

# Nucleonics Week

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## Germany's lower house approves nuclear phase-out bill

Germany's lower house of parliament voted June 30 to permanently shut the country's 17 power reactors, moving the country closer to a nuclear phase-out.

After debating the measure for hours, the Bundestag members voted 513-79 with eight abstentions. The Bundesrat, the upper house, is scheduled to vote on the bill July 8 and it is expected to pass there decisively as well.

Chancellor Angela Merkel's government, which agreed last fall to extend reactor lifetimes that were set under a

previous government's phase-out legislation, reversed its position after the March 11 Fukushima I accident and began pushing for the earlier phase-out.

German nuclear utilities have threatened to sue the government for financial compensation for shutting the reactors before the end of their technical lifetimes, which the utilities say is illegal.

Under the government's plan, eight units — Biblis A and B, Brunsbuettel, Isar-I, Krummel, Neckarwestheim-1, Philippsburg-1 and Unterweser — will

not restart. The other nine units are scheduled to be shut by the end of 2022.

The anti-nuclear Greens and Social Democrats in the Bundestag supported the government's bill, although they had wanted an earlier deadline for completing the phase-out. Left lawmakers, however, voted against the bill because the government would not move up the deadline.

During the debate, Social Democratic Party leader Sigmar Gabriel

*(continued on page 10)*

## SNC-Lavalin purchase of AECL likely to advance design work: analyst

SNC-Lavalin's purchase of the reactor division of Atomic Energy of Canada, Ltd., or AECL, is likely to enable the new owner to move ahead with the completion and government certification of the design of new power reactors for construction in Canada and sale overseas, an analyst said last week.

But making AECL a world-class competitor will require the Canadian government's assistance, Steve Aplin, vice president of energy and environment

with The HDP Group in Ottawa, said in a July 1 interview.

"There are many, significant opportunities for AECL to sell reactors in Eastern Europe and Asia, even Latin America, but in the end, this will depend on how badly the government wants to sell these [reactors] abroad," he said.

The Canadian government announced June 29 it had agreed to sell AECL's reactor division to SNC-Lavalin, a Montreal-based engineering

and construction firm, for C\$15 million, three years after Prime Minister Stephen Harper sought to sell off the state-owned company founded in the 1950s. Although the government said the purchase agreement will not be made final until the fall — citing the need for required Competition Act approvals — it committed to provide up to \$75 million to complete development of the 700-MW Enhanced Candu,

*(continued on page 10)*

## France, US differ on universal liability regime

The heads of the French and US delegations to the IAEA Ministerial Conference on Nuclear Safety last month both said the Fukushima accident in Japan demonstrates the need for a universal nuclear liability regime, but they differed on what could be the basis for that regime.

French Environment Minister Nathalie Kosciusko-Morizet, addressing the conference delegates, called for a regime based on the Paris and Vienna conventions.

She said at a press conference after her

speech June 20 that France would "revise on a national level" the amount of compensation available to accident victims while working internationally to promote a "truly universal nuclear liability regime" based on the two conventions.

Daniel Poneman, US deputy energy secretary, agreed that an international regime is needed. But Poneman said it should be based on the Convention on Supplementary Compensation, or CSC.

Nuclear liability specialists say the CSC is the only liability convention the

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US can join because the country's Price-Anderson Act stipulates economic channeling of liability to facility operators, while all other regimes, including Paris and Vienna, use legal channeling.

Legal channeling means that only the operator can be held liable for damage incurred in a nuclear accident, while in economic channeling any entity can be held legally liable but the economic consequences of that liability — compensation paid to victims who successfully sue — are channeled to the responsible nuclear operator. Thus, any party held legally liable for damages will be indemnified by the operator.

The level of compensation available to victims of US nuclear accidents is much higher than that available in countries following the Vienna or Paris conventions even after those conventions raised their compensation levels in 1997 and 2004, respectively. The 2004 revision to the Paris Convention is not in force. The original Paris and Vienna conventions were adopted in 1960 and 1963, respectively.

The CSC was adopted in 1997. An annex to the convention allows countries with legislation based on the Paris or Vienna conventions, as well as countries whose national legislation is consistent with the treaty, to join the CSC.

Only four countries — Argentina, Morocco, Romania and the US — have ratified the CSC. In order for the CSC to enter into force, it must be ratified by countries whose power reactor fleets total 400,000 thermal megawatts or about 130,000 MW electric. The four countries that have ratified the CSC have a total of 109,882 MWe, the bulk of it

in the US.

Kosciusko-Morizet said the CSC “is not a general global regime” and is not “strict” enough because it allows different national regimes to coexist. She said countries that want to use US-based vendors for domestic projects should join the CSC.

To protect against liability suits associated with work in foreign countries, many US-based companies seek the greater protection that they consider would be provided by treaty relations with customer countries through the CSC.

Poneman said the CSC “helps prevent accidents by permitting operators, suppliers and investors to work together on nuclear projects as part of a harmonious and stable international legal framework, as well as to protect companies that offer their assistance to others in the industry during a nuclear accident.”

A member of the IAEA's Inlex legal advisory group said in an interview June 21 that the annex to the CSC was originally designed to allow adherence by countries that are members of the Paris or Vienna conventions, or countries whose national legislation follows a certain set of principles. Because the Paris and Vienna countries then required the annex to specify legal channeling, a grandfather clause was added to the CSC to allow the US to join without changing its domestic law, the source said.

