

## Editorial

Dear readers of the WISE/NIRS Nuclear Monitor,

In this issue of the Monitor:

- A downbeat assessment by the US Government Accountability Office of the prospects of small modular reactors and 'advanced' reactor concepts.
- Updates from Japan, including the reactor restart process, and heavy-handed attempts by the government to force people to resettle in contaminated areas.
- Michael Mariotte deconstructs a silly report on nuclear economics by the International Energy Agency and the OECD's Nuclear Energy Agency.
- A shift in opinion in the US in favor of a 'dilute and dispose' approach to plutonium waste could signal the end of the MOX boondoggle and also dent the prospects for 'integral fast reactors'.
- The latest problems with the planned EPR reactors at the Hinkley Point site in the UK.

Feel free to contact us if you have feedback on this issue of the Monitor, or if there are topics you would like to see covered in future issues.

Regards from the editorial team.

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## US Government Accountability Office pours cold water on advanced reactor concepts

**NM810.4491** The US Government Accountability Office (GAO) has released a report on the status of small modular reactors (SMRs) and other new reactor concepts in the US.

Let's begin with the downbeat conclusion of the GAO report:

*"While light water SMRs and advanced reactors may provide some benefits, their development and deployment face a number of challenges. Both SMRs and advanced reactors require additional technical and engineering work to demonstrate reactor safety and economics, although light water SMRs generally face fewer technical challenges than advanced reactors because of their similarities to the existing large LWR [light water] reactors. Depending on how they are resolved, these technical challenges may result in higher-cost reactors than anticipated, making them less competitive with large LWRs or power plants using other fuels. ...*

*"Both light water SMRs and advanced reactors face additional challenges related to the time, cost, and*

*uncertainty associated with developing, certifying or licensing, and deploying new reactor technology, with advanced reactor designs generally facing greater challenges than light water SMR designs. It is a multi-decade process, with costs up to \$1 billion to \$2 billion, to design and certify or license the reactor design, and there is an additional construction cost of several billion dollars more per power plant.*

*"Furthermore, the licensing process can have uncertainties associated with it, particularly for advanced reactor designs. A reactor designer would need to obtain investors or otherwise commit to this development cost years in advance of when the reactor design would be certified or available for licensing and construction, making demand (and customers) for the reactor uncertain. For example, the price of competing power production facilities may make a nuclear plant unattractive without favorable rates set by a public authority or long term prior purchase agreements, and accidents such as Fukushima as well as the ongoing*

*need for a long-term solution for spent nuclear fuel may affect the public perception of reactor safety. These challenges will need to be addressed if the capabilities and diversification of energy sources that light water SMRs and advanced reactors can provide are to be realized.”*

Many of the same reasons explain the failure of the Next Generation Nuclear Plant Project. Under the Energy Policy Act of 2005, the US Department of Energy (DoE) was to deploy a prototype ‘next generation’ reactor using advanced technology to generate electricity, produce hydrogen, or both, by the end of fiscal year 2021. However, in 2011, DoE decided not to proceed with the deployment phase of the project.

### **Small modular reactors**

Four companies have considered developing SMRs in the US in recent years. NuScale has a cost-sharing agreement such that the DoE will pay as much as half of NuScale’s costs – up to \$217 million (€194m) over five years – for SMR design certification. NuScale expects to submit a design certification application to NRC in late 2016, and may begin operating its first SMR in 2023 or 2024. (However the timeframe is unrealistic, and the project may be abandoned – as other SMR projects have.)

The other three companies are a long way behind NuScale:

- mPower, a subsidiary of Babcock & Wilcox, enjoyed a cost-sharing agreement with the DoE but in 2014 scaled back its R&D efforts because of a lack of committed customers and a lack of investors.
- Holtec says it is continuing R&D work, but does not have a detailed schedule.
- In 2014 Westinghouse suspended its efforts to certify its SMR design, because of a lack of committed customers (and the lack of a DoE cost-sharing agreement).

The GAO report states that the development of light water SMRs may proceed without serious difficulties as they are based on existing light water reactor technology. That said, standardization is a key pillar of SMR rhetoric, and members of an expert group convened by the GAO noted that component standardization has proven challenging for the construction of the larger Westinghouse AP1000 that has some modular components.

Another pillar of SMR rhetoric is mass production (to make them economic), and the development of a massive construction chain to allow for mass production is a radically different proposition to NuScale’s plan to build just one reactor over the next decade.

### **Not-so-advanced reactor concepts**

According to the GAO report, SMRs and new reactor concepts “face some common challenges such as long time frames and high costs associated with the shift from development to deployment – that is, in the construction of the first commercial reactors of a particular type.”

The report notes the US government’s generous financial support for utilities developing SMRs and advanced reactor concepts – DoE provided US\$152.5 million (€137m) in fiscal year 2015 alone. Advanced reactor concepts attracting DoE largesse are the high temperature gas cooled reactor, the sodium cooled fast

reactor, and to a lesser extent the molten salt reactor (specifically, a sub-type known as the fluoride salt cooled high temperature reactor).

DoE and Nuclear Regulatory Commission (NRC) officials do not expect applications for advanced reactors for at least five years. In other words, an application may (or may not) be submitted some time between five years and five centuries from now.

