused to accede to any other agreement for preventing the spread of, reducing the numbers of, or abolishing nuclear weapons.**

(677.5892) **WISE-India** - The Nuclear Suppliers Group, a 45-nation private arrangement set up after India's first nuclear weapons explosion in 1974, turned a full circle at its special meeting in Vienna, early September, the second one in a fortnight, held at the behest of the United States. The NSG was originally established "to ensure that nuclear trade for peaceful purposes does not contribute to the proliferation of nuclear weapons or other nuclear explosive devices". But it has now done

the very opposite by agreeing to the exceptional waiver for India as part of New Delhi's controversial nuclear cooperation deal with the U.S. inked three years ago.

Washington hailed the waiver as "historic" and one that would boost nuclear non-proliferation, while New Delhi described the deal as an "important step" towards meeting the challenges of climate change and sustainable development. Clearly

though, the waiver only became possible because of the strong-arm methods used by the U.S. to bludgeon dissenting NSG members into agreeing to the exemption text it had drafted in consultation with India.

Contrary to the claim that the waiver, and more generally, the U.S.-India nuclear deal, will bring India into the global "non-proliferation mainstream" or promote nuclear restraint on India's part, it will allow India to expand its

nuclear weapons arsenal and encourage a nuclear arms race in Asia, particularly in the volatile South Asian subcontinent, where Pakistan emerged as India's nuclear rival 10 years ago.

Barring the exceptional situation in which India might conduct another nuclear test, the NSG imposes no significant conditions on nuclear trade with India. Even this condition is not stated up-front, and is mentioned in reference to a general statement by India's Foreign Minister Pranab Mukherjee on Sep. 5, in which he reiterated India's unilateral and voluntary moratorium on nuclear testing and its non-proliferation commitments. But a voluntary moratorium can be lifted easily and unilaterally. In any case, it falls short of a legally binding commitment not to test.

India had insisted on a "clean and unconditional" waiver from the NSG, and has very nearly secured it, thanks to the indulgence of the U.S., which proposed the deal in the first place and lobbied hard and furiously for it. With the waiver under its belt, India can proceed to import uranium fuel, of which it is running short, and a range of other nuclear materials, equipment and technologies for its civilian nuclear program. But it can divert domestic uranium exclusively for weapons purposes.

"Under the U.S.-India nuclear deal, India signed an agreement to separate its military nuclear facilities from civilian installations and subject some of the latter to safeguards under the International Atomic Energy Agency," says Achin Vanaik, head of the department of political science at Delhi University, and a national coordination committee member of the Coalition for Nuclear Disarmament and Peace (India). According to Vanaik, India will only put 14 of its 22 operating or planned civilian nuclear reactors under IAEA safeguards, which are meant to ensure that no nuclear material from them is diverted to military purposes. "But it can use the remaining eight reactors to produce as much plutonium as it likes for its weapons program." According to a report prepared by independent scientists and experts for the International Panel on Fissile

Materials two years ago, these eight reactors alone can yield fuel for as many as 40 Nagasaki-type bombs every year. In addition, India can produce more bomb fuel from its dedicated military nuclear facilities and fast-breeder reactors, which it can maintain and expand. India accepts no limits or restrictions on the size of its nuclear arsenal and has an ambitious nuclear doctrine under which it continues to stockpile fissile material for weapons use.

The NSG has all but put its imprimatur on India's nuclear activities, which would allow it to expand its arsenal of mass-destruction weapons and thus set a negative example for the rest of the world, in particular, wannabe atomic states. In the process, says Daryl F. Kimball of the Arms Control Association (U.S.), the NSG has undermined "efforts to contain Iran's and North Korea's nuclear programs, and it will make it nearly impossible to win support for much-needed measures to strengthen the NPT" at its next review conference due in 2010. The waiver may weaken and harm the NPT itself by aiding the acquisition of nuclear weapons by a country not recognized by it as a nuclear weapons-state, which it explicitly prohibits. Effectively, it expands the Nuclear Club to include a member, which has refused to sign the treaty.

Within the NSG, there was a great deal of resistance to the waiver. An earlier meeting of the group, on Aug. 21-22, failed to produce a consensus -- necessary for any decision to go through. Six "like-minded" countries -- Austria, Ireland, the Netherlands, New Zealand, Norway and Switzerland -- which argued that India must accept three conditions in order to resume nuclear trade, led the resistance.

These included a periodic review of compliance with India's non-proliferation pledges, exclusion from trade of sensitive technologies such as uranium enrichment and spent fuel reprocessing, and cessation of nuclear commerce in case India tests. In the event, India only accepted the first condition and doggedly refused to go beyond reiterating its unilateral moratorium on testing.

The decision early Saturday morning to grant an unconditional Indian specific waiver probably was inevitable. A small group of nonproliferation stalwarts - Austria, Ireland, and New Zealand - could not by themselves withstand the onslaught of economic and political pressure brought to bear by four of the nuclear weapons states led by the United States. Ironically, complicity in ignoring non proliferation obligations and bullying reluctant NSG members to exempt India from well established export restraints may be one of the last areas of nuclear cooperation between the United States and Russia. To its credit, only China among the nuclear weapons states, voiced any reservations about the deal. But, say Indian media reports, a critically timed telephone call from Bush to Chinese president Hu Jintao did the trick and China quickly fell in line.

