1. Senate panel orders US withdrawal from ITER

Appropriators cite rising costs and mismanagement for terminating US participation in ITER, but a House spending bill would increase funding above the administration’s request for the project.

David Kramer

June 2014

http://scitation.aip.org/content/aip/magazine/physicstoday/news/10.1063/PT.5.1022?dm_i=1Y69,2L953,E1OV2B,9GGDC,1

Senate appropriators approved a bill last week that would order the US to withdraw from ITER, the international effort to build a fusion test reactor in France. The move sets up a confrontation with House counterparts, who added $75 million to the Obama administration's $150 million request for the project in fiscal year 2015. The Senate measure, approved on 17 June by the subcommittee on energy and water development, would allow just $75 million to pay for contracts that have already been signed with US industry to build and ship ITER components.

Senator Lamar Alexander (R-TN), ranking minority member of the subcommittee, said that US withdrawal from ITER would save US taxpayers at least $3.9 billion, and potentially $6.5 billion. Alexander was referring to two estimates of the US share of construction costs, prepared, respectively, by the Department of Energy’s US ITER Project Office and by the Office of Project Assessment in DOE’s Office of Science.

The House and Senate bills’ disparate treatment of ITER will be reconciled in a conference committee that will be convened following passage by the full chambers. The usual practice in such cases is to split the difference, meaning that US participation could continue at a funding level well below that in the House measure.

Senator Dianne Feinstein (D-CA), the appropriations subcommittee chair, has complained repeatedly about the rising cost of US participation and the ITER central office’s management problems, highlighted in an independent US review last year. A US withdrawal from the project would require negotiations with the six other parties and possible penalties, a Senate staffer noted, because the 2006 agreement establishing the ITER partnership doesn’t include provisions for withdrawals before 2017.

The House bill was approved by the full Appropriations Committee on 18 June. The report accompanying it expressed alarm and dismay with the
management review’s findings, but praised efforts by the governing ITER Council to implement the review’s recommendations. The report scolded the administration for shortchanging the US contribution and said that DOE’s request of only $150 million would delay ITER construction by up to two years and result in further cost overruns “for no apparent reason.” The project, said the report, “remains the most practical US investment in the fusion energy sciences.”

Robert Iotti, chair of ITER’s governing council, says the timing of the Senate action “couldn’t have been worse,” occurring as members of the council gathered in Cadarache, France, for their quarterly meeting on 18–19 June. “I hope this is political posturing,” he says. “We understand we need to show progress and we will.”

Iotti describes the council meeting as productive and notes that in contrast to previous meetings, all of the noncontroversial items were dispensed with in about five minutes. Progress was made toward improving what Iotti says is the biggest single management problem: relations between the central office and the member organizations that supply the components. A search committee was appointed to find a successor to ITER director Osamu Motojima, and that individual could be selected before the next council meeting in November. The first draft of a realistic baseline cost and schedule will be presented at that session, although a final version won’t be available for another year, he says.

Since 2006, when the agreement to build the ITER fusion test reactor was signed, the estimated US share of the project has increased by nearly $3 billion, and the schedule for completing construction has slipped by 20 years, according to a recent report by the Government Accountability Office. But DOE won’t be able to precisely estimate its commitment until a new baseline cost and schedule is established by the central office, a process that won’t be completed for another year, according to the GAO report.

The US has agreed, as have all the members except the European Union, to provide 9.1% of the components and cash for ITER construction. As host, the EU’s share of construction costs is 45%. According to the GAO, the US contribution was put at $1.1 billion in 2005, when DOE officials estimated construction would be completed in 2013. In 2008 DOE reported that experiments at ITER would begin in 2016, and that the US contribution to construction would wind up the following year. Now, DOE estimates put first experiments off until 2023. Due to a cap of $225 million on the US commitment set by the administration, the US will be paying for ITER construction until 2033, the GAO report said. But the actual US contribution has never approached the cap level.