Advanced reactor designers told the GAO that they have been challenged to find investors due to the lengthy timeframe, costs, and uncertainty. Advanced reactor concepts face greater technical challenges than light water SMRs because of fundamental design differences. Thus designers have significantly more R&D issues to resolve, including in areas such as materials studies and fuel certification, coolant chemistry studies, and safety analysis. Some members of the expert group convened by the GAO noted a potential need for new test facilities to support this work. Furthermore, according to reactor designers, certifying or licensing an advanced reactor may be particularly time-consuming and difficult, adding to the already considerable economic uncertainty for the applicants.

The process of developing and certifying a specific reactor design can take 10 years or more for design work and nearly 3.5 years, as a best case, for NRC certification. Even that timeframe is more hope than expectation. Recent light water reactor design certifications, for the Westinghouse AP1000 and the GE Hitachi ESBWR, have taken about 15 and 11 years respectively. Both the AP1000 and ESBWR are modifications of long-established reactor types, so considerably longer timeframes can be expected for advanced concepts.

The cost to develop and certify a design can range from US\$1–2 billion (€0.9–1.8b). Developers hope that costs can be reduced as they move from certification to the construction of a first-of-a-kind plant to the construction of multiple plants. But the GAO report notes that those hopes may be unfounded:

*“[S]ome studies suggest that existing, large LWRs have not greatly benefitted from industry-wide standardization or learning to date for reasons including intermittent development and production. In fact, some studies have found that “reverse or negative learning” occurs when increased complexity or operation experience leads to newer safety standards. On a related point, another reactor designer said that the cost and schedule difficulties associated with building the first new design that has been certified by the NRC and started construction in the United States in three decades – the Westinghouse AP1000, a recently designed large LWR – have made it harder for light water SMRs to obtain financing because high-profile problems have made nuclear reactors in general less attractive. ... The AP1000 was the first new design that has been certified by the NRC and started construction in the United States in three decades. However, construction problems, including supply chain and regulatory issues, have resulted in cost and schedule increases.”*

*US Government Accountability Office, July 2015, ‘Nuclear Reactors: Status and challenges in development and deployment of new commercial concepts’, GAO-15-652, [www.gao.gov/assets/680/671686.pdf](http://www.gao.gov/assets/680/671686.pdf)*

*(Written by Nuclear Monitor editor Jim Green.)*

# Fukushima Fallout: Updates from Japan

## Reactor restarts

**NM810.4492** There were 54 reactors operating before Fukushima, reduced to 43 with the permanent shutdown of the six Fukushima Daiichi reactors and five others. Of the 43 'operable' reactors, the Sendai 1 reactor restarted on August 11 but the outlook for Japan's nuclear power industry remains bleak according to a Reuters analysis.<sup>1</sup> The analysis was based on reactor inspection data from the Nuclear Regulation Authority (NRA), court rulings, and interviews with local authorities, utilities and energy experts. Reuters predicts the of the 42 operable-but-not-operating reactors, seven will restart in the next few years (half the number predicted in a similar survey last year), nine are unlikely to ever restart, and the fate of the remaining 26 is uncertain. Former World Nuclear Industry Association executive Steve Kidd said in June 2015 that if "more than half of the 43 operable units return to service, it may be regarded as a good result."<sup>2</sup>

TEPCO's plan to restart reactors at Kashiwazaki-Kariwa – the largest nuclear power plant in the world (seven reactors, 8.2 gigawatts) – remains stalled due to local opposition led by Niigata Governor Hirohiko Izumida. On August 24, after meeting with NRA chair Shunichi Tanaka, Izumida repeated his stance that a full investigation is needed into the Fukushima disaster before restarts can be considered. He is calling for the NRA to reinstate the use of an emergency response system known as SPEEDI, used to predict the spread of radiation and to facilitate evacuation planning in the event of an accident.<sup>3</sup> In October 2013, Izumida said TEPCO must address its "institutionalized lying" before it can expect to restart reactors.<sup>4</sup>

## Decontamination and waste

The clean-up of sites contaminated by radioactive fallout from the Fukushima disaster is proceeding slowly and has a long way to go. In some regions, radiation doses rise again after decontamination because little or no effort has been made to decontaminate surrounding forests, and radioactive materials are transported from the forests by wind and rain.<sup>5</sup>

Plans to dispose of the vast amounts of contaminated material from decontamination operations continue to face obstacles. Across the entire evacuation zone, workers have already filled 2.9 million bags.<sup>6</sup> The government plans to build landfill facilities for final disposal of radioactive waste in five prefectures – Tochigi, Miyagi, Chiba, Gunma and Ibaraki prefectures – which lack the capacity to dispose of such waste at existing facilities.<sup>7</sup>

On August 29, about 2,700 residents of Shioya, Tochigi Prefecture, gathered to oppose the government's plan to dispose of waste near the town. In Tochigi, waste is currently stored at about 170 different locations on a temporary basis.<sup>7</sup> On September 1, residents of three Miyagi Prefecture towns barred the entry of

Environment Ministry officials seeking to carry out survey work for waste disposal.<sup>8</sup> People in the towns of Kami, Kurihara and Taiwa stalled the officials' plan to conduct geological surveys, holding banners and signs and yelling "Protect children's future!" and "Get lost!" Plans to start surveys near the towns have been stalled since October 2014, when Environment Ministry officials began visiting them.