The source said the liability issue has become prominent in the wake of Fukushima because some US companies are reluctant to take work at Tokyo Electric Power Co.'s Fukushima I station for fear of potential nuclear

**Chief Editor**

Tom Harrison (tom\_harrison@platts.com)

**Managing Editors**

Steven Dolley (steven\_dolley@platts.com)

Elaine Hiruo (elaine\_hiruo@platts.com)

**Senior Editors**

William Freebairn (william\_freebairn@platts.com)

Jim Ostroff (james\_ostroff@platts.com)

**Associate Editor**

Yanmei Xie (yanmei\_xie@platts.com)

**Assistant Editor**

Barbara Lewis (barbara\_lewis@platts.com)

**Contact the editors;**

+1-202-383-2170, nuclear@platts.com

**European Bureau Chief**

Ann MacLachlan, +33-1-4075-2521, (ann\_macLachlan@platts.com)

**European & Asian Editor**

Claire-Louise Isted +44 207 176 6296 (claire-louise\_isted@platts.com)

**Editorial Director, Global Power**

Larry Foster

**Vice President, Editorial**

Dan Tanz

**Platts President**

Larry Neal

**Manager, Advertisement Sales**

Kacey Comstock

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liability claims.

Japan is not a member of any of the international liability conventions, although it has been considering joining the CSC for several years.

### More compensation

Kosciusko-Morizet also said France wants to raise the amount of compensation available to victims of nuclear accidents. France is prepared to revise the compensation amounts available to victims in France "in line with our international commitments," she said.

France will first try to work within the EU to increase the amount of compensation under the Paris Convention from Eur91 million to Eur700 million, an aide to Kosciusko-Morizet said.

The 2004 revisions to the Paris and Brussels Conventions, which have not entered into force, raise the compensation available from the facility operator to a minimum of Eur700 million and the total compensation from the so-called installation state — the country where an accident happened — plus all contracting parties to Eur1.5 billion. But EU law says all EU countries have to join at the same time.

A handful of EU countries have refused to approve ratification of the revised texts, as is required in the EU's unanimous voting system.

The aide said France will try to get the EU Council to agree to a change in the number of countries required for adoption of the ratification measure, from all 27 to a two-thirds majority.

If the multilateral process of getting approval from all EU countries takes too long, France will raise the compensation level in national legislation, he said, adding that would require approval by the French parliament.

—Ann MacLachlan, Vienna

## Shaw wins cleanup contract for Fukushima, sees additional work

The Shaw Group is working on a \$50 million contract to clean water from Tokyo Electric Power Co.'s Fukushima I station and is likely to win a series of similar contract awards for remediation and recovery at the site, Shaw Chairman and CEO Jim Bernhard said in a conference call with analysts June 29.

In large projects, it is common for contracts to be awarded as "task orders" for specific and limited work, a strategy that has been adopted by Tepco, he said.

Contracts could be issued for other tasks, such as extraction of the fuel rods from the core, he said. "We're going to be a major participant for a long time to come," he said.

The value of recovery and remediation work at Fukushima I might total more than \$10 billion, Shaw Chief Financial Officer Brian Ferraioli said during a presentation to investors in New York June 2.

During the June 29 call, Bernhard said Westinghouse expects to get an update for the timeline of NRC review of its amended AP1000 reactor design certification rulemaking "in the next few weeks." Westinghouse presented its latest version of design documents for the AP1000 to NRC in June, saying they should resolve the agency's pending questions. NRC officials said last week that the changes mean an earlier target of completing rulemaking by September will not be met, but they could not say what the new target might be (Inside NRC, 4 July, 3).

Shaw is a 20% owner of Westinghouse and the company's partner in two nuclear construction projects in the US.

Shaw's forecast for future revenue and earnings now considers that the combined construction permit-operating licenses for Southern Nuclear Operating Co.'s Vogtle expansion will be issued in early 2012 instead of late 2011, Bernhard said. There is a "strong possibility" that Southern Nuclear could still receive the COL from NRC earlier, as soon as October, he said.

Southern Nuclear is seeking to build and operate two AP1000 units at the Georgia site of two existing units.

Previously, Shaw had said it expects fiscal 2012 new nuclear revenue would be about 20% of overall revenue, based on COLs being issued in late 2011. Assuming COLs for Vogtle in early 2012, that estimate is in the "high teens," Ferraioli said. Shaw's fiscal year begins September 1.

Shaw forecasts fiscal 2012 revenue of between \$6.2 billion and \$6.5 billion, the company said in its earnings presentation.

Shaw reported a loss of \$70 million, compared to a \$68 million profit a year earlier, for the three months ended May 31. It was "an extremely challenging and disappointing quarter," Bernhard told analysts.

The loss reflected a \$112.8 million cost increase for a Singapore petrochemical plant project and the \$48 million write-off of loans to Nuclear Innovation North America's two-unit South Texas Project expansion, which has been suspended, the company said in a statement June 27.

Shaw loaned the money to NINA, a joint venture of NRG Energy and Toshiba, but NRG said earlier this year it was reducing spending on the project because of uncertainties following the accident at Fukushima I.

