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MONITORED THIS ISSUE:

CHINA'S EMERGING ANTI-NUCLEAR MOVEMENT

On August 18, 2007, China officially started the construction of the Hongheyan nuclear power plant, 110 km north of Dalian city in Liaoning province, kicking off a new round of nuclear power booming in China. Using China's own CPR 1000 nuclear technology, the Hongheyan nuclear power plant will have six reactor, each with a capacity of 1 million kilowatts (1000MW). Though Chinese media reported the assurance from governmental officials on safety of nuclear reactors, in a rare stance, China Daily publicized concerns over nuclear safety from residents in nearby Changxing Island.

(663.5843) Pacific Environment - The third largest island in China, Changxing Island, was once mapped into a national Spotted Seal nature reserve. Each spring, spotted seals and their pups harbors along the western shore of the Changxing Island while migrating to the open seas of the West Pacific.

The site of the Hongheyan nuclear power plant is used to be a breeding ground of the spotted seal and a stopover of migratory birds traveling between the Russian Far East and Australia. Being a coastal flat with sparsely populated villages, this area was chosen as a potential site for a nuclear power plant as early as 1978. In 1995, ten years after the Chernobyl accident, the construction plan was revisited. At the time, a senior official opposed to the building of such a nuclear power plant near the tourist city of Dalian. The construction was subsequently postponed for ten years.

Wang Zhifeng, a Dalian retired worker, expressed his outrage on the proposed nuclear plant, saying it would mean the doomsday for China's spotted seal and the entire Bohai Sea marine ecosystem. In spring of 2006, Wang learnt about the proposed nuclear power plant from

Dalian Environment Protection Agency and the impending construction activity. According to Wang, the government of Dalian was not even invited during the decision-making process of the proposed Hongheyan NPP and no adequate Environmental Impact Assessment has been conducted. It is very likely some local environmental officials intentionally revealed the difference between Dalian government and the advocates of nuclear power plant. But no one seems to be able to constitute an effective force to stop the nuclear power project.

Like Wang Zhifeng and the city of Dalian, concerns about the growth of nuclear power are widely spread across the country in light of China's rapid approaching new nuclear era. China plans to build 40 nuclear reactors with a total capacity of 40,000MW by the year 2020. Eighteen Chinese provinces have been bidding for hosting nuclear power plants and have been actively in designing blueprints for the growth of nuclear power.

In March 2005, Premier Wen Jiabao publicly announced his support for a rapid development of the nuclear power

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sector. The China Nuclear Science Academy submitted a letter to Chinese leadership urging the authority to prioritize nuclear power production. China's energy shortage and rising demand for electricity has pushed the government to consider nuclear energy as a rational source of future power supply. Currently, nuclear power consist of 12% of the total electricity output, while the largest part of the produced power comes from coal, however, it is estimated that China will run out of coal supply by the year 2050.

Besides the real shortage of power, economic incentive is another reason why local provinces actively lobby to have a nuclear power reactor in their own province. International business interest is another factor, Westinghouse and the Russian nuclear power sector have been cultivating a good relation with Chinese government and actively promote the sale of their equipment.

China is ill prepared for the coming of nuclear power booming. Besides astronomical financial investment required, lack of nuclear technical personnel could pose long term challenges. Only three Chinese universities supply nuclear-related talents. Lack of training and experience, as well as lax quality management, China's nuclear power facility would not stay immune to various structure problems already widely occurring across economical sectors.

Chinese citizens worry about nuclear development

Most citizens' nuclear awareness comes from memories of the Chernobyl accident in 1986. Chinese media had covered the catastrophe without any censorship. Besides, news about nuclear accidents in Japan's nuclear power plants has also been timely reported in China. Chinese media had also been open in publicizing anti-nuclear rallies in Taiwan and planned Taiwanese nuclear waste shipments to North Korea and international criticism around it. And each year, the Stop Castor campaign in Germany also reaches the Chinese TV news.

However, environmental impacts of nuclear power and nuclear wastes

within China have not been reported much in Chinese media. Most of recent publicity is focusing on the transformation of a previous nuclear testing site in Qinghai into a radiation-free tourist site. Only modest coverage of uranium mining radiation incidents were reported in Chinese media. Therefore, Chinese people in general are less aware that the nuclear threat is close to their own regions, and no longer just an issue only occurred in other countries.

This situation is going to change. In Shandong province there are three proposed nuclear power stations, two near Weihai's famous Silver Beach resort and one near Rushan, six kilometers away. Last year, a well organized anti-nuclear petition campaign started against these proposed nuclear plants by Dahai (meaning 'Ocean') Commune. The founder of the Dahai Commune, nicknamed as Yi Wuchen ('Wearing-No-Dust'), walked along China's coastlines in the year 2000 and witnessed first hand how Chinese seas were under serious ecological threat. Later, Yi Wuchen initiated the Dahai Commune. With the help from student volunteers, the group built up an online community of ocean lovers. Through this online community, in 2006, Dahai Commune spread its open letter to Premier Wen Jiabo, expressing public opposition on the planned three nuclear power plants on the Shangdong peninsula. A petition letter was also delivered to the State Environment Protection Administration to voice their environmental concerns. Local concerned citizens in Weihai also formed a self-initiated network called "Silver Beach Environmental Initiators". They have been actively appealing to various governmental agencies in Beijing to reflect the need of protecting Silver Beach. The group stated that for such a nuclear project, a public hearing should have been organized before the plan was approved. The group also demands the government to promote renewable energy to meet the energy need.

Another anti-nuclear campaign happened in Hunan around July 25, when the China National Nuclear Corporation (CNNC) signed an agreement with Hunan provincial

government to build the Taohuaijiang Nuclear Power Station. This would be the first nuclear power plant in an inland province. Similar online anti-nuclear debates on nuclear power plans in provinces like Fujian and Hainan were spread on the internet.