"Another factor," Kimball added, "was the role of Germany, ostensibly the NSG chair. At this meeting, the Germans apparently sat on their thumbs and let the Americans run the show and keep asking for more consultations despite the remaining differences. A more competent and less biased chair would have provided more balance and would have adjourned the meeting Friday night when it was clear there was still disagreement on some fundamental issues..."

What is especially disheartening about the nuclear agreement - and bodes poorly for future nonproliferation efforts - is the extent to which economic considerations and power politics overrode those involving nuclear arms control - even among states typically regarded as international nonproliferation leaders. Australia, Brazil, Canada, Germany, South Africa, and Sweden were largely missing in action - or worse - during the prolonged struggle to impose consensus on the deeply divided 45-member Nuclear Suppliers Group.

Did these states, and others, simply forget the commitments they undertook at prior Non-Proliferation Treaty (NPT) review conferences to forswear nuclear cooperation with states lacking comprehensive safeguards? What credibility will they have now to hold

the feet of the nuclear weapons states to the fire on other NPT commitments such as nuclear disarmament, the creation of nuclear-weapon-free zones, and the provision of nuclear energy for peaceful purposes? Having rewarded India, a nuclear weapons possessor, with nuclear trade benefits previously reserved to states in compliance with the NPT, what incentives remain for other states to join the Treaty? How can one tighten controls on nuclear exports to NPT members of sensitive uranium enrichment and plutonium reprocessing technology having just created a giant loophole for such exports to a non-NPT state? Which countries retain the moral authority to

speak credibly about other states' nuclear disarmament and arms control shortcomings in light of the collective nonproliferation amnesia on display in Vienna this past week? Certainly, the tiny group of white knights no longer includes Canada, Germany, South Africa, and Sweden - nations who pride themselves as models of nonproliferation propriety.

"This was a triumph of crass power politics," says Vanaik. "It is sad and profoundly disturbing that nobody resisted U.S. or Indian pressure and stood up for elementary principles in a group where even a single member could have blocked the waiver. India's

'victory' is founded on crude muscle power and cynicism, and negates rational, democratic decision-making based on a commitment to making the world a safer place."

**Sources:** Praful Bidwai, peace activist and co-founder of the Movement in India for Nuclear Disarmament (MIND), Inter Press Service - 8 September 2008 / William Potter, Director of the James Martin Center for Nonproliferation Studies at the Monterey Institute of International Studies, The Hindu, 9 September 2008

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## IGNALINA TURNS VISAGINAS

### Expanding talks of nuclear in the Baltic region

**Over the last months, nuclear talk in the Baltic region has come into a higher gear. According to press agency ELTA, the Lithuanian government established the energy company LEO LT with a capital of 145.000 euro (US\$ 215.000) to deal with the plans for a new nuclear power station. In the process, the project was renamed from Ignalina to Visaginas. The town of Ignalina would like to develop its potential for tourism and in that there is no place for the legacy history of the Chernobyl type nuclear reactors situated in the neighboring municipality of Visaginas nor for new bold plans for nuclear power stations with the name of Ignalina.**

**(677.5893) Greenpeace EU Unit** - LEO LT started the environmental impact assessment (EIA) procedure for the new Visaginas NPP, after it closed off the scoping phase with inputs from Finland, Estonia, Sweden, Latvia and Poland. NGOs in those countries, however, were not satisfied with the ways that their remarks were taken up into the procedure, a point they will be able to stress in the further EIA process. On request of the Latvian Green Movement, there will be two public hearings in Latvia instead of only one as announced earlier by LEO LT: one in Daugavpils, which is near to the proposed site, and one in Riga.

The full EIA report in English can be downloaded and comments still can be submitted in October. Alda Ozola from the Latvian Green Movement commented: "We see the same pattern as earlier nuclear EIAs in Europe, like the Belene and Cernavoda ones: very abstract indications of possible nuclear power plant designs, so no details; no reference to beyond-design accident impacts; no clarity about high level wastes; a lot of emphasis on marginal

issues; no proper and credible alternatives considered, and certainly no decentralized ones." She added: "I call on all interested experts and NGOs in Europe to react on this EIA. The nuclear industry should not be allowed to get away with this low quality work."