Analyst Robert Connors of investment company Stifel Nicolaus downgraded Shaw shares to "hold" from "buy" on June 29, saying new nuclear construction revenues may be more distant than had been believed by investors. The ability of nuclear-related revenue in fiscal 2012 to translate to increased earnings "does not appear to be as robust as previously estimated," he wrote in a report to clients.

The company invested heavily in nuclear projects and is relying on them to provide future profits, Connors said.

Shaw shares fell 7.7% to \$29.83 on June 29, the first day of trading after results were released late June 28. The shares continued to fall July 5, when they closed at \$28.81 in trading on the New York Stock Exchange.

Shaw also said it won three-year contracts from NextEra Energy subsidiaries to provide maintenance and uprates at

five nuclear units in Florida and Massachusetts

Shaw did not disclose the value of the contracts, which will cover Florida Power & Light's four Florida units and NextEra Energy Resources' Seabrook unit. Shaw expects more maintenance and modification contracts of the same type in the future, Bernhard said.

The uprate market in the US is expected to be between \$5 billion and \$8 billion in the next 10 years, Bernhard said.

With the new contract, Shaw now provides maintenance services for 41 of the 104 operating US reactors, the company said in slides accompanying the earnings call.

—William Freebairn, Washington

## French lawmakers: Nuclear industry must remain under state control

France's nuclear industry must remain under state control, the only way to guarantee safety to "a worried public," two French lawmakers concluded in a report prepared for the parliament's technology assessment office, Opecst, and released June 30.

Socialist Member of Parliament Christian Bataille told journalists that he and co-author Bruno Sido, a senator from the ruling UMP party, also consider that European energy market competition rules "must not be applied indiscriminately to nuclear energy production," especially given France's heavy dependence on nuclear power compared to its neighbors.

In the 125-page report, the legislators said European public procurement rules should be changed to explicitly favor "best bid" over "low bid" when it comes to risky industries like nuclear power production.

The Opecst report was commissioned by the leaders of the two chambers of parliament in mid- and late March in the wake of the Fukushima I accident in Japan. The two authors and Opecst Chairman Claude Birraux held a series of hearings over the spring and also visited several nuclear installation sites in France.

The report presented last week was an interim text, covering the first part of the parliament's request, an assessment of the safety of France's reactor fleet in light of the Fukushima accident.

Sido said the government and nuclear safety authority ASN must use their influence in EU institutions to ensure that post-Fukushima reactor stress tests under way at all 143 power reactors in the EU are done on a "common objective basis," that is, that all countries and all operators apply the criteria in the same way. He said EU institutions must establish a ranking of units "from the least fragile to the most fragile" on the basis of the test results and require shutdown of those that are shown to be "insufficiently safe, even if [that] deprives a member state of a large part of its electricity supply."

"We can't allow plants to be closed in France and leave less safe ones in operation right across the border," Sido told a June 30 press conference. He did not refer to specific foreign plants.

## World safety standards

Bataille and Birraux said progress must be made toward "world standards" of nuclear safety to avert risks in the least-safe existing plants and "raise safety requirement levels for plants under construction or planned."

The lawmakers propose that the first step toward definition of world standards take the form of an agreement on common standards between EU countries and those of North America. Birraux said those standards could be based on work by the Western European Nuclear Regulators Association.

Bataille said it was especially important to guard against the export of "low-cost" reactors with obsolete safety standards to countries that "don't have the know-how" to operate them.

He said he hoped that the Fukushima accident had "definitively sealed the decline of the low-cost Franco-Chinese reactors" that he said EDF had once hoped to export in cooperation with Chinese industry to countries such as South Africa.

## Cascading contractors

The authors also asked the government to study how the practice of "cascading" subcontracting of work on EDF's nuclear power plant sites could be limited. They said that while recourse to contractors for maintenance and repair is justified, they had identified cases involving a "cascade" of up to eight levels of subcontractors. They said that situation diluted responsibilities and made it hard for EDF to exercise its legal responsibility as site operator.

They also asked the Institute of Radiological Protection and Nuclear Safety to study the "traceability" of doses incurred by contract employees who work at multiple reactor sites.

The CGT labor union has said that contract workers are not sufficiently protected, and the fate of so-called nuclear nomads — contract workers who move from site to site to do work on units as they have scheduled outages — has gained a high profile in the French media.

Birraux said that each nuclear plant site should have an occupational health doctor who can monitor the doses of all personnel who work on the site, whether EDF employees or contractors. Under French medical secrecy laws, site doctors are normally not allowed access to medical data for contract workers.

Saying that "safety has no price, but it has a cost," Bataille said the lawmakers were asking nuclear safety authority ASN to report annually on the cost of additional safety measures for French nuclear facility operators.

The lawmakers said that they "have the feeling that nuclear security and safety are managed in France in the most rigorous way," but that they had identified some areas for improvement.

Bataille said the final report, which will cover the future of France's nuclear industry, will be presented at the end of the year.

—Ann MacLachlan, Paris

## Regulators issue new requirements for longer operation of Tricastin-1

French nuclear safety authority ASN made public June 30 a May 27 decision imposing 32 new technical requirements on EDF for 40-year operation of Tricastin-1.

The unit on the Rhone River was the first of EDF's 34 900-MW-class PWRs to be licensed for operation past 30 years, the original plant design life. The oldest EDF unit, Fessenheim-1, received conditional approval for 40-year operation from ASN on July 4.