Northwest China, a legacy of nuclear wasteland

Nuclear weapon testing in Xinjiang and Qinghai has led to a massive increase in cancer and congenital diseases among people living close to the sites. Chinese government documents show that the incidence of higher cancer rates and other more common diseases like tumors, leukemia and birth defects such as cleft palates. In Xinjiang, Lake Lop Nor was wiped out from the map due to nuclear testing and related human activities.

In Gansu, uranium mining and corruption of officials with the military mining company have led to grave human tragedies. One Chinese activist who spoke out is Sun Xiaodi, a former Project 792 worker. Since 1988 the whistleblower has repeatedly traveled to Beijing to reveal the scandal of corruption that saturates Chinese nuclear industry, government funding allocated to relocate uranium company staff, as well as frequent discharges of radioactive waste into the Gansu waterways. In 2006, Sun Xiaodi was awarded the Nuclear-Free Future Resistance Award by international community. (see *Nuclear Monitor* 650, 15 December 2006)

International Opinion

In Asia, the most well-connected anti-nuclear network is the No Nukes Asia Forum, which has organized forums in various East Asian countries. Though the member groups in South Korea, Japan and Taiwan have been active nuclear watchdogs, the decentralized network does not have much capacity to function as a facilitator of the anti-nuclear movement in mainland China.

In July 2007 in Niger, where a Chinese company is also searching for uranium supply, Niger's Tuareg-led rebels have kidnapped a Chinese uranium dealer, Zhang Guohua, an executive at Chinese uranium company Sino-U. The group demanded his company to stop

its activities in the desert region. Niger Movement for Justice (MNJ) said they cannot allow the Chinese to continue extracting natural resources while civilians are being killed.

On March 8 2007, the Chinese language Southern Weekend mentioned a German Green Party environmental policy spokesperson and also a congress person who showed her disappointment over China's pursue over nuclear power.

Despite concerns in Australia on exporting uranium to China, China will use its supply to expand its nuclear weaponry. Environmental organizations like Friends of the Earth-Australia, are worried about uranium mining's impact domestically. The Anti Nuclear Alliance of West Australia has also been trying to work with Chinese groups and audience to bring awareness on uranium mining and its negative

impacts.

The Australian government estimates that by 2020 the Chinese demand for uranium could be equal to Australia's entire annual export performance. Even though nuclear energy will not be used in Australia for sometime, it still considers export to China. Within the Australian politics, the Greens in parliament, like their counterpart in Germany, disagree with uranium export to China. (However, uranium export to China is less likely after Labor won the Australian general elections on November 25 - addition WISE-Amsterdam)

Future trends

Much like hydropower development boom, nuclear power is another energy sector which was put forward by governmental companies in the name of satisfying energy shortage. As many petitioners highlighted, the huge

financial investment in these projects will become a hotbed for corruption at different levels. The social and environmental impacts would be enormous and risk of any possible radiation accidents would destroy the confidence and trust of citizens on the safety of the nuclear power plants.

Current online anti-nuclear campaigns have mostly been "not in my backyard" ones. And it would be logical to form an inter-regional alliance for joint advocacy. But with the increased knowledge and capacity at Chinese environmental groups, as well as the growth of sophistication of anti-nuclear campaign organizers, a full-fledged anti-nuclear movement will soon be in the making.

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AGREEMENT ON PLUTONIUM DISPOSAL PLAN

On November 19, the US and Russia signed an accord establishing the actual mechanisms for the disposal of 34 metric tons of surplus plutonium from Russia's nuclear weapons program. The US will contribute US\$400 million (Euro 270 million) to the disposal program, according to a statement signed by Bodman (US Energy Secretary) and Sergei Kiriyenko (director of the Russian Federal Atomic Energy Agency).

(663.5844) WISE Amsterdam - The US and Russia will cooperate to transform the weapons-grade plutonium into mixed-oxide fuel, or MOX, by blending it with low-enriched uranium. The nations agreed to get rid of 34 metric tons each of weapons plutonium in a 2000 accord. The accord is "more symbolic than anything else," according to Thomas Neff, a physicist and uranium-industry analyst at the Massachusetts Institute of Technology in Cambridge, US. Based on the Energy Department's statement, output from the program would be equivalent to 1.3 million pounds of uranium a year, less than 1 percent of the 180 million pounds consumed annually by the world's reactors, Neff estimated. Execution of the agreement may spur the U.S. to begin converting its surplus weapons into fuel, he said. Construction began in August on a US\$4.8 billion South Carolina plant at the Savannah River site that will convert U.S. weapons to reactor fuel. The plant

is being built for the Energy Department by Shaw Areva MOX Services LLC, a venture of Shaw Group Inc. and France's Areva SA.. Four test MOX assemblies made in France are already in use at the Catawba 1 PWR in the US.

For Russia another driving force for the use of MOX, apart from the US-Russia agreement, is the strategic approach Russia has taken to close its nuclear fuel cycle in the long term, which assumes the recycling of plutonium. In October requirements for mixed-oxide (MOX) nuclear fuel in Russia have been approved by the regulator, Rostekhnadzor. It is Russia's goal to use the MOX fuel in fast breeder reactors able to destroy plutonium from dismantled weapons and re-use materials from used nuclear fuel. Rostekhnadzor's documentation sets out the standards MOX fuel assemblies must meet in terms of thermal and mechanical stresses and resistance to

effects of radiation. The fuel rods must withstand these potentially damaging forces lest they degrade to the point where heat from the highly-radioactive fuel inside could not be safely removed.