The GAO acknowledged that DOE has been able to reduce US ITER costs by $388 million as of February. Design changes have shaved $18 million off the cost of the central solenoid magnet and have cut $34 million from the vacuum auxiliary system. Through March 2014, DOE had spent a total of $692 million on ITER, according to the GAO.
Russia’s Beloyarsk-4 Ready To Begin Nuclear Reaction


Plans & Construction
25 Jun (NucNet): Russia’s BN-800 fast neutron reactor unit Beloyarsk-4 has enough fuel loaded into the reactor to begin a nuclear reaction, the operator of Russia’s nuclear power plants, Rosenergoatom, has said.

Rosenergoatom said the amount of fuel loaded into the reactor reached “minimum critical mass” – the minimum amount of fuel required for a sustained nuclear chain reaction – on 21 June 2014. The company said final preparations and procedures are being followed to obtain approval from the regulator for the reactor to achieve first criticality, which is expected “in the coming days”. After the unit achieves first criticality, it will be connected to the grid and begin to produce commercial electricity at a minimum power level. The unit’s power level will then be increased in stages until the unit is brought into commercial operation. This is expected to happen in 2015, Rosenergoatom said. Beloyarsk-4 is a 789-megawatt sodium-cooled fast reactor of the BN-800 design. It burns mixed uranium-plutonium fuel. Rosenergoatom said the BN-800 unit will be used for development of fast reactor technology with a closed fuel cycle. This could lead to a 50-fold increase in the amount of energy extracted from natural uranium, substantially expanding the nuclear industry’s fuel base, Rosenergoatom said. There is already one commercially operational reactor at the Beloyarsk nuclear station, the Beloyarsk-3 BN-600 fast reactor unit. Two other units, both AMB-100 light water graphite reactor blocks commissioned in the 1960s, have been permanently shut down. Construction of a fifth fast reactor unit with a capacity of about 1,200 megawatt is in the planning stage.
Kalpakkam FBR to be commissioned in March 2015

T. S. SUBRAMANIAN


The 500-MWe PFBR will mark a ‘Hanuman jump’ from currently operational FBTR

Things are on course for the commissioning of the 500-MWe Prototype Fast Breeder Reactor (PFBR) before the end of this financial year (March 2015) at Kalpakkam. The loading of 1,750 tonnes of liquid sodium into seven loops in the reactor will commence in two weeks from now. Dummy fuel has already been loaded into the reactor. While plutonium-uranium mixed oxide is the reactor’s fuel, liquid sodium is the coolant. The PFBR’s generation of 500 MWe will mark a “Hanuman jump”, as French nuclear scientist George Vendryes put it, from the 13-MWe Fast Breeder Test Reactor (FBTR) currently operational at Kalpakkam.

“The PFBR team is determined to move ahead in compliance with all the requirements specified by the regulatory authorities. We have to ensure that the PFBR operates smoothly and successfully. We have to ensure that this breeder technology is safe, robust and cheap,” declared Prabhat Kumar, Chairman and Managing Director, Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI).

BHAVINI, a public sector undertaking of the Department of Atomic Energy (DAE), has been mandated to build a series of breeder reactors to provide energy independence to the country. The Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam, designed and developed the technology for the PFBR. They are called breeder reactors because they breed more fuel than they consume.

Announcing that all electrical systems in the PFBR were operational, Mr. Kumar said: “The PFBR should be commissioned
safely without sodium leaking from the system. We have to transfer 1,750 tonnes of sodium from ten tanks to the seven loops. We have completed most of the piping and instrumentation. We have energised most of the equipment. Instruments and sensors are connected to the Control Room. Results of the tests done so far are encouraging. Most of the support systems are fully commissioned and operating satisfactorily. They include raw water system, service water system, air mask system, nitrogen system, argon system etc. All the electrical systems including the switch-yard and battery banks are operational.”

This reactor is different from the fleet of Pressurised Heavy Water Reactors (PHWRS) already operating in India. Fabrication of gigantic PFBR components involved highly complex technology.