#### **Nuclear Kaliningrad**

In the mean time, Russia is opening an attack on the Visaginas plans by speeding up its until recently very vague plans for two 1000 MW nuclear blocks in the enclave of Kaliningrad, which borders to Poland and Lithuania and the Baltic Sea. The plans are to start next year already with the construction of an AES-2006 nuclear power plant - an upgraded version of the AES-92 that is to be built in Belene in Bulgaria, and the VVER 1000 reactors as used in Temelin in the Czech Republic. The AES-2006 is said to be a third generation design. It is to go on-line before the Visaginas project in Lithuania. Because the Kaliningrad region has no demand for 2000 MW electricity, it is clear that the project is built for the export market and operator Rosatom announced it will seek a 49%

project partner in the West to guarantee sale of power. Czech power giant CEZ already expressed interest in the project. With this, the Kaliningrad project is openly competing with the Visaginas plans, creating the basis for a nuclear power war between Russia and the Baltic States with the Polish, Swedish and German markets as prize. The Russian Federation is signatory to the Espoo Convention on cross-border environmental impacts, but has never ratified the Treaty. Nevertheless, several EU countries already have indicated they would want to see a cross-border EIA procedure for this project.

#### **Belarus**

Also in neighboring Belarus plans for a new nuclear power station continue. President Lukashenko declared a tender for designs for over 3000 MW of capacity and explicitly opened it for non-Russian participation. However according to one Belarus environmental expert, Toshiba Westinghouse and Areva already indicated not to be interested in investing in what is often called the last dictatorship in Europe. In case a Belarussian nuclear power plant

is to be built, it also will add to the export capacity towards the West. Environmentalists and several state authorities from the surrounding countries Lithuania, Latvia, Poland and even Austria have already announced that they want to participate in the EIA for this project, as Belarus is a full party to both the Aarhus and Espoo Conventions.

All these nuclear plans will put an extra burden on the planning of the electricity future in the region, as they will likely demotivate promising developments in decentralization and grid-upgrading, energy efficiency and renewable energy. Still, because none of them is likely to bring any power into the grid before the end of the next decade, utilities are looking for faster ways to meet raising demands, which could mean that the projects would come on a saturated market. Latvian power monopoly Latvenergo is currently planning 200 MW of cogeneration near the capital Riga and is discussing ways to meet another capacity of 300 MW in the West of the country. On top of this, there are plans for power links between

Lithuania and Poland and Sweden, Latvia and Sweden and Estonia and Finland, all projected to deliver an integration with the UCTE (the transmission system in continental Europe) and Nordic markets and able to deliver the needed stability in case of more renewable energy in the grid. There are fast developing plans for large off-and on-shore wind capacity and dual-fuel and biomass co-generation. All involved countries will need to increase the part of renewables in their electricity mix under EU plans to fight climate change.

### **Ignalina 2**

In a separate development, European Commission president Jose Manuel Barroso has made it 17 September once more clear to Lithuania that there is no chance that the Ignalina 2 nuclear power plant will be able to remain open longer than 2009. Lithuania is preparing a referendum on the issue to be run simultaneously with its parliamentary elections this fall and is likely to call for lifetime extension of the Chernobyl type reactor. Jan Haverkamp, nuclear energy expert of the Greenpeace EU Unit,

commented: "This is the same type of game as we have seen around Kozloduy in Bulgaria and Bohunice in Slovakia. There is no chance that all 27 EU Member States would unanimously accept a lifetime extension of this dangerous reactor and the European Commission has stressed this to Lithuania. The referendum is an internal political game to create more support for new nuclear power instead. It has to hide the lack of a serious energy policy that can deliver on short term more energy security and CO2 reduction for the region."

The full EIA report for Visaginas can be downloaded from [http://www.le.lt/en/main/atom/PAV\\_nuclear/EIA\\_Program](http://www.le.lt/en/main/atom/PAV_nuclear/EIA_Program)

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## **VASSILI B. NESTERENKO 1934 - AUGUST 25, 2008**

**Vice-president of the French-Belarus association "Enfants de Tchernobyl Bélarus", Vassili Nesterenko has died. Nuclear physicist at the highest level in the Soviet Union, since 1986, he has fought against the disinformation on Chernobyl. In 1990 he set up the Independent Institute for Radioprotection BELRAD to investigate radioactive contamination and to provide assistance to the affected populations, in particular the children.**

**(677.5894) Enfants de Tchernobyl Bélarus** - In the hours following the Chernobyl catastrophe in 1986, a man rebelled against the lies of the state and paid the price in terms of his career and his own personal safety. Member of the Academy of Sciences in Belarus, physicist at the highest international level, Vassili Nesterenko had access in the Soviet Union to the towns, which were out of bounds for military reasons. Chernobyl rocked his life.

Confronting the inaction and lies of the Soviet government, in a gesture of extraordinary courage, Nesterenko decided, without the approval of his superiors, to stop the ongoing scientific work that he directed at the Institute of Nuclear Energy in Belarus. Instead, he put all his staff to work on the health effects of Chernobyl and he developed

assistance policy for affected populations. Of course, he was removed from his position and suffered pressure from the KGB. He escaped two attempts on his life.

In 1990, with the help of others, he set up the Independent Institute of Radioprotection, BELRAD, to provide assistance to the children of the areas affected by radioactive fallout. He trains doctors, teachers and nurses in radioprotection. In 1994, with the help of Western NGOs, BELRAD acquired mobile chairs for whole body measurement of radioactivity, which Nesterenko then improved and perfected. These spectrometers measure radioactivity in the human body and are hooked up to a computer, which records the gamma rays of incorporated radionuclides, mainly

cesium 137 but also potassium. The data collected are regularly published in a document, which is distributed to national, regional, and local health authorities as well as to families.