Burning instead of breeding

Starting in 2012, Russia will use some of the fuel in an existing reactor and some in a new reactor currently under construction. Russia does not intend to use MOX widely in its PWR fleet and would prefer to load it instead in the prototype of the fast breeder reactor (FBR) family it hopes to use widely in coming decades. One FBR already operates at Beloyarsk unit 3 (fifteen test MOX fuel assemblies are currently in use within the core, where they will stay until 2009), supplying 560 MW to the grid, while Beloyarsk 4 is under construction now. This 800 MW FBR should operate from 2012 and is planned to use all 34 tons of weapons plutonium during its life, even if not by 2014. Other stocks of

plutonium have already been separated from previously used nuclear fuel. Future plans envisage an 1600 MW unit which should be economically competitive with conventional water-cooled reactors from operation in 2020. However, one should then no longer speak of Fast Breeders but (slow) burners, because the original aim of the FBR is to produce plutonium, not to consume it. The Fast Breeder technology failed in the 1980's when

the prototype FBRs in Germany (Kalkar) and France (Superphenix) did not go into operation or were closed. In Japan the fast breeder Monju is still closed after a severe incident (a massive sodium leak) in December 1995. Worldwide, the Beloyarsk-3 is the only FBR in operation and it is not even a fast breeder reactor. So the question is if there is any reason to believe that the aim of the international agreement can be met? Or

is it just a US\$400 million subsidy for the further development of the fast breeder technology (which by the way is the preferred technology to be used in some of the Generation IV reactor projects, which are coincidentally pushed mainly by.... the USA).

Contact: WISE Russia

Sources: Bloomberg, 19 November 2007 / World Nuclear News, 18 October 2007

GREEN PARTY & GREENPEACE WANT TO STOP ANGRA-3. BRAZILIAN NGOs AGAINST NUCLEAR ENERGY PLANS

Brazilian President Luiz Inacio Lula da Silva defends nuclear energy as a means to overcome power supply problems and called again for the completion of Angra-3 a few months ago. Lula said: "Nuclear energy is clean, it doesn't pollute, doesn't emit carbon dioxide, so it won't cause greenhouse effect on the planet." He said, Brazil needed as much energy as possible, including new nuclear plants such as Angra-3.

(663.5845) Norbert Suchanek -

Currently two nuclear reactors are in operation, Angra-1 and Angra-2 (first power respectively 1982 and 2000), generate around 2,000 megawatts - less than 3 percent of Brazil's total capacity. Angra-3 would add 1,350 MW. The French state-controlled nuclear group Areva (through its joint subsidiary with Siemens, Framatome) is optimistic about a restart of work on Angra-3 soon in the next months. The Angra-3 unit was part of the same contract as Angra-2 and was designed to be a twin of it. While 70% of the equipment is on site, actual construction has not started.

If everything goes well for Lula, Angra-3

will cost about US\$3.6 billion (Euro 2.4 billion) - and would be ready in 2014, so the calculation of Eletronuclear president Luis Hiroshi Sakamoto. Angra-3 is part of a wider nuclear plan of the Lula Government to build up to eight new 1,000 MW reactors by 2030 - together with more uranium mining in Brazil (in Lagoa Real / Caetite of Bahia state and in Itataia Ceara state). Some local Brazilian NGOs, the network called Brazilian Forum of NGOs and Social Movements for the Environment and the Development (FBOMS) and the Green Party are against Angra-3. During the last year there have been some protests by these NGOs and Greenpeace in Brazil. In March 2007 a

demonstration took place in Brasilia, organised by Greenpeace. In June they signed and presented a letter to Lula to stop his nuclear plans. In September 2007 there have been small protests in Rio de Janeiro, São Paulo and Salvador. Greenpeace demonstrated in front of the Comissão Nacional de Energia Nuclear (CNEN - National Energy Commission), in Rio de Janeiro, to remember the victims of the nuclear accident in Goiânia, 20 years ago (A cesium-137 radioactive source was left in an abandoned clinic in the city of Goiânia. Scavengers took the massive device, gouged out the iridium window, which allowed high gamma radiation and a beautiful blue light to escape,

A non-transparent entanglement. Who is responsible for the Nuclear Energy in Brazil?

Eletronuclear was set up in 1962 as a holding company controlled by the Ministry of Mines and Energy, and 70% government owned. It is the main shareholder in Eletronuclear, the Brazilian nuclear utility. In 1970 the government decided to seek bids for an initial nuclear plant. The turnkey contract for Angra-1 was awarded to Westinghouse, and construction started in 1971 at a coastal site between Rio de Janeiro and Sao Paulo. In 1975 the government adopted a policy becoming fully self-sufficient in nuclear technology and signed an agreement with West Germany for supply of eight 1300 MWe nuclear units over 15 years. The first two were to be built immediately, with equipment from Siemens-KWU. The rest were to have 90% Brazilian content under the technology transfer agreement. To effect this, a state-owned company Empresas Nucleares Brasileiras (Nuclebras) was set up with

a number of subsidiaries focused on particular aspects of engineering and the nuclear fuel cycle. In 1988 a new company, Industrias Nucleares Brasileiras SA (INB) replaced Nuclebras and most of its subsidiaries, but with limited authority and function related to fuel cycle activities. INB is a subsidiary of the National Nuclear Energy Commission (CNEN). Responsibility for construction of Angra-2 & 3 was transferred to the utility Furnas, a subsidiary of Eletronuclear. Then in 1997 a new company Eletronuclear* was set up as a subsidiary of Eletronuclear and made responsible for all construction and operation of nuclear power plants. It combined the nuclear side of Furnas with the engineering company Nuclen, and Siemens then relinquished its 25% share in it. Nuclep is the continuing subsidiary from the Nuclebras.

World Nuclear Association: <http://www.world-nuclear.org/info/inf95.html>

and sold it to a junk-yard owner).

But all these protests did not receive big recognition by the Brazilian media. In fact unfortunately the news about these demonstrations did not reach most of the Brazilian population. And the national TV stations nearly never showed critics against the nuclear power plans nor against the bioenergy plans of the Lula government. Still in October this year the Brazilian President signed a nuclear energy treaty with India

and South Africa to expand the production of nuclear energy. At the beginning of November the Green Party and Greenpeace asked courts in Rio de Janeiro / Angra dos Reis to block the construction Angra-3. Another action was filed in the capital Brasilia. Greenpeace said, that the construction of Angra-3 is "illegal and unconstitutional." The environmental organization said, the plant lacks the express authorization of President Luiz Inacio Lula da Silva and

the approval of Congress.