Two towns in the Futaba area, Okuma and Futaba, have agreed to accept interim storage facilities, and the shipment of radioactive wastes into the area has begun. But there has been almost no progress acquiring land for this, however, and difficulties are expected in negotiations with land owners.<sup>5</sup>

## litate

In mid-2015 Greenpeace conducted a radiation survey and sampling program in the district of litate, which covers more than 200 square kilometers north-west of the Fukushima nuclear plant. Even after decontamination, radiation levels are higher than background in some areas, with typical readings equating to annual doses of 10 mSv/year.<sup>9</sup>

Jan Vande Putte, radiation specialist with Greenpeace Belgium, said: "Prime Minister Abe would like the people of Japan to believe that they are decontaminating vast areas of Fukushima to levels safe enough for people to live in. The reality is that this is a policy doomed to failure. The forests of litate are a vast stock of radioactivity that will remain both a direct hazard and source of potential recontamination for hundreds of years. It's impossible to decontaminate."<sup>9</sup>

Despite the clean-up efforts, only about one-fifth of the 6,200 displaced residents of litate are willing to return, according to a recent survey by town officials. The mayor of litate, Norio Kanno, admits that farmers will probably not be allowed to grow food in litate for many years to come but says the town is drawing up plans to help them switch to flowers and other crops not for human consumption.<sup>6</sup>

Among regions where the entire population was forced to evacuate after the nuclear disaster in March 2011, Naraha is the first town to allow all of its residents to return permanently. In early September 2015, the government lifted the evacuation order for the town, but only about 10% of 7,368 registered residents are expected to return.<sup>10</sup>

## Resettlement of evacuees

A Cabinet resolution – 'Towards Acceleration of Fukushima's Recovery from the Nuclear Accident' – was passed on June 12, as was a plan to accelerate clean-up work in contaminated zones. The government's plan would allow two-thirds of evacuees to return by March 2017, the sixth anniversary of the disaster.<sup>6</sup>



Clean-up work in Iitate, 2015.  
Photo from Greenpeace.

Prime Minister Shinzo Abe said on June 12: “There is no revitalization of Japan without the reconstruction of Fukushima. It is our responsibility to ensure that the over 110,000 people who are still living as evacuees as a result of the nuclear disaster return to their hometowns as quickly as possible and start new lives.”<sup>11</sup> Abe pointed to the lifting of evacuation orders for Tamura City and Kawauchi Village, and some progress towards the establishment of interim radioactive waste storage facilities. Nevertheless, he said, “there are still many issues that we must address before we can achieve true reconstruction.”

On the basis of the June 12 government announcements, three days later the Fukushima Prefecture mapped out a policy of ending the provision of free temporary housing and privately leased housing by March 2017. TEPCO announced on June 17 that it plans to end compensation for psychological damage to residents of the areas for which evacuation orders had been lifted by March 2018.<sup>12</sup>

Thus evacuees are facing another injustice. Those relying on subsidised accommodation and compensation payments will have no choice but to return to their previous homes – in areas that are still contaminated and are largely bereft of industry, infrastructure and services.

As the Tokyo-based Citizens Nuclear Information Center noted, the government is “attempting to further strengthen policies of effectively abandoning people to their own devices under the nice-sounding names of ‘new life support’ and ‘support for independence and rebuilding of businesses, livelihoods and lives.’”<sup>12</sup>

## Lawsuits

More than 10,000 citizens (mostly evacuees) have joined at least 20 class-action lawsuits against the government and TEPCO. Many are seeking more compensation so they can afford to choose whether to return to their former home-towns or to build new lives elsewhere.<sup>6</sup>

“This is likely to become a long battle where lawsuits go on for several decades or half a century,” said Shunichi Teranishi, a professor emeritus of environmental economics at Hitotsubashi University in Tokyo.<sup>13</sup>

In May, the Federation of Nuclear Accident Victims’ Organizations was founded. It consists of 13 organizations, including 10 groups throughout Japan and three observer groups. The Federation says its goals are to “obtain an apology to the victims from TEPCO and Japan’s government,” to “ensure the victims are completely compensated and can recover their lives and livelihoods,” as well as “implementation of detailed medical examinations for the victims, with medical security and reduction of exposure levels,” and “pursuit of responsibility for the accident.”<sup>14</sup>

The biggest class action, with 4,000 plaintiffs, seeks to hold TEPCO’s liable by proving negligence under Japan’s civil law, rather than simply proving harm and seeking compensation.<sup>13</sup>

Another lawsuit involves 534 residents of Minamisoma City, Fukushima Prefecture, who are challenging the legality of the 20 mSv/year radiation dose limit. The government is encouraging resettlement of areas where annual doses are expected to fall below that level, which is 20 times greater than the pre-Fukushima limit of 1 mSv/year from anthropogenic sources (and about 10 times greater than typical background levels).<sup>15</sup>

Japanese authorities said in late July that they would move forward with cases against three former TEPCO executives. Prosecutors had twice rejected requests to indict the executives, but a review board overruled their decision and ordered that charges be brought. “We had given up hope that there would be a criminal trial,” said Ruiko Muto, who leads the Fukushima Nuclear Disaster Plaintiffs Group, an umbrella organization representing about 15,000 people, including residents displaced by the accident and their supporters.<sup>16</sup>