Nesterenko was the only scientist taking systematic measurements of artificial internal radiation. His measurements have revealed contamination levels that are 8 times higher than those published by the Belarus Ministry of Health, which persistently obstructed his activities.

Nesterenko himself has had to battle with the effects of radioactive contamination. He flew over the burning reactor the day after the accident. His health became extremely fragile. Since 2007, harassment from government administration doubled after he refused

the offer of directing the construction of the new power station in Belarus.

which includes Vassili's son, Alexei Nesterenko, who is ready to take over as director and continue to expand knowledge, expose the truth in the face of lies from the authorities and to

provide assistance to the children of Belarus who continue to suffer from radioactive contamination.

Fortunately, BELRAD, with more than thirty staff, has built up a solid team

# OVERNIGHT COSTS OF NEW NUCLEAR REACTORS

**Cost estimates for new reactors have been rising at an extremely rapid rate in the US and Europe. There are many reasons for real cost increases, including sketchy or poor estimates from 2000-2003, rising raw and finished materials costs, and supply chain imbalances for skilled labor, forging capacity, and sub-suppliers with nuclear quality assurance programs. All of these issues affect reactor designs and building costs in all nations. In 2007, a reasonable range of overnight (i.e., without interest or real escalation during construction) costs for a new reactor was in the range of US\$3000-4000/kW. In 2008, it is more reasonable to assume US\$5000/kW in overnight costs. This July 2008 testimony describes the reasons for real cost escalation. I do not predict whether costs will continue to grow at recent historical rates, but substantial contingency allowances should be built into any prudent estimate.**

**(677.5895) Jim Harding** - For a number of years in the early to mid 2000s, the prevailing view in the US was that reactor costs were roughly US\$2000-2500/kW. For the most part, these "estimates" were goals. Natural gas and wind power were the resources of choice; few, if any, utilities and vendors made substantial investment of time and money to verify probable costs. This situation changed in 2006 and 2007, when rising gas prices and near certain controls on carbon forced a number of utilities and vendors to examine nuclear costs in earnest.

In developing this testimony, I have relied on a variety of recent overnight cost estimates and escalation indices. The cost estimates include estimates by Florida Power & Light for Turkey Point, Southern Nuclear for two additional units at the Alvin Vogtle site, and Progress Energy for two units in Levy County. A number of investment firms have also made concurrent estimates, including Standard & Poor's, Moody's, and Lazard Freres. In most cases, the estimates do not include highly desirable information, such as annual cash flows or whether the vendor is willing to assume any risks of real escalation or schedule delay during construction. In some cases, key information is redacted as commercially sensitive information. I have also orally discussed the costs and terms of conditions for a plant that was contemplated by MidAmerican Energy Holdings for southern Idaho. In this case, the owners halted further consideration based on the unwillingness of vendors to assume much, if any, cost or schedule risk.

The Florida Power & Light estimate is the most complete of the utility estimates described above.(1) FP&L developed its estimates in conversations with vendors and by using a TVA study for the Bellefonte nuclear project. FP&L's low, medium, and high overnight cost estimates, in 2007 dollars, are shown below:

It is not entirely clear how comparable the TVA and FP&L cost estimates are. The TVA cost estimate was for EPC (engineering, procurement, and construction) costs. In 2004, remaining "owner's costs" were usually estimated at about 20 percent of EPC costs, but if we assume that the TVA estimate entirely excluded owner's costs, the escalation from 2004-2007 has been extraordinary. FP&L's cost estimates incorporate contingency (rather than real escalation) going forward, but the values used imply about 1.5-2.5 percent real escalation per year through commercial operation - far below recent historical averages.

Estimate	2004 TVA	FP&L Low	FP&L Medium	FP&L High
<b>Overnight cost</b>	<b>US\$1661/kW</b>	<b>US\$3108/kW</b>	<b>US\$3596/kW</b>	<b>US\$4540/kW</b>
<b>Escalation</b>	<b>NA</b>	<b>18.8%/year</b>	<b>30.6%/year</b>	<b>41.2%/year</b>
<b>Real escalation</b>	<b>NA</b>	<b>16.3%/year</b>	<b>28.1%/year</b>	<b>38.7%/year</b>

American Electric Power recently presented analysis on one of the key reasons for cost escalation - rising commodity costs.

The estimated value (8 percent real, assuming 2.5 percent inflation) for

Commodity	Escalation 86-03	Escalation 03-07	Ratio vs. History
<b>Nickel</b>	<b>60.3% per year</b>	<b>60.3% per year</b>	<b>15.9x</b>
<b>Copper</b>	<b>3.3% per year</b>	<b>69.2% per year</b>	<b>21x</b>
<b>Cement</b>	<b>2.7% per year</b>	<b>11.6% per year</b>	<b>4.3x</b>
<b>Iron/steel</b>	<b>1.2% per year</b>	<b>19.6% per year</b>	<b>16.3x</b>
<b>Heavy construction</b>	<b>2.2% per year</b>	<b>10.5% per year</b>	<b>4.8x</b>

"heavy construction" is significantly below the rate implied by the FP&L, but nevertheless quite high.