Now there will be a *audiência pública* (public hearing) organised by the environmental agency IBAMA together with the state owned nuclear company Eletronuclear in Rio de Janeiro on November 26. Public hearings already have been held in the cities Angra dos Reis, Paraty and Rio Claro.

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ENEL AND NUCLEAR POWER IN ITALY

After the recent takeover of Spanish Endesa, ENEL is presently the 2nd largest power company in Europe and one of the biggest concerning the use of nuclear power. It looks like a paradox as Italy banned nuclear power in 1987 with a popular referendum. Moreover, one of the three questions of the referendum dealt with ENEL's nuclear investments abroad and the answer of the overwhelming majority of the Italian people was a definite stop to this possibility.

(663.5846) Campagna per la Riforma della banca Mondiale - ENEL's current strategy has been well explained by his chief executive officer, Fulvio Conti, in an interview for the newspaper *la Repubblica* this summer: "We can say that our growth phase [in Europe] is almost finished [...]. When the takeover of Endesa will be concluded, we will reach the qualitative and quantitative dimensions we've been seeking, becoming a corporation with our heart in Italy and many arms in Europe. We'll have an adequate technologic mix composed by nuclear, clean coal, gas and renewable, and we will serve 60 million customers in 19 countries".

In the last three years the Italian utility concentrated its efforts more in the international market rather than the domestic one, including also the development of a "nuclear strategy" focused mainly on the buyout of old and promotion of new soviet-type nuclear power plants in Eastern European countries. ENEL is planning a massive dumping of nuclear risks onto these countries given that Italy will import most of this new nuclear production soon through the European inter-connected power grid in order to meet is growing power demand.

As far as Italy is concerned, ENEL seems to be not really willing to force publicly a strong push towards a new

nuclear season. Actually, reading through the lines of the company's press communicates and the public statements of its management, it is clear that its main fear is still the possible resistance of the Italian public opinion - and thus ENEL's customers - against the revival of nuclear power in the country.

ENEL has moved a pro-active media approach given that after the full liberalization of the national power market came into force on July 1, the company is facing a more competitive environment in Italy. To this end, a few months ago ENEL has launched a big advertising campaign with the message "The real revolution is not changing the world", based on the image of an environment-friendly company that invests mainly in renewable energies and cares about the health and the future of mankind. In this framework, it is easier and convenient for the company, in terms of marketing and communication strategies, to give the way to politicians in pushing and stressing the national need to go back to nuclear power. Unfortunately, the theory that going back to nuclear is the only solution to reduce the CO2 emissions and the best means to improve national energy independence has been well spread and learned inside almost the whole Italian Parliament, among both right wing and left wing groups.

Nobody seems to remember that Italian population is still paying high costs - through ENEL electricity bills - for decommissioning the nuclear heritage. In 1999 a new State owned Company, SOGIN, has been founded with the specific objective of decommissioning the four national nuclear power plants. SOGIN activities are financed by Italian ENEL's customers through a special taxation included in the general electricity bill. But very few know about it as the special nuclear decommissioning cost is included in the bill with the unspecific title "General system taxes, component A". In 2006, this kind of taxation covered decommissioning costs for 143.2 million Euro (US\$212 million), taxes deducted.

Nevertheless, according to the latest statement on the nuclear issue made by the Italian foreign Minister, Massimo D'Alema, during the World Energy Council, "the government intends to move Italy back to the nuclear research field in order to decrease the gap [comparing our situation with other European countries]". The call for a slow reprisal of nuclear energy seems to be already planned. ENEL is moving in this direction and soon the agreement with EdF for the cooperation in the construction of the new EPR, will be signed between the companies.

It is worth remembering that the Italian Economy Ministry holds 21.4% of ENEL directly and another 10.2% indirectly through state-run lender Cassa Depositi e Prestiti. Furthermore, any other investor in ENEL should comply with the ownership limitation of just 2 per cent of company's shareholding capital. Thus, the Italian government still controls a big share of the company. But too often the government is not keen to exert any significant direction on the management, given the high dividends that ENEL has been paying to the cash-strapped Italian State in the last years. Just in 2006 ENEL produced

dividends of more than 2.5 billion Euro, of which about 800 million went to the government.

However recent take-overs have put ENEL under financial stress. On November 19, ENEL issued a new tranche of corporate bonds to cover debts occurred in the last months for buying Endesa. This issuance will go much further the domestic market, as well as profits tend to be produced more and more outside Italy. Thus ENEL has become finally a mature energy multinational company and will be more and more judged by the market. So its reputational risk

becomes more and more important to compete with other European and global energy giants, without relying any longer just on the domestic market and the subsidies of the Italian State.

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WORLD NUCLEAR INDUSTRY STATUS REPORT 2007

Fifteen years ago, the Worldwatch Institute in Washington, WISE-Paris and Greenpeace International published the *World Nuclear Industry Status Report 1992*, this was then subsequently updated in 2004 by two of the original authors. The November 2007 update of the *World Nuclear Industry Status Report* (commissioned by the Greens-EFA Group in the European Parliament) provides an entirely updated and slightly modified version of the 2004 report. This report aims to provide a solid basis for analysis into the prospects for the nuclear power industry.

(663.5847) Schneider/Froggatt - At the end of October 2007, there are 339 units operating in the world - that is one less than at the moment of the release of the 2004 version of the World Nuclear Industry Status Report and five units less than at the historical peak in 2002 - which total 371.7 GW of capacity. The installed capacity has increased faster than the number of operating reactors because units that are being shut down are usually smaller than the new ones coming on-line and because of uprating of capacity in many existing plants. According to the World Nuclear Association (WNA), in the USA the Nuclear Regulatory Commission (NRC) has approved 110 uprates since 1977, a few of them "extended uprates" of up to 20%. As a result an additional 4,700 MW were added to the nuclear capacity in the USA alone. A similar trend of uprates and extending the lives of existing reactors can be seen in Europe. However, in the absence of significant new build, the average age of operating nuclear power plants in the world has been increasing steadily and stands now at 23 years, up two years from the Status Report 2004.