The three executives are Tsunehisa Katsumata, 75, the chair of TEPCO at the time of the accident, and two former heads of the utility’s nuclear division, Sakae Muto, 65, and Ichiro Takekuro, 69. They will be charged with professional negligence resulting in death. A first trial is not expected to start until 2016 at the earliest. The forced disclosure of an internal 2008 TEPCO may affect the lawsuits. The report called for TEPCO to prepare for a worse tsunami than it previously assumed, based on experts’ views. The internal document stated: “Considering that it is difficult to completely reject the opinions given thus far of academic experts on earthquakes and tsunami, as well as the expertise of the (government’s) Headquarters for Earthquake Research Promotion, it is unavoidable to have tsunami countermeasures that assume a higher tsunami than at present.”<sup>13</sup>

In another lawsuit, Toshiba Corp., Hitachi Ltd. and General Electric Co. face a claim in the Tokyo District Court lodged by citizens trying to hold them to account for the Fukushima disaster. The manufacturers deny any legal obligation, citing legislation which gives manufacturers immunity from compensation claims, but plaintiffs claim that the law violates the Constitution and is therefore invalid. Under the product liability law and other laws, plaintiffs are demanding a token payment of ¥100 each.<sup>7</sup>

*(Written by Nuclear Monitor editor Jim Green.)*

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# Nuclear advocates fight back with wishful thinking

**Author:** Michael Mariotte – President of the Nuclear Information & Resource Service

**NM810.4493** It must be rough to be a nuclear power advocate these days: clean renewable energy is cleaning nuclear's clock in the marketplace; energy efficiency programs are working and causing electricity demand to remain stable and even fall in some regions; despite decades of industry effort radioactive waste remains an intractable problem; and Fukushima's fallout – both literal and metaphoric – continues to cast a pall over the industry's future.

Where new reactors are being built, they are – predictably – behind schedule and over-budget; while even many existing reactors, although their capital costs were paid off years ago, can't compete and face potential shutdown because of operating and maintenance costs that are proving to be too high to manage.

Not surprisingly, the nuclear industry is fighting back. After all, what other choice does it have? But a major new report by established nuclear advocates indicate that the only ammunition left in their arsenal is wishful thinking. The study, 'Projected Costs of Generating Electricity', is jointly produced by the International Energy Agency (IEA) and its sister organization in the OECD, the Nuclear Energy Agency (NEA).<sup>1</sup>

It's an update of a study last produced in 2010 and despite the headlines being pushed by the industry,

which claim nuclear power is economically competitive with other generating technologies, it doesn't actually say that at all. But perhaps that's to be expected by an organization now headed by former US Nuclear Regulatory Commissioner William Magwood and devoted to the promotion of nuclear power.

As Jan Haverkamp of Greenpeace International explains:

*“You can see the NEA's bias very clearly in slide 11<sup>2</sup> (part of the public presentation on the report's release), where the title is: “Nuclear: an attractive low-carbon technology in the absence of cost overruns and with low financing costs” ... which shows clearly where the problem is. To call this “attractive” but then sidelining two of the inherent financial issues with the resource is tendentious to say the least. Apart from not including costs like those for clean-up after severe accidents, an insecure cost idea of waste management, and a preferential liability capping scheme with government back-up.”*

Exactly. If you assume there are no economic problems with nuclear power, then it looks just great. The problem is that in real life, nuclear power's financing costs are not low – they are extremely high because nuclear reactors are considered, for good reason, by investors to be very risky undertakings. One reason they are risky, and thus incur high financing costs, is that they are notorious for their cost overruns.

As if to slap its Paris-based companion the NEA in its face with cold reality, Electricite de France underscored new nuclear power's fundamental economic problems, announcing that the EPR reactor it is building in Flamanville, France, is another year behind schedule and its cost is now projected at triple its original 2007 estimate.<sup>3</sup>

The IEA/NEA study calculates the levelized lifetime cost of electricity for reactors based on a 60-year lifespan at an 85% capacity factor, even though the study itself admits the global capacity factor in 2013 was only 82.4% and has dropped a bit since the 2010's study reference point of 2008. So the study thus assumes a lifetime that no reactor has yet reached, and that many reactors globally will not even attempt to reach (see below), at a capacity factor higher than has been attained and when the trend is in the opposite direction. Even manipulating the numbers like that, however, only gets the IEA/NEA back to its starting point of needing both the unattainable low financing costs and absence of cost overruns to make new nuclear appear economic.

As for that 60-year lifespan, while most U.S. reactors already have received license extensions allowing their 60-year operation, that is not the case globally (nor is it at all clear that a piece of paper allowing operation will be sufficient on either an economic or safety basis to enable operation). And a new report from a company called Globaldata projects that the number of reactors expected to seek license extensions globally will decline until 2025 (at least).<sup>4</sup> Globaldata senior analyst Reddy Nagatham said: "This will be most notable in Europe, where the capacity of NPPs starting PLEX operations is expected to drop almost sevenfold from approximately 8.3 GW this year to 1.2 GW by the end of 2025."

Of course, the shorter a reactor's lifetime, the higher its lifetime cost of electricity will be.