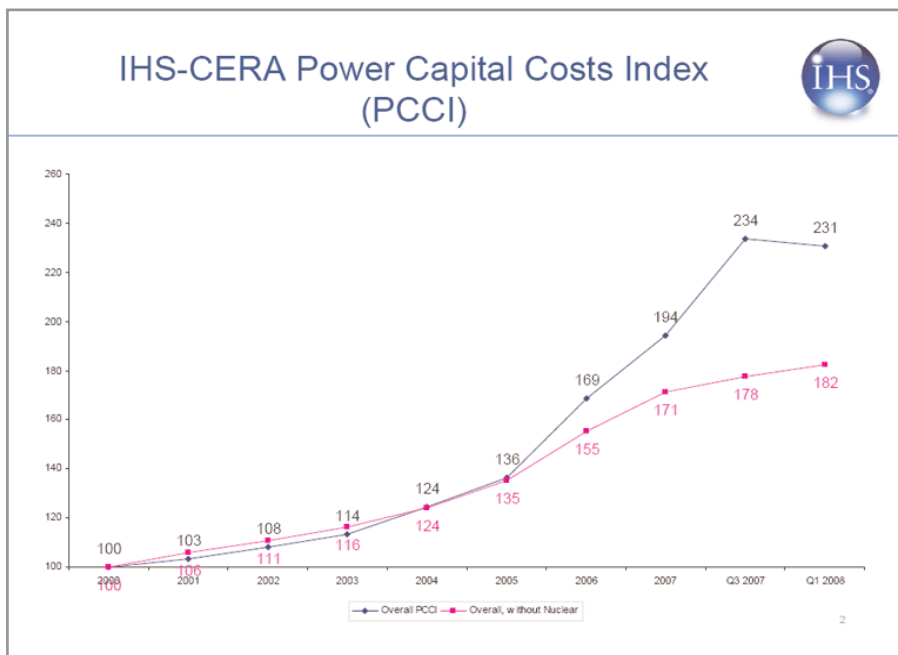
Cambridge Energy Research Associates has introduced a new index for power plant construction that tracks vendor bids worldwide. Their index shows nearly a three fold increase in estimated reactor construction costs over the last 6.8 years (14 percent real.)

companies - Japan Steel Works and, shortly, Creusot Forge - and the reactors builders will be competing with each other as well as with simultaneous demand for new refinery equipment. Japan Steel Works prices have increased by 12% in 6 months, with a new 30% down payment requirement.(5)

Other long lead-time nuclear qualified

potential shortage of craft labor within a 400-mile radius of the Bellefonte site, forcing the adoption of a longer construction schedule.(7) Other sources have pointed to the potential for skilled labor shortages if nuclear construction expands.(8)

Several of these problems have clearly surfaced at the Finnish Olkiluoto 3 site, where the French vendor Areva is building a 1600 megawatt advanced European pressurized reactor (EPR). Areva originally estimated a four year construction period, but the plant has fallen 18 months behind schedule, and is substantially over budget. Analysts estimate that Areva's share of the loss on the "turnkey" contract will be between US\$700-900 million (meanwhile, these figures have risen to more than a billion and two years delay) Concrete poured for the foundation of the nuclear island was found to be more porous than the Finnish regulator would accept. Hot and cold legs of the reactor cooling system required reforging. The design drawings must be redone to accommodate the longstanding requirement that the containment be able to withstand the impact of a commercial airliner.



It is very difficult to determine whether real cost escalation will continue into the future, and it clearly affects all generating options (in greater or lesser degree), and is most acute for capital intensive and longer lead time resources - nuclear in particular. As described earlier, nuclear power faces some specific supply-chain challenges that argue against a low number. Twenty years ago, the U.S. had about 400 suppliers and 900 nuclear or N-stamp certificate holders (sub-suppliers) licensed by the American Society of Mechanical Engineers. The numbers today are 80 and 200.(2) I have not reviewed equivalent numbers for the Canadian industry.(3) It is notable that the Ontario RFP process was recently extended for an additional three months at the request of bidders. This likely reflects the design, supply chain and cost uncertainty challenges facing the bidders.(4)

Worldwide forging capacity for pressure vessels, steam generators, and pressurizers is limited to two qualified

components, including reactor cooling pumps, diesel generators, and control and instrumentation equipment have six year manufacturing and procurement requirements. In the near term, reliance on foreign manufacturing capacity could complicate construction and licensing. NRC Chairman Dale Klein recently indicated that reliance on foreign suppliers would require more time for quality control inspections, to ensure that substandard materials are not incorporated in U.S. plants.(6) Two of the three reactor designs under consideration in Ontario are non-Canadian designs. The Canadian (AECL) design is a new design that moves away from the previous non-enriched fuel CANDU approach. All of these designs would thus entail new challenges for the local Canadian supply industry and would likely involve substantial reliance on imported components.