A total of 117 reactors have been

permanently shut down, with an average age of about 22 years, the figure is up one year from the situation in 2004. Since the 2004 edition of the Status Report ten reactors have been shut down - eight in 2006 - and nine have been started up.

The capacity of the global fleet increased annually between the years 2000 and 2004 by about 3,000 MW, much of it through uprating and dropped to 2,000 MW per year between 2004 and 2007. This figure should be compared to the global net increase in all electricity generating capacity of about 135,000 MW *per year*. Wind power alone recorded an average annual increase of 13,300 MW between 2004 and 2006, more than 6.5 times the nuclear additions. This leaves nuclear power with a global share of roughly 1.5% of the annual increase. The slightly increased output from nuclear energy will not be sufficient, at least over the short and medium term, to maintain its current 16% share in the world commercial power production and the 6% in the commercial primary energy - which is less than the contribution of hydropower alone - or about 2% to 3% final energy

consumption.

The international nuclear industry continues to forecast a positive future. "Increasing energy demand, concerns over climate change and dependence on overseas supplies of fossil fuels are coinciding to make the case for nuclear build stronger. Rising gas prices and greenhouse constraints on coal have combined to put nuclear power back on the agenda for projected new capacity in both Europe and North America," says the WNA.

The nuclear industry is not alone to proclaim its "renaissance". Over the last three years, several international assessments of the possible future of nuclear power in the world have been adjusted to more optimistic prospects for the horizon of 2030. The OECD International Energy Agency's World Energy Outlook 2007 presents a "reference scenario", an "alternative policy scenario" and a "450 stabilisation case" that include respectively 415 GW, 525 GW and 833 GW of nuclear power. Electricity generation from nuclear plants under the high scenario would more than double from current levels to reach 6,560 TWh in 2030. Under the

reference scenario the share of nuclear power in the world commercial primary energy supply would drop from 6% to 5% in 2030.

The U.S. Department of Energy, in its latest edition of the International Energy Outlook (IEO), forecasts 438 GW of nuclear by 2030, "in contrast to projections of declines in nuclear power capacity in past IEOs". The International Atomic Energy Agency (IAEA) has revised its forecasts several times over the last years and anticipates 447 MW in its "low" scenario and on 679 MW in its "high" scenario by 2030. The secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) published a "background paper" on investments relative to the "development of effective and appropriate international response to climate change" that presented a "reference scenario" and a "mitigation scenario" with respectively 546 GW and 729 GW of nuclear power plants by 2030.

The scenarios "forecast" an installed nuclear capacity by 2030 of anything between 415 GW and 833 GW, respectively an increase of less than 13% to 125% over the current installed 371 GW. In fact, even the lower figure corresponds to a significant challenge considering the current age structure of operating units. None of the scenarios provide appropriate analysis of necessary and very substantial increases in nuclear related education, workforce development, manufacturing capacity and public opinion shifts.

For the immediate future new build remains essentially restricted to Asia. Of the 32 units listed by the IAEA as under construction in twelve countries (as of 31 October 2007) all but four are located in Asia or Eastern Europe. Eleven of these units have been formally under construction for 20 years or more.

In order to evaluate the status of the world nuclear industry, it is helpful to estimate the number of units that would have to be replaced over the coming decades just to maintain the current number of operating plants. We have considered an average lifetime of 40 years per reactor, with the exception of the remaining 17 German nuclear

plants that, according to German legislation, will be shut down after an average operational lifetime of about 32 years. Considering that the average age of reactors closed to date is 22 years, a 40 year lifetime expectancy might seem optimistic, but at the same time it seems possible given the progress that has been achieved on the current generation of plants compared to the previous one.

The calculation includes 21 reactors with an official start-up dates of the 32 units listed as under construction by the IAEA as of 31 October 2007, all of which would be in operation by 2015. In total, 90 units will reach the age of 40 between October 2007 and 2015 or are scheduled to be shut down for other reasons. In other words, in addition to the 21 units under construction with published start-up dates 69 units or more than 42,000 MW would have to come online until 2015 in order to maintain the current level of equipment. Even taking into account the 11 units officially under construction without scheduled start-up date, 58 reactors would still have to be planned, built and started up over the next eight years to maintain the current number of units operating. This seems virtually impossible given the long lead times for nuclear power projects. Furthermore, in the following decade - up to 2025 - a total of 192 new units or more than 168,000 MW would be needed just to maintain the status quo.

According to the same logic, between 2007 and 2030 a total of 338 reactors would have to be replaced in order to maintain the same number of plants operating than today. The IAEA, in its low scenario, has considered the closure of 145 units and the building of 178 new units by 2030. This would require 193 units extending their lifetime beyond 40 years.

Developments in Asia and particularly in China won't fundamentally change the global picture. The news media *China Daily* recently stated: "China has fast-tracked development of nuclear power in recent years with a target to take its nuclear power capacity from about 9,000 MW in 2007 to 40,000 MW by 2020, according to China's long-term development plan for the nuclear power industry." The average

construction time of the 10 operating units was 6.3 years. Even in the case of further significant advances in building times, in order to be operational by 2020, construction of all of the units would need to have started at the latest in 2015. Only about 10% of the additional 31,000 MW are currently under construction with five units totaling 3,200 MW started over the last three years. Building frequency would have to more than triple in order to meet the ambitious goal. A prospect that seems highly unlikely although not entirely impossible. But even such an extraordinary undertaking in terms of capital investment, technical and organizational challenge would replace only 10% of the number of units that reach age forty around the world within the timeframe considered.

A nuclear utility sponsored analysis carried out by the Keystone Center pointed out that to build 700 GW of nuclear power capacity "would require the industry to return immediately to the most rapid period of growth experienced in the past (1981-90) and sustain this rate of growth for 50 years." The industry organisation WNA is optimistic as it states: "It is noteworthy that in the 1980s, 218 power reactors started up, an average of one every 17 days. (...) So it is not hard to imagine a similar number being commissioned in a decade after about 2015. But with China and India getting up to speed with nuclear energy and a world energy demand double the 1980 level in 2015, a realistic estimate of what is possible might be the equivalent of one 1000 MW unit worldwide every 5 days."