ASN approved a further 10 years of operation of Tricastin-1 November 4 on the basis of EDF's safety case, but said at the time it would issue new operating rules reflecting the results of the periodic safety review EDF undertook for Tricastin-1's 30th-year outage (NW, 9 Dec. '10, 9).

The unit-specific rules reflect the transformation of ASN's regulations into more formal documents, on the basis of the 2006 Nuclear Transparency and Safety Act.

Among the 32 measures announced last week are several aimed at strengthening Tricastin's protection against risks highlighted by the March 11 accident at Japan's Fukushima I nuclear power station. They were, however, already included in the measures ASN said were planned last fall.

Some of the supplementary conditions apply to the entire Tricastin site, which comprises four 900-MW-class PWRs. Among them is a requirement that EDF upgrade flood protection to a level 15% higher than the Rhone's 1,000-year flood, according to the text of the ASN commission's decision, posted on ASN's website June 30 ([www.asn.fr](http://www.asn.fr)).

Another concerns the number and distribution of hydrogen recombiners in the reactor building. ASN said there must be enough recombiners, distributed so as to preclude loss of containment integrity.

Five specifications refer to upgrading of the unit's seismic basis and three concern the capacity, safety and ability to function under accident conditions of the spent fuel pool cooling system.

Two others require EDF to undertake an inspection, between 2013 and 2015, of the part of the reactor pressure vessel that contains "known and monitored" underclad defects, ASN said in a statement accompanying release of the decision June 30.

EDF is also required to install a system to maintain water in the emergency core cooling system tank at or above 20 degrees C (68 degrees F), so as to avert the risk of pressurized thermal shock to the reactor vessel in case of an accident.

In what appeared to be a reference to the consequences of a direct aircraft crash, ASN further required EDF to ensure that the structure of nuclear island buildings containing safety-related systems or components would not be threatened by "a stiff-front triangular shock wave reaching an overpressure of 50 millibar, lasting 300 milliseconds and with a velocity of 350 meters per second."

Implementation of several of the measures is under way as a result of discussions between EDF and safety authorities

since the unit's 30th-year outage in May-August 2009 and completion of the periodic safety review, which included measuring Tricastin-1 against requirements applied to new reactors.

ASN said the new requirements do not preclude further measures that might derive from the conclusions of "complementary safety assessments," or ECS, under way in light of the initial lessons from Fukushima. ASN issued criteria for those assessments — which parallel the EU's reactor stress tests — on May 5.

Results of the post-Fukushima French ECS are due in September.

—Ann MacLachlan, Paris

## Fessenheim-1 safe for 40 years, with conditions, ASN says

French nuclear safety authority ASN ruled this week that EDF's oldest power reactor, the 34-year-old Fessenheim-1, can safely be operated for another decade, provided EDF fulfills several conditions.

But ministers responsible for nuclear licensing said the opinion did not represent a definitive license. They said the government would make the final decision following completion of post-Fukushima complementary safety assessments under way on all 58 EDF PWR units.

In a decision adopted July 4, ASN's five-member commission said the go-ahead was conditioned on EDF fulfilling additional requirements, including two "major" ones: strengthening the reactor basemat by June 2013 to prevent molten corium from reaching groundwater; and installing by the end of 2012 alternative means of core cooling to cope with long-term loss of ultimate heat sink.

ASN also said the requirements were based on Fessenheim-1's 30th-year periodic safety review and did not yet incorporate any conclusions from the "complementary safety assessments," or ECS, under way at all EDF reactor sites on the basis of initial lessons from the March 11 accident at Japan's Fukushima I nuclear power plant.

Environment minister Nathalie Kosciusko-Morizet, who shares nuclear licensing oversight with industry and energy minister Eric Besson, told AFP after the ASN announcement July 4 that the ASN report is a necessary, but not sufficient, condition for 40-year operation of Fessenheim-1. It "would be wrong to conclude that ... the government has decided to extend [Fessenheim-1] for 10 years. That's not the case," she said. The government will decide late this year on extended operation, after the results of all the ECS are known, she said.

In a joint statement with Kosciusko-Morizet and economy minister Francois Baroin, Besson said the ASN decisions "bear witness to the continuous safety improvement and the fact the France has long been committed to prevention of severe accidents." The ASN decision makes it possible to ask EDF to implement measures already identified without wait-

ing for further conclusions, he said.

In the French system, the government has the final say in major nuclear licensing decisions. There is no fixed initial license period for French nuclear power units as is the case in the US.

Rather than license extension, ASN refers to long-term operation. EDF must justify operation for forward periods of 10 years and ASN has said the 40-year licenses would be based on stricter criteria than were applied for operation for the initial design lifetime of 30 years.

### 'Stronger aggressions'

ASN's conditional approval for further operation of Fessenheim-1 "could be called into question" by the results of the ECS, which require assessments of a plant's resistance against "much stronger aggressions" than those included in the assessments conducted for 30th-year outages, ASN Chairman Andre-Claude Lacoste told AFP July 4.

Lacoste had told a press conference earlier that day that as a result of the post-Fukushima assessments, operation of Fessenheim-1 "might well" no longer be possible, or else under "much more stringent conditions."