Skilled labor and experienced contractors present another problem. A recent study by GE-Toshiba identified a

At a recent conference in Nice, Areva NP President Luc Oursel indicated that the company had underestimated what it would take to reactivate the global supply chain for a new nuclear plant. In particular, they were not "100 percent assured" to have a good quality of supply," were not sufficiently familiar with the "specific regulatory context" in Finland, and began building without a complete design. Some 1,360 workers from 28 different nations are now at work at the site. The project manager for STUK, the Finnish regulator, added that "a complete design would be the ideal. But I don't think there's a vendor in the world who would do that before knowing whether they would get a contract. That's real life."(9)

The industry believes that standardization and "learning curves," coupled with clearing supply chain imbalances will drive costs lower over time. But there are chicken-and-egg problems with this conclusion. Utilities may not order new plants and equipment if capacity is limited and

costs are uncertain. Suppliers may not expand production capacity if orders are not immediately forthcoming. As suggested in the comment above, vendors may not be willing to complete engineering designs before contracts are awarded. Moreover, given the structure of the US utility industry, learning curves may be hard to achieve, with different utilities, in different parts of the country, considering standardized but different reactor designs. Using the FP&L overnight cost estimates, a range of real escalation rates, and reasonable assumptions for fuel cost, capacity factor, decommissioning, and operations and maintenance, one can get more than a factor of two difference in levelized life cycle cost.

US\$7500/kW.(13)

Moody's and Standard & Poor's do not spend a great deal of time explaining their methodology. One can infer that that these values are not strictly "overnight costs," but probably include real escalation and real interest during construction, based on the use of fixed charge rates to convert capital cost to capital charges. They would be expressed in real 2007 or 2008 dollars.

US utilities typically report estimates of new reactor construction costs in mixed current dollars at the date of commercial operation. Thus, Florida Power & Light estimates US\$5500-8090/kW for two AP1000 units or US\$5430-7995/kW for two EPRs in

construction costs is a far different problem in Canada than in the US, primarily based on the fact that the Canadian dollar has appreciated against the US dollar since 2002 and many commodities used in reactors are priced in US dollars. There are essentially four issues associated with this argument.

First, trend is not destiny. The commodities "bubble" could reverse itself and redouble the cost in Canadian dollars of reactor construction. The rise of Canadian dollars versus the US dollar clearly does not explain the E.On estimate, as the UK pound has also increased in value compared with the dollar from 2002-2008. This testimony addresses overnight costs, which is simply today's cost. Past changes in the US-Canadian exchange rate should not affect overnight cost.

Second, rising commodity prices, albeit troublesome for new power plant costs, explain very little of the rise in estimated completion costs. Per Peterson (Department of Nuclear Engineering, University of California Berkeley) calculates that high commodity prices for raw materials in March 2008 add only US\$36/kW to a 1 GW PWR. While I have not examined this analysis in detail, I am reminded of the current debate over the cost of wheat in a loaf of bread. Rising raw commodity prices force buyers to buy in advance, pay interest, hedge, and include contingency or indexed adjustments in contracts, potentially adding a significant multiple to Dr. Peterson's estimate. Raw materials are also not the best choice of ingredients in a calculation; nuclear grade concrete and steel are substantially scarcer than ordinary concrete and steel.

Third, the rapid estimated increase in construction costs probably has a great deal to do with bad estimates in the 2002-2005 period. During that time, virtually no utilities worldwide were seriously considering reactor construction. The estimates were primarily done by governments and academic institutions, and were usually R&D targets rather than genuine estimates. It was only when utilities and vendors invested serious time and money (e.g., 1 year and US\$10-15

Case	0% Real	4% Real	8% Real	14% Real
Med overnight	US\$4050/kW	US\$5400/kW	US\$7100/kW	US\$9050/kW
High overnight	US\$4540/kW	US\$6050/kW	US\$8000/kW	US\$10150/kW
Med overnight	US\$0.11/kWh	US\$0.13/kWh	US\$0.17/kWh	US\$0.21/kWh
High overnight	US\$0.12/kWh	US\$0.15/kWh	US\$0.19/kWh	US\$0.23/kWh

The French experience most strongly suggests that rapid construction is best achieved with one utility ordering one basic design at a steady rate, keeping vendors, sub-suppliers, and construction crews operating near capacity and able to move smoothly from one project to the next.(10) That model of single government vendor, coordinated procurement, and single government utility is rare, if not unique and unavailable, in today's world. Even in France, later reactors were substantially more expensive than earlier units.