The authors of the present report remain convinced that, on the contrary, the number of nuclear power plants operating in the world will most likely decline over the next two decades with a rather sharper decline to be expected after 2020. Many analysts consider that the historic key problems with nuclear power have not been overcome and will continue to constitute a severe disadvantage in global market competition. New difficulties have arisen.

In 2005 the U.S. passed legislation in order to stimulate investment in new nuclear power plants. Measures include

a tax credit on electricity generation, a loan guarantee of up to 80% for the first 6,000 MW, additional support in case of significant construction delays for up to six reactors and the extension of limited liability (Price Anderson Act) until 2025.

The licensing procedure has been simplified to avoid the lengthy processes of the past. The Ralph Nader founded public interest group *Public Citizen* views the new licensing conditions not only as heavy subsidy to the industry but as serious impediment to the democratic decision making process. "The Combined Construction and Operating License, or COL, is part of a new, 'streamlined' process designed to encourage construction of new nuclear power plants by heavily subsidizing nuclear owners and removing opportunities for the public to raise important safety concerns. By combining what was previously two steps -- construction and operation -- there is no chance for the public to raise concerns about problems with the actual construction process after it begins. By the time the shovel hits the dirt, the reactor is already approved to start up." The capital market service company Moody's expects extensive legal cases: "We believe the first COL filing will be litigated, which could create lengthy delays for the rest of the sector." The Financial Times obtained confidential documents that confirm a similar situation in the UK: "Fresh legal challenges are expected to hamper plans to build new nuclear power stations in the UK." NRC Chairman Dale Klein stated that potentially necessary grid extensions could lead to further delays and indicated that he was surprised to learn that "it may take as long to site, permit and build a transmission line for a new plant as to site, license and build the plant itself."

Lack of students, workforce and manufacturing capacity

"The single most important factor in assuring quality in nuclear plant construction is prior nuclear experience (i.e., licensee experience in having constructed previous nuclear power plants, personnel who have learned how to construct them, experienced architects-engineers, experienced constructors, and experienced NRC inspectors)," U.S. Nuclear Regulatory

Commission (NRC), NUREG-1055. Investment and construction ratios of the 1980s cannot simply be repeated thirty years later. The nuclear industry and utilities face challenges in a radically changed industrial environment. Today the sector has to deal with waste management and decommissioning expenses that far outweigh estimates of the past, it has to compete with a largely modernized gas and coal sector and with new competitors in the new and renewable energy sector. In particular, it has to face the problems of rapid loss of competence and lack of manufacturing infrastructure.

Keynote speakers at the American Nuclear Society's 2007 Annual Meeting pointed out that "a nuclear renaissance is far from being a sure thing". Art Stall, Florida Power & Light Company's senior vice president and chief nuclear officer, told the event's opening plenary that the euphoria that has surrounded the nuclear renaissance has been slowed down by the realities of the challenges that are involved in building new nuclear power plants. "Stall said one of the biggest challenges is finding qualified people, including craft labor, technicians, engineers and scientists, to support construction and operation. He pointed out that 40% of the current nuclear power plant workers are eligible for retirement within the next five years. Furthermore, he said only 8 percent of the current nuclear plant workforce is under 32 years old. While technical and engineering college graduate numbers are increasing, Stall said that there is much competition from other industries for these graduates and the nuclear industry must become creative if it is going to entice these graduates to enter and remain in the nuclear field." In France, the situation is no better. About 40% of the national utility EDF's current staff in reactor operation and maintenance will retire by 2015. Starting in 2008, the utility will try to hire 500 engineers annually. Reactor builder AREVA has already started hiring 400 engineers in 2006 and another 750 in 2007. The level of success of the hiring efforts is not known. It is obvious that the biggest share of the hired staff are not trained nuclear engineers or other nuclear scientists. The CEA affiliated national Institute for Nuclear Sciences and

Techniques (INSTN) has only generated about 50 nuclear graduates per year. EDF has called upon the institute to double the number over the coming years.

In the UK the situation is similar and university acceptances in Mechanical, Civil and Electrical Engineering, Physics and Chemistry fell by a quarter between 1994 and 2000. And as of 2002, there was not a single undergraduate course in nuclear engineering in the UK. For Philip Thomas, Chairman of the Nuclear Academia-Industry Liaison Society (NAILS), "the risk is not so much that the nuclear companies will be unable to recruit sufficient numbers, but that future recruits will not match the very high quality the nuclear industry has been used to" and "the absence of a market for a BEng/MEng in nuclear engineering serves to confirm that the nuclear energy carries no buzz of excitement for new students, making it all the harder for it to attract the brightest and best."

In Germany the situation is dramatic. A 2004 analysis of the nuclear education and workforce development in the country showed that the situation continues to erode rapidly. Employment is expected to decline in the nuclear sector - including in the reactor building and maintenance industry - by about 10% to 6,250 jobs in 2010, these include still 1,670 hires. While the number of academic institutions teaching nuclear related matters is expected to further decline from 22 in 2000 to 10 in 2005 and only five in 2010. While 46 students obtained their diploma in 1993, they were zero in 1998. In fact, between the end of 1997 and the end of 2002 only two students successfully finished their nuclear studies. In total about 50 students from other options continue to attend lectures in nuclear matters. It is clear that Germany will face a dramatic shortage of trained staff, whether in industry, utilities, research or public safety and radiation protection authorities. As Lothar Hahn, managing director of the German company GRS (Society for Reactor Safety), points out, the consequences could be extremely serious: "First studies indicate that deficiencies in maintaining knowledge

at state-of-the-art levels and a subsequent degradation in education and training of operating personnel may endanger the safe operation of nuclear installations. Furthermore, knowledge deficits at authorities and expert organisations due to a lack of qualified successors to retired experts have been depicted as an imminent threat to the qualified supervision of reactor plants and thereby to safe plant operation."