Fessenheim-1 went into operation in 1977, the first of EDF's 34 900-MW-class PWRs. Fessenheim-1 and -2 and Bugey-2 through -5 comprise EDF's six "pre-series" or CP0 PWRs, whose reference plant was Dominion's Surry-1. The other 28 900-MW units were based on more recent designs, including Dominion's North Anna units.

The 30th-year outage for Fessenheim-1 was delayed to allow Tricastin-1 to serve as the first-of-a-kind unit for extended operation licensing for the 28-unit CP1 and CP2 PWR series. ASN approved 40-year operation of Tricastin-1 in November and issued a set of additional technical requirements last week.

The Fessenheim-1 30th-year outage took place between October 17, 2009 and March 24, 2010. ASN issued permission for the unit to resume operation on February 26, 2010, with a final decision on longer-term operation pending completion by EDF of a comprehensive safety review. ASN's decision this week was based on that review.

The two-unit Fessenheim has drawn controversy in part because of its location just across the Rhine River from the German state of Baden-Wuerttemberg — now headed by a Green politician — and close to large population centers in France, Germany and Switzerland. The last two countries recently decided to phase out their nuclear units. Anti-nuclear groups in all three countries have called for Fessenheim's near-term shutdown. A month after Fukushima, the government of the Haut-Rhin department (county) in which the site is located asked that Fessenheim-2, down for its 30th-year outage, be kept offline and that Fessenheim-1 not be granted the 10-year operation extension pending the results of the post-Fukushima safety assessments.

In a statement July 4, the French Green party Euro-deputies Eva Joly and Yannick Jadot said French authorities are "stubbornly" bucking the trend of nuclear phase-out in

neighboring countries and ignoring the EU-ordered reactor stress tests by approving further operation of Fessenheim-1.

The Sortir du Nucleaire anti-nuclear federation said the approval for Fessenheim-1 ignored the wishes of citizens of three countries. "The oldest French nuclear plant threatens not only France but also our Swiss and German neighbors, who have chosen to do without nuclear power," the group said in a statement.

In its report for ASN on Fessenheim-1's extended operation, the Institute of Radiological Protection and Nuclear Safety, IRSN, said there was no problem specific to Fessenheim-1 that would prevent application of the new licensing basis for 40-year operation that EDF earlier submitted for the 900-MW series on the basis of generic studies, and ASN accepted. But IRSN said EDF would have to implement some generic measures at the unit and correct some nonconformances with the new specifications.

IRSN listed 47 issues in the report ([www.irsn.fr](http://www.irsn.fr)).

ASN, in a 37-page report to the two French ministers, also dated July 4, incorporated measures proposed by IRSN and its own standing advisory committee on reactors, the GPR.

ASN said that "a great majority" of the safety upgrade backfits identified during the unit's 30th-year periodic safety review studies had already been implemented during the 30th-year outage. ASN has set deadlines for implementation of the remaining measures.

Among the outstanding measures are the removal, by the end of this year, of remaining connecting seals between the nuclear island and the turbine building, which ASN said will preclude "harmful interactions" between them in the event of an earthquake. All but 7% of the seals were removed during the 30th-year outage, according to ASN.

ASN said in the report that EDF's evaluation of Fessenheim-1's seismic resistance was satisfactory but that new conclusions could come out of the post-Fukushima ECS.

ASN also noted that it had asked EDF to install an alternative long-term cooling source by the end of 2012, on the basis of proposals to be submitted by the end of this year. That measure does not stem from Fukushima alone, but was already dictated by prior experience at both Cruas and Fessenheim itself, ASN said.

### Thin basemat

ASN said the requirement for backup residual heat removal was also motivated by the unit's thin basemat, which it said "necessitates increased protection against a core melt leading to vessel melt-through."

The basemats of most of EDF reactors are about 3 meters thick (about 9 feet), which studies indicate would delay melt-through to the environment for between 24 hours and several days. But the basemats of Fessenheim-1 and -2 are only 1.5 meters thick, which doesn't provide sufficient protection against corium melting through to the environment, IRSN's corium expert Jean-Michel Bonnet said last fall (NW, 11 Nov. '10, 8).

Bonnet said at the time that ASN was already requir-

ing EDF to pour another layer of concrete to thicken the Fessenheim basemats, adding that a layer of porous concrete would encourage lateral corium spread and reduce the heat flux.

ASN said in the report that it is requiring EDF to submit a report by the end of this year presenting its safety case for the additional basemat protection, analyzing different solutions and justifying proposed backfits. ASN said EDF must also increase its ability to detect a potential vessel melt-through and “estimate the hydrogen risk in the event of a severe accident” at Fessenheim-1.

EDF estimates the cost of the exceptional measures required for Fessenheim-1’s next decade of operation at around Eur100 million, according to Les Echos newspaper on July 5. That includes the addition of 60 to 70 centimeters (23.6 to 27.5 inches) of concrete to the existing basemat, the newspaper said, quoting an anonymous EDF source.

EDF spokeswoman Emilie Prade said July 5 that the estimate was not precise and that the final cost would depend in part on how much money civil works companies will require.

The methodology for this first-of-a-kind operation, which requires work in one of the most radioactive parts of the plant, must also be defined and approved by ASN.

Whether EDF thinks it worth the expenditure depends on the utility’s “vision of Fessenheim’s future,” Lacoste told journalists July 4.