As Greenpeace's Jan Haverkamp points out, the IEA/NEA appears to have a specific endgame in mind: "This study clearly targets the Paris COP [UN climate conference in December 2015] and tries to instill the idea that nuclear needs to get subsidies in the form of credit guarantees and price guarantees and then that will be the silver bullet."

And that brings us back to that more familiar refrain from the nuclear industry: give us more ratepayer bailouts and more taxpayer subsidies and everything will be just fine. The problem for the industry is that fewer and fewer people are singing that song.

## Small modular reactors and Generation IV reactors

Nor should the industry look for help from the trendy new kids on the block: small modular reactors (SMRs) and Generation IV technologies. The report predicts that electricity costs from SMRs will typically be 50–100% higher than for current large reactors, although it holds out some hope that large volume production of SMRs could help reduce costs – if that large volume production is comprised of "a sufficiently large number of identical SMR designs ... built and replicated in factory assembly workshops." Not very likely unless the industry accepts a socialist approach to reactor manufacturing, which is even less likely than that the approach would lead to any significant cost savings.

As for Generation IV reactors, the report at its most optimistic can only say: "In terms of generation costs, generation IV technologies aim to be at least as competitive as generation III technologies ... though the additional complexity of these designs, the need to develop a specific supply chain for these reactors and the development of the associated fuel cycles will make this a challenging task."

So, at best the Generation IV reactors are aiming to be as competitive as the current – and economically failing – Generation III reactors. And even realizing that inadequate goal will be "challenging." The report might as well have recommended to Generation IV developers not to bother.

Another problem with the report is that the IEA – perhaps at the urging of the NEA – simply assumes that the electrical grid of the future will be the same as it is today, despite the rapid pace of change across the world but especially in the IEA's European home base.

In fact, if there is a real takeaway from the report, it is from the headline on the IEA's website rather than any nuclear publication: 'Joint IEA-NEA report details plunge in costs of producing electricity from renewables.'<sup>5</sup>

Yes, while the nuclear industry has been attempting to frame the report as good news for nuclear power, the real findings of the report are in the stunning drop in renewables costs. Onshore wind, according to the report, is the cheapest power source of any examined. Solar power, except residential rooftop, is increasingly competitive and will drop further, unencumbered by the high financing charges and cost overruns experienced by nuclear.

It's good to see IEA say something favorable about renewables. As we reported last year, the organization has been notoriously wrong on the deployment of renewables over the years, greatly underprojecting their growth and compiling a simply embarrassing record.<sup>6</sup>

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# Diminishing prospects for MOX and integral fast reactors

**NM810.4494** A non-existent reactor type called the ‘integral fast reactor’ (IFR) has some prominent champions, including climate scientist James Hansen. Supporters are beguiled by the prospect of nuclear waste and weapons-usable material being used as fuel to generate low-carbon power – helping to address three problems at once.

The theoretical attractiveness fades away when the real-world history of fast reactors is considered: they have proven to be accident-prone, expensive white elephants, and they have contributed to weapons proliferation.

Both the US and the UK governments have been considering building IFRs. The primary purpose in both countries would be to provide a degree of proliferation resistance to stockpiles of separated plutonium. For Hansen and other IFR supporters, the significance of the US and UK proposals is that the construction of IFRs in those countries could kick-start a much greater worldwide deployment.

However, it seems increasingly unlikely that IFRs will be built in the US or the UK ... and no other country is seriously considering building them.

The latest report on US plutonium disposition options signals a shift away from using mixed uranium/plutonium (MOX) fuel in favor of disposal – and it didn’t consider IFRs to be worthy of detailed consideration. The study – commissioned by the Department of Energy (DoE) and produced by a ‘Red Team’ of experts from US nuclear laboratories, the Nuclear Regulatory Commission, the Tennessee Valley Authority, and the commercial nuclear power industry – was leaked to the Union of Concerned Scientists and has been posted on the UCS website.<sup>1,2</sup>

The plutonium in question is 34 metric tons of surplus plutonium from the US nuclear weapons program (with Russia having also agreed to remove the same amount of plutonium from its military stockpile). The partially built MOX Fuel Fabrication Facility at the Savannah River Site in South Carolina has proven to be an expensive white elephant. The DoE Red Team report details the “difficult, downward spiraling circumstances” that have plagued the MOX program and contributed to the delays and massive cost overruns at the MOX facility.

The UCS notes that the estimated life-cycle cost of the MOX facility has ballooned from US\$1.6 billion (€1.43b) to more than US\$30 billion (€26.9b), and the DoE report notes that the cost of the MOX approach for plutonium disposition has “increased dramatically”.

The World Nuclear Association has crunched the numbers: “Despite being 60% built, the MOX plant still needs some 15 years of construction work, said the leaked report, and then about three years of commissioning. Once in operation the plant would work through the plutonium over about 10 years with this 28-year program to cost \$700-800 million per year – a total of \$19.6–22.4 billion on top of what has already been spent.”<sup>3</sup>

The DoE Red Team report states that it may not be possible to get sufficient reactors to use MOX fuel to make the approach viable – and that it may struggle get utilities to use MOX fuel even if it is given away for free (!) and even in markets where additional costs (e.g. licensing costs to enable the use of MOX fuel) can be passed directly on to consumers.