In the 1980s there were about 400 nuclear suppliers and 900 nuclear certifications in the U.S.. These shrank to less than 80 suppliers and fewer than 200 certifications. The DOE nuclear power plant construction infrastructure assessment quoted above concludes that major equipment (reactor pressure vessels, steam generators, and moisture separator reheaters) for the near-term deployment of Generation III units would not be manufactured by U.S. facilities. "Reactor pressure vessel (RPV) fabrication could be delayed by the limited availability of the nuclear-grade large ring forgings that are currently only available from one Japanese supplier (Japan Steel Works, Limited - JSW). Additional lead time may need to be included in the reactor pressure vessel procurement schedule depending on ability of this one supplier to supply the required reactor pressure vessel large ring forgings in a timely manner. This potential shortfall is a significant construction schedule risk and could be a project financing risk." JSW has supplied about 130 or 30% of the currently operating nuclear reactor vessels in the world. In fact, only JSW

can forge components from ingots up to 450 t as needed for the EPR and other Generation III reactor pressure vessels and it has announced to further invest in manufacturing capacity. However, JSW's annual manufacturing capacity is unclear.

Rhetoric rather than reality

The overall nuclear industry strategy is quite clear. In the absence of a short or medium term revival of the nuclear industry, hopes remain with an entirely new generation of nuclear power plants, so-called Generation IV reactors. They would be much smaller in size (100 MW to 200 MW) and capital investment, represent a more flexible solution due to much shorter building times and a lower potential risk due to smaller radioactive inventories and passive safety features. In the meantime, nuclear utilities try to extend plant lifetime as much as possible and do their best to keep up the myth of a nuclear future.

Former NRC Commissioner Peter Bradford, who was involved in the licensing of some 25 nuclear reactors, comes to a severe judgement on the prospects of nuclear power: "Those who tell you things like "It could save the earth" or "Clean, green atomic energy can stop global warming" or "Nuclear energy just may be the energy source that can save our planet from catastrophic climate change" are inviting you into a dangerous lala land in which nuclear power will be oversubsidized and underscrutinized while other more promising and more rapid responses to climate change are neglected and the greenhouse gases that they could have averted continue

to pollute the skies at dangerous rates."

Long-time energy sector observer Walt Patterson, Associate Fellow of the Energy, Environment and Development Programme at the UK's Royal Institute of International Affairs (Chatham House) agrees. He has detected a sort of ramping "nuclear amnesia": "Those suffering from nuclear amnesia have forgotten why nuclear power faded from the energy scene in the first place, how many times it has failed to deliver, how often it has disappointed its most determined advocates, how extravagantly it has squandered unparalleled, unstinting support from taxpayers around the world, leaving them with burdens that may last for millennia."

In June 2005, the trade journal Nuclear Engineering International published the analysis of the 2004 Edition of the World Nuclear Industry Status Report under their headline. "On the way out - In sharp contrast to multiple reporting of a potential 'nuclear revival', the atomic age is in the dusk rather than in the dawn". At the end of 2007, we have nothing to add.

The full report "*The World Nuclear Industry Status Report 2007*", by Mycle Schneider (with contributions from Antony Froggatt), is available at: www.greens-efa.org/cms/topics/dokbin/206/206749.the_world_nuclear_industry_status_report@en.pdf

IN BRIEF

Chernobyl's Subclinical Legacy: Prenatal Exposure to Radioactive Fallout and School Outcomes in Sweden, a report by Douglas Almond, Lena Edlund and Mårten Palme. Published by Columbia University, New York in August 2007

Japanese atomic bomb survivors irradiated 8-25 weeks after ovulation subsequently suffered reduced IQ. Whether these findings generalize to low doses (less than 10 mGy) has not been established. This paper exploits the 'natural experiment' generated by the Chernobyl nuclear accident in April 1986, which caused a spike in radiation levels in Sweden. In a comprehensive data set of 562,637 Swedes born 1983-1988, the researchers find the cohort in utero during the Chernobyl accident had worse school outcomes than adjacent birth cohorts, and this deterioration was largest for those exposed approximately 8-25 weeks post conception. Moreover, Almond, Edlund and Palme find larger damage among students born in regions that received more fallout: students from the eight most affected municipalities were 3.6 percentage points less likely to qualify to high school as a result of the fallout. Findings suggest that fetal exposure to ionizing radiation damages cognitive ability at radiation levels previously considered safe.

The report (51 pages) is available at: <http://www.columbia.edu/cu/economics/discpapr/DP0607-19.pdf>

US: vandal drilled hole at nuclear plant (accidentally?). The FBI says that a contract employee drilled a hole in a cooling system at a Miami nuclear plant in an act of vandalism. The FBI knows the identity of the worker, but says there is no evidence of criminal intent. During the investigation at the Turkey Point plant, 50 agents interviewed 700 people. In the end, they decided that there is no evidence that the worker wanted to sabotage the plant or that the hole, one-eighth of an inch across, was an act of terrorism, The Miami Herald reported. The hole was discovered in March 2006 after a reactor was shut down for routine maintenance. Florida Power & Light said that the damage was repaired quickly. The investigation involved local police, state investigators and the Nuclear Regulatory Commission as well as the FBI. FPL offered a \$100,000 reward for information leading to a suspect.

UPI, 13 November 2007

UK: Dounreay costs increase. The estimated cost of decommissioning Dounreay (see also Nuclear Monitor 660, 30 September 2007) has risen by GBP600 million (Euro 836 million) to nearly GBP2.7 billion. This figure is likely to increase over the next few years as more details are known of the work and complexity involved in decommissioning. Some of the increased costs, revealed in the Nuclear Decommissioning Authority's draft three-year plan, are the result of delays in the UK finding a repository for its intermediate level nuclear waste, particularly plutonium. A new plant to store nuclear fuel is to be built at Dounreay and other wastes are also expected to be kept at Dounreay for longer than originally planned. The NDA says intermediate waste will need to be kept at Dounreay for at least 10 years longer than planned. In the future the NDA will also have to take into account the Scottish Government's policy for long-term storage of waste rather than placing it in a deep repository. This might well have implications for how long waste is stored at Dounreay and the facilities need to manage it.