4. **Wind turbine fires 'ten times more common than thought', experts warn**

Study backed by Imperial College finds wind turbines prone to "catastrophic" fires but the true scale of the problem is unknown

**By Emily Gosden**

12:01AM BST 17 Jul 2014


Wind turbines may catch on fire ten times more often than is publicly reported, putting nearby properties at risk and casting doubt on their green credentials, researchers have warned. The renewable energy industry keeps no record of the number of turbine fires, meaning the true extent of the problem is unknown, a study backed by Imperial College London finds on Thursday. An average of 11.7 such fires are reported globally each year, by media, campaign groups and other publicly-available sources, but this is likely to represent just the “tip of the iceberg”. There could in fact be 117 turbine fires each year, it argues, based on analysis showing just 10pc of all wind farm accidents are typically reported. Fires tend to be “catastrophic”, leading to turbines worth more than
£2 million each being written off, because the blazes occur so high up that they are almost impossible to put out, it warns.

Turbines are prone to catching on fire because their design puts highly flammable materials such as hydraulic oil and plastic in close proximity to machinery and electrical wires, which can ignite a fire if they overheat or are faulty.

“Lots of oxygen, in the form of high winds, can quickly fan a fire inside a turbine,” it says. “Once ignited, the chances of fighting the blaze are slim due to the height of the wind turbine and the remote locations they are often in.”

It warns: “Under high wind conditions, burning debris from the turbine may fall on nearby vegetation and start forest fires or cause serious damage to property.”

The main causes of fires are lightning strikes, electrical malfunction, mechanical failure, and errors with maintenance, it finds.

The academics used data compiled by the Caithness Windfarm Information Forum (CWIF), an anti-wind lobby group, which records 1,328 accidents involving wind farms globally between 1995 and 2012. Of these, 200 – 15 per cent - involved turbines catching on fire, implying 11.7 fires per year.

But the report, published in the journal Fire Safety Science, also back CWIF’s view that the true number is far higher.

It points out that the wind industry body, Renewable UK, has admitted there were 1,500 wind farm accidents and incidents in the UK alone between 2006 and 2010 - while just 142 individual accidents in the UK were documented in CWIF’s database over the same period.

This implies that less than 10pc of incidents are publicly reported.

Dr Guillermo Rein, of the Department of Mechanical Engineering at Imperial, said: “Fires are a problem for the industry, impacting on energy production, economic output and emitting toxic fumes. This could cast a shadow over the industry's green credentials. Worryingly our report shows that fire may be a bigger problem than what is currently reported.”

He told the Telegraph he believed it was “the responsibility of the industry” to keep a proper database and believed the industry itself had been “surprised by the magnitude of the problem”.

UK cases highlighted in the report include a 100-metre tall turbine that caught fire during hurricane-force winds at Ardrossan in North
Ayrshire in December 2011, reportedly due to a lightning strike. The wind turbine was completely burnt out and debris scattered over large distances due to the strong wind.

In 2005, a turbine at the Nissan factory in Sunderland was engulfed in fire before falling onto a nearby A-road, causing traffic disruption. The blaze was believed to be caused by a loose bolt jamming a mechanism, causing it to overheat.

Dr John Constable, director of Renewable Energy Foundation, which has published research showing that wind turbine performance declines sharply with age, said: “This new study on wind turbine fire hazards is an important reminder that there are hidden operation and maintenance costs affecting the economic lifetime of what is after all very expensive equipment. Just because the wind is free doesn’t mean that it is a cheap way of generating electricity.”

A spokesman for Renewable UK said it did “not have numbers of fires as in many cases these do not need to be formally reported”.

Renewable UK’s director of health and safety, Chris Streatfeild, said: “The wind industry welcomes any research that will help reduce maintenance times and improve safety standards. However, the industry would probably challenge a number of the assumptions that are presented in the research, which include the questionable reliability of the data sources referenced and perhaps more importantly a failure to understand the safety and integrity standards for fire safety that are in effect standard practice in any large wind turbine.”

He said: “Fire is a very important issue for the industry in terms worker and public safety as well in reducing costs through minimising any operational down time. However the operational practices and design standards are such that the actual safety risks associated fire are extremely low. No member of the public has ever been injured by a wind turbine in the UK.”