Investment firms have also released a variety of reports on new reactor construction and operating costs. In May 2007, Standard & Poor's released a report on coal, gas, nuclear, and wind costs, and how competitiveness would be affected by carbon taxes. The nuclear capital cost estimate was US\$4000/kW.(11) Moody's followed in October 2007 with a range of US\$5000-6000/kW, which the investor's(12) service called "only marginally better than a guess." In May of this year, Moody's released a new report with estimated capital costs of

mixed current dollars at commercial operation (2018-2020). It is not completely straightforward to convert these estimates to either overnight costs, or real construction costs in 2007 or 2008 dollars, as one must discount both nominal escalation and interest during construction based on annual cash flows. I have approximated final construction cost estimates for both FP&L's Turkey Point project and Progress Energy's Levy 1 and 2 project and believe them to be generally consistent with an overnight cost estimate of US\$5000/kW. E.On's chairman has reportedly estimated that a single reactor in the UK would cost roughly US\$10,000/kW in US dollars, but the details are not available.

In light of the recent rapid cost escalation, I believe that it is prudent to assume an overnight cost of US\$5000/kW in 2008 dollars. I treat this as inclusive of contingency for both potential delays and cost increases, though it would be desirable to treat these factors separately.

The Ontario Power Authority, argues that real escalation of nuclear

million) that significantly larger numbers emerged.

Fourth, if raw commodity price escalation is not the problem, what is? I would infer that the most difficult problem, which Canada cannot escape against currency changes, is supply-chain imbalances. Engineering, procurement, and construction contractors, N-stamp sub-suppliers, skilled crews, large forgers, and other steps in the supply-chain are in short supply. One cannot rule out monopoly pricing for many of these steps, and that may be reflected in current US estimates.

### Summary

In conclusion, I believe that US\$5000/kW is a reasonable overnight cost, including a modest contingency. I have not attempted to estimate escalation or schedule delay risks, or interest during construction going forward. In light of current experience, I believe it is prudent to treat these factors explicitly, and I do not believe it would be prudent to assume zero escalation in the future. This estimate is in line with recent US utility estimates, but is also below some utility and investment firm estimates.

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- 6 and 7 Electrical Power Plant, October 16, 2007, pg. 247.
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- 3)- The current RFP process in Ontario is reviewing Canadian, American and French designs by AECL, Westinghouse/Toshiba, and Areva respectively. All are new 'generation III' designs. The FP&L project discussed herein utilizes the Westinghouse AP1000 design. The Olkiluoto 3 project utilizes the Areva design. None of the projects described here use the AECL design.
- 4)- [http://www.infrastructureontario.ca/en/news/io\\_news/2008/july2508/NPP%20new%20timeline%20NR%20-%20FINAL.pdf?fuseaction=english.news&body=yes&news\\_id=173](http://www.infrastructureontario.ca/en/news/io_news/2008/july2508/NPP%20new%20timeline%20NR%20-%20FINAL.pdf?fuseaction=english.news&body=yes&news_id=173)
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## IN BRIEF

**Australia: uranium export to Russia in doubt.** Last year in Australia, Putin and (now ex PM) Howard signed a nuclear-sharing deal, which would allow Australian uranium to be sold to Russia. The new Government referred the matter of whether to ratify the Treaty to a Parliamentary Committee for consideration, which received public submissions.

On September 18 a majority report of the Committee suggested Australia not to proceed with the deal until a number of significant requirements are met (including Russia separating its civilian and military nuclear program). The Prime Minister responded that they are 'considering' the request. This is quite hypocritical: Australia voted in favor of the waiver for India at the Nuclear Suppliers Group, although the separation of the military and civil nuclear program in India is at least as unclear as in Russia. But at least the Rudd Government's ban on uranium sales to India will stay in place despite the decision by NSG. On September 7, Trade Minister Simon Crean confirmed Canberra's ban on yellowcake sales to India would stay in place as long as it refused to sign the NPT.

### The Australian Sep. 8, 2008 / Committee Recommendations, 18 September 2008

**Pro-uranium-party in WA-government.** As mentioned in the last issue, the September 6 elections in Western Australia would be important for uranium mining in the state. The Labor-premier Alan Carpenter said that if re-elected he would ban uranium mining. Unfortunately, Colin Barnett, leader of the Liberal Party - which supports uranium mining - was announced as Premier on 14 September after the Labor Party lost its majority. The Liberals secured the support of the pro-uranium mining National Party, led by Brendon Grylls, and will form a coalition government. Grylls, who held the balance of power after the elections left both Labor and Liberal parties without a majority, had said he was open to negotiations with both parties. However, he

said he would not support either unless they backed his plan to spend some 25% of Western Australia's mineral royalties - about A\$700 million (US\$568 million, 400 million euro) - on infrastructure and services in rural areas.

**World Nuclear News, 16 September 2008**

**IAEA's Great Expectations.** The IAEA has revised upwards its nuclear power generation projections to 2030, while at the same time it reported that nuclear's share of global electricity generation dropped another percentage point in 2007 to 14%. This compares to the nearly steady share of 16% to 17% that nuclear power maintained for almost two decades, from 1986 through 2005.