Before Fukushima, EDF projected spending between Eur400 million and Eur600 million per unit to make backfits and upgrades required to get permission to operate its 900-MW PWRs for up to 60 years.

—Ann MacLachlan, Paris

## Smaller reactors a fit for niche market: OECD report

Small and medium-sized reactors, or SMRs, can penetrate niche markets where large ones face restrictions, according to a study by the OECD’s Nuclear Energy Agency.

The main factor that negatively affects SMRs’ competitiveness is the lack of economy of scale, which makes them more expensive to build and operate than large reactors, said the report, dated June.

The study considered reactors with capacities less than 700 MW, but mainly focused on those of less than 300 MW.

It concluded that “SMRs have a significant potential to expand the peaceful applications of nuclear power” by serving “remote or isolated areas” that cannot accommodate large power plants and by providing heat and desalinated water in addition to electricity to facilities that need those products.

SMRs could also replace fossil fuel plants at places with siting restrictions, “such as limited free capacity of the grid, limited spinning reserve, and/or limited supply of water for cooling towers of a power plant,” the report said.

It also said SMRs could still attract investors in traditional markets because they require small up-front capital investment compared to large reactors and provide flexibility because utilities could increase capacity incrementally.

The study analyzed 14 SMR designs from seven countries. It said Russia is poised to have a barge-mounted plant with two 35-MW PWRs in operation in 2013, leading the field in deploying SMRs. China could be a close second because it is set to begin construction of a plant comprised of two 105-MW high-temperature gas-cooled reactors, it said.

The report is at [www.oecd-nea.org/ndd/reports/2011/current-status-small-reactors.pdf](http://www.oecd-nea.org/ndd/reports/2011/current-status-small-reactors.pdf).

—Yanmei Xie, Washington

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FIELD REPORT #5	
Topic	Nuclear Energy
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### The context has changed, not the fundamentals

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## More complex risk models needed for nuclear projects: consultant

After the Fukushima accident, risk assessments of nuclear power plant projects need increasingly complex models that include quantitative analysis techniques, the head of the PA Consulting Group’s nuclear generation practice said June 23 at the Platts European Nuclear Power conference in Prague.

Arun Mani said this change followed “some of the worst disasters in large-scale energy production” in the past 18

months — at Deepwater Horizon in the Gulf of Mexico, the Massey mine in West Virginia and the Fukushima nuclear power plant in Japan.

PA Consulting Group is a London-based management, system and technology consulting firm. Mani is based in the US.

“In the past, a lot of these ‘black swan’ events were modeled independently, but going forward these are going to be looked at as what we call a stacked event impact, which means what happens when you have both or all events [in a single disaster] happen at once,” Mani said. A so-called black swan event means one that is considered extremely unlikely.

In the 1970s and 1980s, the US nuclear power market saw a “lot of overruns and costs,” Mani said, but “what’s different today” is that analysis of risk is a “lot more deliberate process” and “a lot more qualitative.”

It is also better documented, because in the 1980s there was a “lot of litigation around partially built plants,” he said.

Another difference is there is a “lot more open discussion, domestically and internationally,” he said.

“We are looking at a lot more sophisticated analytics — such as Monte Carlo techniques, with not so much a focus on the 90% part of the curve that people know, but to really focus on the tail — what the really bad event might look like and to be able to quantify it,” he said.

Monte Carlo techniques, or methods, are a class of computational algorithms that rely on repeated random sampling to compute their results. Monte Carlo methods are often used in simulating physical and mathematical systems.

When incidents like Fukushima or Deepwater Horizon occur and “they appear 24/7 on TV, showing a smoking nuclear power plant or a burning oil rig,” the event is very clear and vivid, Mani said, “but vivid is not the same as being true and this fact complicates one’s decision-making for the long term.”

According to PA Consulting, there are four factors in making a decision to build new generating plant — fuel choice, regional power market prices, the cost and schedule, and environmental concerns and regulations in the near term and the long term.

A decision to build a nuclear power plant is “very complex, just by the nature of the animal,” he said, because it is an “extremely large and visible undertaking” that extends over a period of seven to 17 years, from the time the “concept is hatched” to commissioning.

“If it’s so complicated, what’s been the business case in the past — from the US perspective, where companies have decided to go forward with new build? From our analysis, we’ve identified eight micro drivers in all cases,” Mani said.

Four of these eight “contribute positively” to a project. First, forward price stability, because “once the plant is built, the price is pretty predictable in terms of what you are going to be paying going forward,” he said.

Second, current fleet performance. “In the last 20 years, the performance of the 104 reactors in the US has gone up tremendously and capacity factors have been within the

92%-95% range,” he said.

Third, “clean air value,” meaning nuclear power is considered a clean source of energy.

Fourth, the economic development and job creation from developing and operating a nuclear power plant in a specific region.

Also, Mani said there are two factors that “can go either way:” reliable energy sourcing and the licensing process.

Reliable energy sourcing means a country would be less dependent on oil and gas if it opted for nuclear power. “In the last 18 months, however, the business case for this has actually gone South considerably in the US and that’s primarily because of shale gas,” he said.

About three years ago, gas prices were around US\$12-13/Btu and the case for nuclear power was “relatively simple,” he said. Now, “with enough shale gas for probably the next 10 years,” the forward-looking gas price has “cut back by at least half of that,” he said.

As a result, the case for nuclear power is getting difficult to make as an economic alternative, he said.