5. Offshore wind farms in doubt as subsidy pot can fund just one project

Finite budget for green energy subsidies is now on the verge of exhaustion, leaving nearly a dozen proposed offshore wind farms facing uncertain fate

Plans for a series of new offshore wind farms have been thrown into doubt after the Government disclosed it would only award enough subsidies this autumn to fund one such project. Wind farm developers who fail to secure a subsidy contract this year will be forced to wait and attempt to secure funding in future years, with no guarantee of how much money – if any – will be available.

The disclosure underlines a growing realisation in the industry that the finite budget for green subsidies is now on the verge of exhaustion and there is simply not enough cash left for many projects now in the pipeline to be built this decade.

The Treasury has said the cost to consumers of green subsidies must rise to no more than £7.6bn in the 2020-21 financial year. The vast majority of that will be used up by subsidies for projects that have either already been built, are under construction, or have already been awarded a subsidy contract.

Ministers said on Thursday that they would allocate new contracts this autumn for projects requiring up to £205m in annual subsidies, of which £155m is earmarked for technologies such as offshore wind.

Gordon Edge, director of policy at Renewable UK, said this sum would fund just one typical 500 megawatt offshore wind farm “which is significantly less than we need”.

There are five offshore wind farms with planning consent that are likely to want to secure a contract, plus a further six projects which are still in the planning system.

One of the projects with consent is ScottishPower’s East Anglia proposal, which has capacity of 1.2GW and therefore appears unable to secure full funding for the entire project this year. Until now, offshore wind farms have been subsidised through a scheme called the Renewables Obligation (RO), but this will be closed to projects built after April 2017.

The long construction time means the window is now rapidly closing for offshore farms not already being built to qualify for the RO, leaving the new contracts as the main option.

But the National Audit Office warned last month that only £600m from the 2020-21 budget was left to be allocated for the new system of subsidy contracts to cover all large-scale renewables such as offshore wind, onshore wind and solar farms.

The energy department said on Thursday it still had “around £1bn potentially available” for further projects up to 2020-21 but did not specify when this would be allocated, beyond £50m next year.
The budget post-2020 is yet to be set but at a minimum will have to expand to accommodate new nuclear plants, the first of which could start generating power - and therefore using up subsidies - from around 2024.

6. **Wind farm expansion will see more factories paid to switch off**

*Credit: By Emily Gosden, Energy Editor | The Telegraph | 10 Jun 2014 | www.telegraph.co.uk ~*

Britain’s drive for wind farms will result in businesses routinely being paid to switch off their power when there is not enough wind to stop the lights going out, National Grid has said.

Thousands of wind turbines are being built around the country and off the British coast under Government plans to hit green energy targets, but the power they produce is intermittent.

This has forced the National Grid to find alternative ways of keeping the lights on when wind levels are not high enough to meet power demand.

Steve Holliday, chief executive of National Grid, said this would include businesses such as factories, which use a lot of energy, reducing their electricity usage on days when there is low wind and receiving payments in return.

Mr Holliday said that it would be very expensive to solve the problem by building extra back-up power stations that would only run infrequently, and it would be cheaper for consumers to instead fund measures to cut demand.

He said this would be one of a number of measures, including connecting wires to the continent and storage of energy, to deal with variable power output from renewable sources.

National Grid, which operates Britain’s electricity system, began on Tuesday recruiting businesses to a similar, short-term scheme that is aimed at getting businesses to switch off
between 4pm and 8pm on winter weekdays over the next four years to help avoid blackouts. The temporary measures, which will see businesses being paid tens of thousands of pounds to take part and then receive further payments if they stop drawing power from the Grid, were described as a “last resort” to keep the lights on.

But Mr Holliday said that the plans were in fact just “the beginning” and that measures to cut demand would become commonplace in the longer-term, as Britain builds more intermittent renewable energy sources.

[rest of article available at source]

7. Global Economics

**China Wants Nuclear Reactors—Fast**

By Dexter Roberts and Stanley Reed December 02, 2010

http://www.businessweek.com/magazine/content/10_50/b4207015606809.htm

The ballroom of the Grand Hyatt on Beijing's East Chang An Avenue was packed. The occasion: the first-ever China International Nuclear Symposium, a gathering of China's top nuclear players and many of the world's nuclear power companies, including Westinghouse, Areva, and Hitachi-GE.