The DoE Red Team report promotes a ‘Dilute and Dispose’ option – downblending or diluting plutonium with adulterating material and then disposing of it. The DoE has already used that method to dispose of several tons of plutonium. DoE proposes disposal of the 34 metric tons of downblended plutonium in the Waste Isolation Pilot Plant (WIPP) in New Mexico.

WIPP would also be required if the MOX approach is pursued. WIPP has been closed since a February 2014 underground chemical explosion but the Red Team anticipates that it will re-open in the coming years and could be available for downblended waste (or MOX waste).

Don Hancock from the Albuquerque-based Southwest Information and Research Center opposes the MOX project but is sceptical about disposal at WIPP, saying the DoE should review other options including storing the plutonium at the Savannah River Site or the Pantex Plant near Amarillo, Texas, where thousands of plutonium pits are already warehoused. Hancock said: “The Red Team or the Union of Concerned Scientists may be confident that WIPP will reopen in a few years, but I don’t see any real basis for that. Going from one bad idea to another bad idea is not the solution to this problem.”<sup>4</sup>

## Integral fast reactors

IFRs – also called PRISM or Advanced Disposition Reactors (ADR) – have been considered for plutonium disposition in the US. The ADR concept is similar to General Electric Hitachi’s PRISM according to the DoE.

Last year a DoE Working Group concluded that the ADR approach would be more than twice as expensive as all the other options under consideration for plutonium disposition; that it would take 18 years to construct an ADR and associated facilities; and that the ADR option is associated with “significant technical risk”.<sup>5</sup>

The 2014 DoE Working Group report stated:

*“Irradiation of plutonium fuel in fast reactors ... faces two major technical challenges: the first involves the design, construction, start-up, and licensing of a multi-billion dollar prototype modular, pool-type advanced fast-spectrum burner reactor; and the second involves the design and construction of the metal fuel fabrication in an existing facility. As with any initial design and construction of a first-of-a-kind prototype, significant challenges are endemic to the endeavor, however DoE has thirty years of experience with metal fuel fabrication and irradiation. The metal fuel fabrication facility challenges include: scale-up of the metal fuel fabrication*”<sup>3</sup>

*process that has been operated only at a pilot scale, and performing modifications to an existing, aging, secure facility ... Potential new problems also may arise during the engineering and procurement of the fuel fabrication process to meet NRC's stringent Quality Assurance requirements for Nuclear Power Plants and Fuel Reprocessing Plants."*

In short, the ADR option is associated with "significant technical risk" according to the 2014 DoE report, and metal fuel fabrication faces "significant technical challenges" and has only been operated at the pilot scale.

If the August 2015 DoE Red Team report is any guide, the IFR/ADR option is dead and buried in the US. The Red Team didn't even consider IFR/ADR worthy of detailed consideration:<sup>1</sup>

*"The ADR option involves a capital investment similar in magnitude to the MFFF [Mixed Oxide Fuel Fabrication Facility] but with all of the risks associated with first-of-a-kind new reactor construction (e.g., liquid metal fast reactor), and this complex nuclear facility construction has not even been proposed yet for a Critical Decision (CD)-0. Choosing the ADR option would be akin to choosing to do the MOX approach all over again, but without a directly relevant and easily accessible reference facility/operation (such as exists for MOX in France) to provide a leg up on experience and design. Consequently, the remainder of this Red Team report focuses exclusively on the MOX approach and the Dilute and Dispose option, and enhancements thereof."*

The DoE Red Team report states that the IFR/ADR option has "large uncertainties in siting, licensing, cost, technology demonstration, and other factors". It states that the IFR/ADR option "could become more viable in the future" if fast reactors were to become part of the overall U.S. nuclear energy strategy.

IFR/PRISM/ADR advocates argued in 2011 that the first PRISM could be built in the US by 2016.<sup>6</sup> However the US Nuclear Regulatory Commission has yet to receive a licensing submission from General Electric Hitachi and there are no concrete plans for PRISMs in the US let alone any concrete pours.

### IFRs in the UK?

The UK government is also considering building IFRs for plutonium disposition. Specifically, General Electric Hitachi (GEH) is promoting 'Power Reactor Innovative Small Module' (PRISM) fast reactors.<sup>7</sup>

The UK Nuclear Decommissioning Authority (NDA) released a position paper in January 2014 outlining potential options for future management of separated plutonium stockpiles.<sup>8</sup> The NDA report stated that reuse in Candu reactors "remains a credible option", that MOX is a "credible and technically mature option", while PRISM "should also be considered credible, although further investigation may change this view."

The NDA report stated that the facilities required by the PRISM approach have not been industrially demonstrated, so further development work needs to be undertaken with the cost and time to complete this work yet to be defined in detail. GEH estimates that licensing these first of a kind PRISM reactors would take around six years. GEH envisages first irradiation (following development, licensing and construction) in 14–18 years but the NDA considers that timeframe "ambitious considering delivery performance norms currently seen in the UK and European nuclear landscape".

As in the US, the likelihood of IFR/ADR/PRISM reactors being built in the UK seems to be diminishing. An August 2015 report states that the Canadian Candu option seems to be emerging as a favorite for plutonium disposition in the UK, and that GEH is 'hedging its bets' by working with Candu Energy to develop the Candu approach.<sup>9,10</sup>

*(Written by Nuclear Monitor editor Jim Green.)*

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# Hinkley Point C mothballed

**NM810.4495** More delays are being predicted for the Hinkley Point C nuclear project – originally expected to be generating electricity by Christmas 2017. As revelations emerge that the site has been effectively mothballed since July 1 this year, the Stop Hinkley Campaign is calling for the project to be cancelled now, rather than waiting for its slow death.