In the licensing area, the NRC’s newer application process for a combined construction permit-operating license “looks to be a very promising development,” he said. Under NRC’s older rules, an applicant seeks separate construction and operating licenses.

The two factors that “contribute negatively” to assessing a new nuclear project are construction cost uncertainty and the need for supply, he said.

“In the last few years, the cost-per-unit basis has gone up significantly and it’s been difficult to sell a nuclear project to [a utility’s] management,” he said.

In terms of the need for supply, Mani said that the recession and the need for energy conservation had also made the business case for nuclear more difficult.

—Claire-Louise Isted, Prague

## Lithuania seeks Eur1.5 billion more for decommissioning of Ignalina

Lithuania will ask the European Commission for Eur1.5 billion (US\$2.2 billion) for decommissioning the Ignalina nuclear plant from 2014-2029, in addition to the Eur1.4 billion the EC approved from EU states for work from 2007-2013.

Sources involved in negotiations on the decommissioning financing between Lithuania and the EC on behalf of EU members have said that such an amount is not feasible. “Realistically, [the Lithuanians] can expect far less than they are asking for,” one source said.

“If we don’t get the money, we will keep asking,” Osvaldas Ciuksys, director of corporate affairs for Ignalina, said in a June 15 interview. If Lithuania does not get the additional funds, it will not be able to completely clean up the site, he said.

Ciuksys was plant manager for about a year before being

replaced and put in charge of negotiations with the EC and the Ignalina International Decommissioning Support Fund administered by the European Bank for Reconstruction and Development, or EBRD. The fund was established in 2000 to provide a framework through which international donors could contribute to the decommissioning process. The EU contributes about 95% of the money to the fund. The fund has provided Eur480 million for decommissioning work and Lithuania has contributed about Eur320 million.

Currently, Lithuania is negotiating with the EC for about Eur870 million for decommissioning funding from 2014 through 2020. The government has hired the law firm Taylor Wessing to help with the negotiations.

Total decommissioning costs from 2004 through 2029 are expected to be Eur2.9 billion, Ciuksys said.

Ciuksys said that decommissioning is costing more than expected because of delays with decommissioning projects and because of inflation.

As part of its EU membership treaty, Lithuania agreed to close the two 1,300-MW RBMK reactors at Ignalina. Ignalina-1 was shut in 2004 and Ignalina-2 in 2009.

Ciuksys and Rasa Adomaitiene, deputy director of the Economic Security Policy Department at the Lithuanian Foreign Ministry, say they are convinced Lithuania will get the additional money, in spite of questions from both the Lithuanian National Audit Office and the EC's European Court of Auditors about how decommissioning money has been spent so far. The European auditors are reviewing Lithuania's use of the money, as well as how Bulgaria and Slovakia have used similar EU nuclear plant decommissioning funds.

The EU accession treaty "clearly says that the EU understands the burden that Ignalina's closure puts on Lithuania and the need for sufficient decommissioning funds. It is black on white," Adomaitiene said in a June 15 interview.

### **Tougher negotiations**

Ciuksys said that questions the Lithuanian government has been asking about how the EBRD is administering decommissioning money and projects make the negotiations tougher.

Getting more money "will be very difficult," he said, "because the environment we created is not very good for negotiations."

The government is asking questions because it is "dissatisfied with the bank" and with the EU's "insistence" that donor fund money be administered by the bank, he said.

Ciuksys said Lithuania's agreement with the bank and the decommissioning fund does not meet EU procurement requirements and that all the decommissioning projects administered by the bank are delayed, especially interim spent fuel storage.

But Vince Novak, director of the EBRD nuclear safety department, said in a June 28 interview, that "that allegation is completely wrong. The bank has done everything it could to deal with the situation." Novak said the bank has proper systems for administering money and that procure-

ment has been properly done.

Ciuksys said that instead of the bank administering decommissioning funds, it could be done by the Lithuanian Central Project Management Agency, which is accredited by the EU. The agency already administers other EU funds and money for decommissioning Ignalina. That would remove a layer of bureaucracy, which would allow projects to move more quickly, he said.

### **Future uncertain**

Meanwhile, Ignalina management is trying to cope with day-to-day work at the plant and the concerns of almost 2,000 plant workers about their future.

Boris Solchov, a 44-year old technician who has worked at the plant for 25 years and was a member of the team loading fuel into Ignalina-2 before it was permanently shut, is now responsible for unloading fuel from the unit.

Solchov's father also worked at Ignalina. But in an interview during a tour of Ignalina-2 June 15, Solchov said he sees no chance that any of his three sons will get a job at the new Visaginas reactor Lithuania hopes to build because of competition for the new jobs and the limited number of positions.

Solchov is unsure how long he will have a job and what else he might be able to do. Like most of the plant workers, Solchov is a native Russian and although he now has Lithuanian citizenship, he does not speak any language except Russian, making it difficult for him to move to another EU country and train to operate another type of reactor. "We are proud of the job we did and proud of the job we are doing. But I am quite worried about the future," he said.

In a June 17 interview, Antanas Budraitis, head of the Ignalina decommissioning division at the Lithuanian Energy Ministry, said that for plant workers, "psychologically, it is difficult for them to have to destroy what they built."