What brought the Chinese to the Hyatt on Nov. 24 and 25 was a hunger for the latest technology. What brought the foreigners was money: According to Michael Kruse, consultant on nuclear systems for Arthur D. Little, the Chinese are ready to spend $511 billion to build up to 245 reactors. "The market is being driven by the construction of new reactors, and it is no secret that most of those are right here in China," says
Fletcher T. Newton, an executive vice-president of Uranium One, a mining company.

The global nuclear industry is willing to take big risks to get a piece of China's nuclear budget. The danger is that in landing those fat contracts—and sharing technology with Chinese partners—the industry will help build a formidable rival. Even though they lack the most advanced technology, the Chinese are rapidly becoming self-sufficient in reactor design and construction, according to the World Nuclear Assn. The industry has the backing of the deep-pocketed Chinese state, an ambitious plan to train an army of nuclear engineers, and the leverage that comes from being the biggest market around. "They are going to use a bunch of different [suppliers] with the goal of being a developer themselves," says Jeffrey Holzschuh, a Morgan Stanley (MS) vice-chairman. Westinghouse, for example, says it has handed over more than 75,000 technical documents to its Chinese customers as part of an agreement to license reactor technology. "We look at this as a long-term opportunity and partnership," says Jack Allen, Westinghouse Asia's president. "But there are no guarantees."

Just 13 nuclear plants operate in China today, and until recently the Chinese were building only one or two reactors a decade. Now they are building 25 facilities, accounting for close to half the reactors under construction worldwide (map). "This shows the rapid momentum of China's nuclear power development," says Zhang Shanming, president of China Guangdong Nuclear Power Group, the country's No. 2 builder and operator of reactors.
China's energy planners say they aim to have 40 reactors by 2020 and, by 2030, enough additional reactors to generate more power than all 104 reactors in the U.S., the leader in nuclear energy.

Westinghouse, Areva, and other foreign companies will profit by licensing their reactor technology, consulting on safety and other issues, supplying components, and helping with construction. "Money is not an issue, which is different from the rest of the world. The Chinese have the capacity to deliver and they are deadly serious about achieving it," says Steve Kidd, director of strategy and research at the London-based World Nuclear Assn., the industry trade group.

President Hu Jintao wants nonfossil fuels to produce 15 percent of China's energy by 2020. Although the Chinese have spent plenty on wind turbines and solar panels, only a buildup of nuclear power can make that target reachable. "Developing clean, low-carbon energy is an international priority," says Zhao Chengkun, vice-president of the China Nuclear Energy Assn. "Nuclear is recognized as the only energy source that can be used on a mass scale to achieve this."

Foreign companies are already getting contracts. On Nov. 23, Cameco (CCJ), the miner, agreed to supply 29 million pounds of uranium to Guangdong Nuclear through 2025. Thomas Mundy, president and chief executive officer of Exelon Nuclear Partners, whose parent company runs 17 nuclear reactors in the U.S., says he hopes to reach an agreement by mid-2011 to help the Chinese manage their reactors. Westinghouse designs are being used for four reactors now being built. Areva has sold two latest-generation reactors
now under construction, as well as nuclear fuel. Areva Chief Executive Officer Anne Lauvergeon told the French Senate on Nov. 24 that she expected another deal on two more.

According to Lauvergeon and Allen, China is building reactors faster and at a lower cost than the rest of the world. State ownership of the industry guarantees capital and relatively quick approvals of new plants. Low-cost labor and experience in major infrastructure projects, whether power plants or subway systems, also help. As a result, building a Western-designed reactor in China costs about $4 billion, 40 percent less than one in Normandy, and can be completed in 46 months, vs. 71 months in France, according to Areva.

One challenge for the Chinese is locking in a supply of components, including reactor vessels (which protect the nuclear fission core), steam generators, and nozzles produced in large-size forges. Just a few companies make these parts, says Westinghouse's Allen. "You end up in a queue for these long-lead specialized materials," he says. "That is a constraint on how fast you can build."