In its 2008 edition of Energy, Electricity and Nuclear Power Estimates for the Period to 2030, the IAEA expects global nuclear power capacity in 2030 to range from a low case scenario of 473GW(e), some 27% higher than today's 372 GW(e), to a high case scenario of 748 GW(e), i.e., double today's capacity.

But while projections for nuclear power's future rose, its share of the world's electricity generation today dropped from 15% in 2006 to 14% in 2007. "The reason is that while total global electricity generation rose 4.8% from 2007 to 2008, nuclear electricity actually dropped slightly," said Hans-Holger Rogner, Head of the IAEA's Nuclear Energy Planning and Economic Studies Section

The main reason that nuclear generation dropped was an earthquake in western Japan on 16 July 2007, which shut down all seven reactors at the Kashiwazaki-Kariwa nuclear power plant - the seven units total 8.2 GW(e), almost one sixth of Japan's nuclear capacity. There were also several other 'unusual outages and reductions' (the words used by the IAEA for accidents) experienced in Korea and Germany. Finally, the increases in the load factor for the current fleet of reactors appear to have plateaued.

According to the IAEA's 2008 high projection, growth in nuclear generation will match the 3.2% per year growth in overall generation, and nuclear power's share therefore will hold steady at 14%. In the low projection, overall electricity growth is lower, but nuclear power's growth is lower still, and by 2030 nuclear power's share of global electricity is projected to drop to about 12.5%.

**IAEA press release, 11 September 2008**

**How Russian nuclear renaissance looks like.** On September 16, special police forces and FSB (ex-KGB) searched the office of the well-known regional environmental group 'Dront' in the city of Nizhny Novgorod (third most-important city in Russian political life, 400 km south-east of Moscow). Activists believe that the main reason for the search is support of anti-nuclear efforts in this region by 'Dront' (official reason is said to be related to taxes and debts). Earlier this year 'Dront' -chief was warned several times by "friends" in the local government, better not to be involved in support of anti-nuclear activities. Actually, 'Dront' never organized protests itself but always served as resource-center. Last summer there were several waves of protests (organized by Ecodefense and local groups) and 'Dront' again was warned in relation to that. By the way, Rosatom, the state nuclear-corporation, announced construction of a new nuclear power plant in this region last year. Preliminary information Ecodefense received indicates FSB has found some maps in the 'Dront'-office, which they took to investigate if they are related to state secrets.

This is not the first time government attacks groups protesting new nuclear reactors. Last year, local government attacked Siberian anti-nuke group TESI in the city of Tomsk. This was the only anti-nuclear group in the region protesting a proposed nuclear plant. TESI was basically forced out of their office and nearly closed down as a result of this. In two more regions - Kaliningrad and Voronezh - new nuclear reactors are proposed to be built and anti-nuke groups ran into trouble with the state. Last year, a local group in Voronezh affiliated with Ecodefense was nearly closed down by court and tax police but managed to survive after organizing some public protest. In Kaliningrad, Ecodefense had some trouble with tax police, which tried to freeze bank account without any single reason for it.

There are many reactors proposed for the future here (36 to 38 according to a government plan) and it looks like state and nuclear industry (which belongs to the state) are not very happy with people who oppose such plans. Who knows what's next, but so far this is reality here. This is how the Russian nuclear renaissance looks like.

**Ecodefense email, 16 September 2008**

**Taiwan: Shortlist of nuclear dumpsites released.** Three Taiwanese villages are being considered as future sites for nuclear waste disposal facilities. The Ministry of Economic Affairs announced the list on September 3, under pressure from local media. The three villages are Taitung County's Nantien village, Pingtung County's Hsuhai village and the village of Dongjiyu on the offshore islands of Penghu.

The announcement follows a two-year search for a site that is 'suitably remote'. The economics ministry has come under fire for dragging its heels before announcing the list and its lack of transparency. Ministry officials are said to have first contacted local government officials in secret before making the announcement.

The state-owned Taipower Company hopes to begin constructing the waste disposal facilities by 2010. But each of the county's will have to first pass a referendum agreeing to the construction, and the sites will need to undergo an environmental impact assessment.

**Radio Taiwan International, 3 September 2008**

## WISE/NIRS NUCLEAR MONITOR

The Nuclear Information & Resource Service was founded in 1978 and is based in Washington, US. The World Information Service on Energy was set up in the same year and houses in Amsterdam, Netherlands. NIRS and WISE Amsterdam joined forces in 2000, creating a worldwide network of information and resource centers for citizens and environmental organizations concerned about nuclear power, radioactive waste, radiation, and sustainable energy issues.

The WISE/NIRS Nuclear Monitor publishes international information in English 20 times a year. A Spanish translation of this newsletter is available on the WISE Amsterdam website ([www.antenna.nl/wise/esp](http://www.antenna.nl/wise/esp)). A Russian version is published by WISE Russia and a Ukrainian version is published by WISE Ukraine. The WISE/NIRS Nuclear Monitor can be obtained both on paper and in an email version (pdf format). Old issues are (after two months) available through the WISE Amsterdam homepage: [www.antenna.nl/wise](http://www.antenna.nl/wise).

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