Plant manager Zilvinas Jurksus said in a June 15 interview that morale at the plant has improved since unit 2 was shut at the end of 2009, because "there's no speculation that the reactors will restart. Now, there's no turning back."

Michail Demcenko, acting head of the Lithuanian State Nuclear Power Safety Inspectorate, Vatesi, said plant workers understand that decommissioning jobs will be available through 2029.

But he acknowledged in a June 17 interview that the number of workers needed at the plant will steadily decline. About 800 of the employees are expected to reach retirement age by 2020 but it is unclear how many of them will still be employed at that point.

Jurksus took over as plant manager in April. He replaced Ciuksys, who had been manager for about a year, succeeding longtime plant manager Viktor Shevaldin.

Lithuanian Energy Minister Arvydas Sekmokas has said the management changes were necessary for the transition from operation to decommissioning.

He said in a June 16 interview that it was difficult for the management group under Shevaldin to adjust from generat-

ing energy and income for the Lithuanian government to being the recipient of decommissioning funds.

Budraitis said that “we changed management because we needed somebody fresh who could deal with big projects. The management attitude needed to change.”

—Ariane Sains, Vilnius and Ignalina

## German ... from page 1

said the government is simply reinstating the phase-out negotiated in 2000 between the government of then-Chancellor Gerhard Schroeder and the nuclear industry.

Also on June 30, the Bundestag approved bill that will allow the government to implement its plan to replace Germany's roughly 23% of nuclear-generated electricity by increasing the amount of renewable energy generation and raising energy efficiency.

—Ariane Sains, Stockholm

## AECL ... from page 1

or EC6 reactor.

SNC-Lavalin agreed to contribute \$15 million toward this project, according to a June 29 statement issued by the company in announcing the agreement. Aplin said the Canadian government will retain patents and intellectual property rights to Candu technologies, potentially earning royalties from the sale of Candu reactors.

The outlook for development of AECL's ACR-1000, a 1,000-MW reactor, are uncertain. AECL spokeswoman Claudia Martin said in a July 6 e-mail, “We are considering all options at this point. If there is an appetite for the technology and a client or partner willing to invest, we will gladly work with them to meet their needs.”

The Canadian Nuclear Safety Commission in January completed its review of the reactor design. The CNSC said in a January 28 statement that “there are no fundamental barriers to licensing the reactor design in Canada.”

Candu Energy, a newly created subsidiary of SNC-Lavalin, will complete refurbishment projects at the Bruce A station, Point Lepreau and Gentilly-2 in Canada and at Wolsong in South Korea, the company said in the June 29 statement. AECL has been the prime contractor for the projects.

Candu Energy will target construction projects in Ontario as well as in Jordan, Romania, Argentina, Turkey and China, the company said in a statement.

Aplin said Candu Energy will “face stiff competition from a world of competitors” including Areva, GE Hitachi, Rosatom and Westinghouse.

China is a prime market for Candu reactors, given that its government has said it wants to add 85,000 MW of nuclear capacity and two Candus are operating at Qinshan, he said. Although four Westinghouse AP1000 units are under construction in China, Aplin said that nation's

intended reactor construction plan likely will have supply chain issues that could benefit Candu-design reactors. “China's ambitious ramp-up of nuclear power will run into supply chain problems because there are not many firms can make forged PWR pressure vessels,” he said.

The Candu-design reactors have a “built-in advantage” in that they do not have pressure vessels, he said. “Their reactor core is made up of individual pressure tubes and not one fuel assembly that fits into a reactor vessel,” he said.

It will require federal and provincial government commitments for Candu Energy to realize substantial new sales opportunities, he said. “There has been talk in the last year or so about selling two Candu 6's to Romania, where two already operate, but the talks fell apart earlier this year because there wasn't much participation by the government,” Aplin said. “Discussions with Argentina for a Candu 6 sale there and a [reactor] refurbishment project in Argentina was halted last year” because AECL was for sale, he said.

The Jordan Atomic Energy Commission in 2010 said it was considering AECL's Candu 6 reactor for that country's first nuclear power station.

On January 17, Jordan called for tenders for turnkey construction of a single-unit nuclear power plant with the option of a second unit.

Atomstroyexport's AES-92 VVER-1000 is another of the designs short-listed by JAEC, along with the 1,100-MW Atmea-1 from a joint venture between France's Areva and Japan's Mitsubishi Heavy Industries.

On June 23, Jordan informed bidders for the project that the deadline for financial bids is August 14, ASE said.

Aplin said a request for proposal by Ontario's government made two years ago for an additional 2,000 MW of nuclear capacity at Darlington B was put on hold due to uncertainty about AECL's future. The provincial government owns Ontario Power Generation, which operates Darlington.

He said the Darlington project was stalled after the federal government backed away from making any financial commitment to guarantee it will pay construction cost overruns for building new units at Darlington with the provincial government.

“Making the big, international sales will depend on how much our federal government wants to sell [Candu reactors] in international markets and work with [Candu Energy] to find local partners, as it did previously when it made deals that resulted in sales in Argentina, China and Romania,” Aplin said.

Aplin said the Canadian government could emulate France's support for Areva reactor sales, such as pledging to pay for cost overruns beyond the contractual price for the sale and installation of new reactors. He also said that Canada's Export Development Corp. could offer Candu Energy tax credits for the overseas sales of reactors.

—Jim Ostroff, Washington