Hinkley C is now delayed by more than five years, and will probably be delayed further according to Alan Whitehead MP. The Government wants 35% of UK electricity to be supplied from nuclear by 2028, so all the other sites will have to be magically completed by then. “Not a snowballs chance in hell that all this will happen”, Whitehead says.

Instead of a complete nuclear programme by 2025, the likelihood is that there will be one plant and maybe not even that operational at that point. Time, you might think, for a plan B. What about filling the low carbon generation gap with much more easily deployable, speedily buildable, better financeable renewables? Oh, we’ve just taken most of those programmes out and shot them. Bit of a mess then, really.<sup>1</sup>

Recently the media was predicting that David Cameron and China’s president, Xi Jinping, would sign a deal at a meeting in the UK in October which would signify that a Final Investment Decision on Hinkley Point C had been made. The Chinese are expected to fund two thirds of the scheme.<sup>2</sup>

However there has been a chorus of voices calling for Hinkley C to be cancelled, or at least re-examined.<sup>3</sup> Paul Massara, Chief Executive of RWE nPower said nuclear was “an expensive mistake”.<sup>4</sup> A *Daily Telegraph* editorial said “there is a risk of being lumbered with a white elephant under current plans. Amber Rudd, the energy secretary, needs to reassess them before committing taxpayers to what may be an unsustainable project at Hinkley Point.”<sup>5</sup>

Peter Atherton of Jefferies Investment Bank calculated that we could build around 15 gas-fired power stations replacing the whole thermal generation fleet for the same price.<sup>6</sup> HSBC Energy Analysts said Hinkley is becoming harder to justify and there is ample reason to cancel the project.

And the Chancellor’s father-in-law, former Conservative Energy Secretary Lord Howell of Guildford, described Hinkley as “one of the worst deals ever for British households and British industry”. He told the House of Lords that while he was personally “very pro-nuclear”, he would “shed no tears” if the “elephantine” scheme was to be abandoned “in favour of smaller and possibly cheaper nuclear plants a bit later on”.<sup>7</sup>

Perhaps all of this had something to do with Amber Rudd launching a project to examine the actual cost of electricity generation – including not just the cost of constructing offshore wind farms, for instance, but also of connecting them to the national grid. It will also

examine nuclear power and conventional energy. The study is being conducted by Frontier Economics, the consultancy chaired by former Cabinet Secretary Lord O’Donnell.<sup>8</sup> Although this might also have more to do with the Tories ongoing attack on renewables. One source told the *Daily Mail*: “We might conclude we need less renewable energy than we thought because there are other ways of doing it cheaper – by using technology to reduce consumer demand, for instance”.<sup>9</sup>

Now the Construction Products Association (CPA) is predicting that the start of the main works on the nuclear site will be delayed until 2018.<sup>10</sup>

## Mothballed

Two recent articles in *Click Green* and *Professional Engineer* indicate that Hinkley Point C is now officially mothballed. We already knew that site preparation work at Hinkley Point C was stopped in April 2015, up to 400 construction workers were laid off, and the Final Investment Decision was delayed until the autumn.<sup>11</sup> What wasn’t clear at the time was that NNB Genco – the consortium planning to build the reactors which consists of EDF Energy, China General Nuclear Corp and other investors – put a cap on future spending on the project.<sup>12</sup>

On July 1 the site entered Care and Maintenance which means that activity at the site is limited to the management of material stockpiles and water management zones, remediation of asbestos contaminated land and archaeological surveys.<sup>13</sup>

The budget cap seems to have been more severe than the Office for Nuclear Regulation (ONR) was expecting. ONR charges NNB Genco for all the work it carries out to regulate its activities.

ONR says it has taken the decision to suspend the production of future inspection reports until a Final Investment Decision is made. It has also suspended attendance at the local liaison committee – the Community Forum. These suspensions are most likely because NNB Genco no longer has the budget to pay for them, so the consortium will have asked ONR to stop visiting the site to do inspections and stop attending the forum because it can’t afford to pay.

In retaliation ONR says it is “monitoring the impact of the budget constraint upon NNB Genco’s competency and capability”. In other words NNB Genco had better watch out or it will lose its status as an organisation competent and capable of holding a nuclear license.

ONR says its inspectors “continue to engage with the programme of design and safety case activities” related to the start of nuclear safety related construction. Its August newsletter said that further submissions are expected in September this year and the Pre Construction Safety Case related to nuclear island construction was ready for ONR to begin initial engagement at the end of July this year.<sup>14</sup>

So while some desk work appears to be continuing

all major work on-site appears to have stopped and NNB Genco is so uncertain that the final investment decision will be positive it has asked ONR to stop as much work as possible to save money – even to the point of threatening its own status as a nuclear capable organisation.