N-Base Briefing 548, 21 November 2007

UK: Sellafield Magnox reprocessing longer operational.

The same Nuclear Decommissioning Authority is proposing to keep the B205 Magnox reprocessing plant at Sellafield operational until 2016 - "or later". This is four years longer than current plans which were seen as central to the UK meeting its legal environmental obligations under the OSPAR Convention. About 80 per cent of Sellafield's discharges come from the reprocessing work in B205. The proposed extension of the plant's life will mean more radioactive pollution going into the Irish Sea, North Sea and North-East Atlantic. There is little explanation in the draft three-year NDA work plan on why the extension is necessary. It refers only to "logistical difficulties" related to delays in defuelling Magnox reactors that are being decommissioned. These delays arise because funding problems have forced the NDA to concentrate spending on Dounreay and Sellafield, where the main radioactive hazards exist. Part of the funding problems arise because of the continuing two-year shutdown of the Thorp reprocessing plant at Sellafield following a major leak.

In 1998 members of the OSPAR Convention, including the UK, agreed a progressive reduction of radioactive pollution of the marine environment so it was 'close to zero' by 2020. The closure of the Magnox reprocessing plant was seen by the Government as "a key element in further discharge reduction".

Full details of the NDA's draft plan, that is out to consultation is available at www.nda.gov.uk

N-Base Briefing 547, 14 November 2007

Nuclear phase out in Belgium under pressure. In 2003 Belgium adopted a nuclear phase out law. It decreed to stop the 7 nuclear reactors after 40 years, and to not build new reactors. The first reactors are to close in 2015, the last in 2025. Both aspects of the law are now about to be undermined by the upcoming new federal government. The government negotiations are extremely difficult on the institutional aspects, but on energy and environment it all went much easier. Actually one of the first issues that the Christian-democrats and liberals settled was the nuclear one. In the run-up to the elections these parties made their position on nuclear very clear. The Christian-democrats are vehemently opposed to the phase-out law, and specifically want a lifetime extension of 10 to 20 years. The owner of the plants should pay some kind of retribution from the excessive profits on the nuclear electricity. The liberals on the other hand are proponents of the fourth generation reactors, and would like one to be built in Belgium. The resulting agreement is that the new government will decide to "leave some reactors open for a limited longer time", because of greenhouse gas emissions, power price considerations and energy security. Research into 4th generation concepts will be supported. There will be a "windfall profit tax" on the sale of power from nuclear (and coal) power plants that are paid off. The revenue of the tax will be invested in something, but it is not clear in what. It might be renewables and efficiency, but also CCS (Carbon Capture and Storage) or might even just be injected in the overall budget. The decision on the lifetime extension is equally vague. It is not stated which reactors exactly will be kept open, for how long... Creating insecurity like this, is clearly devastating for investors wanting to invest in alternatives. It also blows away the credibility of the claims of respect for sustainable development of the negotiating parties. But to be clear: as long as there is no government, there is no decision.

Email Bram Claeys (Belgium), 25 November 2007

IAEA: Iran is cooperating, but not 'pro-active' enough. International efforts to understand Iran's past nuclear activities are "proceeding according to schedule," IAEA director-general Mohamed ElBaradei said. He did not, however, paint an entirely rosy picture. "The agency has so far not been able to verify some important aspects of Iran's nuclear program: those relevant to the scope and nature of Iran's centrifuge enrichment activities," ElBaradei said. "I would urge Iran to be more proactive in providing information, and in accelerating the pace of this cooperation, in order for the agency to be able to clarify al major

remaining outstanding issues by the end of the year."

Iranian Ambassador Ali Asghar Soltanieh, claimed that the director general's call for "more proactive" cooperation meant that Iran had already acted proactively and the agency simply wanted additional proactive assistance. Soltanieh also argued that the agency had formally "concluded and resolved" its examination of Iran's centrifuge acquisition history, an assertion countered by Western officials who noted that ElBaradei's report contained no such language. Other officials with knowledge of agency affairs, however, concurred that the agency has learned essentially all it could about Iran's past centrifuge efforts but would find it difficult to "close" the case in an official way. The November 15, IAEA report on Iran can be found at <http://www.iaea.org/Publications/Documents/Board/2007/gov2007-58.pdf>

Global Security Newswire, 26 November 2007

Hunger strike calls for moratorium on U-mining Ontario. On June 28, 2007, the Ardoch Algonquin and Shabot Obaadijwan First Nations of Eastern Ontario, Canada, along with many supporters, began a blockade of the Frontenec Ventures Corporation's staging area for uranium mining exploration in 30,000 acres around Lake Sharbot. The First Nations claim aboriginal and jurisdictional rights to the land. As reported in the July 13 issue of the *Nuclear Monitor*, the protesters are calling for a moratorium on uranium mining in Ontario. On October 19 2007, the blockade was lifted when the Ontario government agreed to twelve weeks of mediated negotiation with the First Nations and signed an agreement pledging to consult the nations on the future of the mining operation.

A supporter from the local settler community, Donna Dillman, 53, aka Gramma Donna, resolved to stage her own protest and started a hunger strike on October 8 in a tent trailer on the blockade site. Now closing in on 50 days, Donna has taken her protest to Queen's Park next to the Ontario government's seat in Toronto. This has renewed the pressure on the government with almost a tag team effect. Ontario Premier Dalton McGuinty stated that Dillman should not endanger her health. This outraged Dillman who said "this is about our grandchildren and the future health of the province, why should my health be considered and not theirs?"

NIRS, 20 November 2007

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WISE/NIRS NUCLEAR MONITOR

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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). 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.

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