Stop Hinkley Spokesperson Roy Pumfrey said:

*“With the Chinese stock market in turmoil it is hardly surprising that the construction industry is predicting yet more delays to this £24.5 billion project. But we think the CPA is being overly optimistic. By 2018 the renewable industry will have had another 2 or 3 years of falling costs and innovation, whereas nuclear costs just keep rising and technical problems mount up. Somerset should kick EDF out now so that we can get on with building the sustainable industries we need to tackle climate change, capture the jobs required and transform our energy and transport system into one over which communities have more control.”*

### Alternative view

The *Western Daily Press* (August 26) gave an alternative view. It said EDF Energy played down the ONR’s decision to suspend work on future inspection reports. And they reported some analysts who felt the Chinese financial turmoil would actually make an investment in Hinkley more likely. The newspaper reports that the Final Investment Decision is likely to be made in Paris after the August holidays are over, and then an announcement will be made during Chinese President, Xi Jinping, visit in October. The announcement could even see the President visit Hinkley.

*The Ecologist* reports that there has probably been some heavy EDF spinning in recent weeks in response to the negative coverage about the HSBC report and

other bad news afflicting the Hinkley C project. As part of its media offensive, EDF has also put the word out that it is placing £1.3 billion in contracts to the mainly UK based contractors, and that a deal with China should be finalised within weeks.

So what’s the real situation? For a start, says *The Ecologist*, it would be extremely unwise for the UK to commit any serious money to the Hinkley C project until there is a single example of a working reactor of the EPR design and legal challenges in the European Court have been safely dealt with. So until both of those major obstructions are out of the way, it’s hard to imagine any meaningful deal being signed.

Now maybe the government itself has turned against the project altogether. The mood in government is increasingly towards bypassing the Hinkley C project and its failed EPR design altogether, and going straight for the more affordable AP1000 design (which has problems of its own). And EDF is desperately fighting back.

*The Ecologist* concludes very possibly David Cameron and Xi Jinping will sign a piece of paper in October, but will Hinkley C ever be built? The smart money says no.<sup>15</sup> The *Western Morning News* said there’s a big elephant in the room – Hinkley Point C – and some say the big creature in the room is actually a vast, unaffordable white elephant. When it comes to something as vast and vital as future energy generation, we can’t have any elephants stalking around the room.<sup>16</sup>

Meanwhile EDF-Areva has confirmed that it will bear the cost of any over-runs associated with the Hinkley Point C nuclear power project. After Olkiluoto, Flamanville and Taishan this represents a big risk for the newly merged French state-owned company as all three of those projects have experienced costly delays.<sup>17</sup>

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# Nuclear-Free Future Awards

The winners of the annual Nuclear-Free Future Awards have been announced. The awards will be presented on October 28 in Washington, DC. This years winners come from Canada, Austria, Switzerland, the Marshal Islands and the U.S.

*Resistance category: Megan Rice, Michael Walli and Gregory Boertje-Obed, USA.*

In July 2012, Sister Megan, 82, together with Michael Walli and Gregory Boertje-Obed entered the Y-12 National Security Complex in Oak Ridge, Tennessee, where the US stores the highly enriched uranium needed for nuclear bombs. The three of them – all members of the “Transform Now Plowshares” group – were sentenced to jail terms.

*Education category: Cornelia Hesse-Honegger, Switzerland.*

Swiss artist and scientific illustrator Cornelia Hesse-Honegger did field studies near the German nuclear power plants Krümmel and the French reprocessing facility in La Hague, and she made drawings near Three Mile Island and the nuclear testing sites in Nevada. Everywhere she encountered heteroptera bugs and drosophila flies with distinct mutations.

*Solutions category: Tony De Brum, Marshal Islands*

Senator De Brum, Foreign Secretary of the Republic of the Marshall Islands, spent the better part of his professional life fighting for clean-up and damages for radiation victims in the Marshall Islands.

*Special recognition category: Cree Youth of Mistissini, Canada (Quebec)*

Shawn Iserhoff, Justice Debassige, Desmond Michel, Kayleigh Spencer come from the First Nation community of Mistissini in Northern Quebec. In 2012 they recognized the encroaching danger when Strateco Resources began test-drilling for uranium. Strateco seemed especially interested in conducting probes in the Otish Mountains – land sacred to the Cree. Shawn, Justice, Desmond, and Kayleigh gained support throughout the community and the Cree Nation. Cree youth marched 850 km from Mistissini to Montreal in the fall of 2014 to build support for their campaign against uranium mining. Strateco eventually ended its exploration work and left Cree lands.

*Special recognition category: Alexander Kmentt, Austria.*

Ambassador Kmentt joined the Austrian Federal Ministry for European and International Affairs in 1994, and he also served as Austria’s Deputy Representative to the Conference on Disarmament in Geneva, Switzerland. As a leading advocate for disarmament for many years, he was recognized earlier this year as “Arms Control Person of the Year” by the members of the US-based Arms Control Association.

[www.nuclear-free-future.com/en/home/news/169-the-laureates-of-2015/](http://www.nuclear-free-future.com/en/home/news/169-the-laureates-of-2015/)

## WISE/NIRS Nuclear Monitor

The World Information Service on Energy (WISE) was founded in 1978 and is based in Amsterdam, the Netherlands.

The Nuclear Information & Resource Service (NIRS) was set up in the same year and is based in Washington D.C., US.

WISE and NIRS joined forces in the year 2000, creating a worldwide network of information and resource centers for citizens and environmental organizations concerned about nuclear power, radioactive waste, proliferation, uranium, and sustainable energy issues.

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