How long will it take for the Chinese to become tough competitors? Guangdong Nuclear says it would like to be selling its reactors abroad by 2013 (to date, China has supplied commercial reactor technology only to Pakistan). The Chinese ability to complete large civil engineering projects is already "very worrying" for Europe's companies, Lauvergeon told the French Senate on Nov. 24. Yet Areva, like every other Western company, still wants those China deals.
The bottom line: China expects to spend $500 billion on as many as 245 reactors as part of a plan that could transform the global nuclear industry.

8.

**July 15, 2014**

**Britain Pushes Hard on Nuclear Power**

*The New York Times, Stanley Reed, New York Time*

[http://www.realclearenergy.org/2014/07/15/britain_pushes_hard_on_nuclear_power_262412.html](http://www.realclearenergy.org/2014/07/15/britain_pushes_hard_on_nuclear_power_262412.html)

LONDON — There are few places in the West where companies that build nuclear plants are welcome to construct new ones. That lack of choice probably accounts for a lot of the appeal of a nearly 500-acre stretch of scrubland called Moorside near the Irish Sea in northwest England.

Last week, Toshiba, the Japanese industrial giant, and GDF Suez, the French utility, said they planned to build three commercial nuclear reactors there at a cost of at least 10 billion pounds, or about $17 billion, beginning around 2020.

Even though Britain has not built a nuclear power station since the mid-1990s it is a hot prospect for the nuclear industry. The British government — unlike many of its Western counterparts — wants new nuclear power plants and appears to be willing to compel taxpayers and consumers to pay for them. It is a large and risky bet that energy prices will rise and that nuclear plants can be built without the delays and cost overruns that have plagued recent nuclear projects in France and Finland.

The British government is intervening in a big way in what had been one of the more open energy markets. The government is responding to worries, including fears that
Britain, which has an aging fleet of nuclear and coal plants, may not have enough generating capacity to keep the lights on in the coming years.

In addition, a nuclear power station, once built, produces carbon-free energy for decades — a characteristic that will help Britain meet the government’s targets for reducing carbon dioxide emissions. In the first quarter of this year, Britain obtained 37 percent of its electricity from low-carbon sources, including 18 percent from nuclear power.

The government is open to financing and other help from just about anywhere in its efforts to encourage construction of new nuclear plants and other low-carbon forms of electricity generation, like offshore wind turbines. British utilities have been unwilling to build nuclear power plants at home, and with the exception of the French, European utilities are also wary.

The nuclear project that has advanced furthest, Hinkley Point in southwest England, which will cost at least £16 billion, is to be built by a French utility, EDF, with help from Chinese nuclear companies and possibly other international investors.

Most of the countries in the global business of building nuclear power plants, including Russia and South Korea, are giving Britain a look. British energy projects are also attracting attention from the sovereign wealth funds of oil-producing countries and elsewhere that have cash to invest and want to earn steady returns for decades. Abu Dhabi, which has one of the world’s largest pools of capital, has made investments in British offshore wind projects through its renewable-energy arm, Masdar.

Under an agreement signed last year, the electricity generated by Hinkley Point will be guaranteed a wholesale price almost double the current price of power for 35
years, indexed to inflation, promising an estimated 10 percent rate of return.

Whether the government’s nuclear push is smart policy is a different question. Building a nuclear plant requires years, if not decades, of expensive design and regulatory work. A natural gas-fired power plant could make money with a 40 percent lower electricity price than is being guaranteed for Hinkley Point, according to Roland Vetter, an analyst at CF Partners, an energy trading firm based in London.

The financing of new nuclear plants in Britain has also raised concerns. For one thing, the European Union is looking into whether the arrangements for Hinkley Point are contrary to rules on state aid. A ruling against the plant would hurt other nuclear projects.

Nuclear power may be carbon free, but it can be harmful in other ways. After decades of operation, the nuclear industry in Britain is still searching for a way to safely dispose of the waste it generates. And nuclear energy always carries the risk of catastrophic accidents as the Fukushima disaster of 2011 in Japan showed.

Another big concern is whether the British government is making the right call when others in Europe are going the opposite direction. Chancellor Angela Merkel of Germany responded to the Fukushima disaster by accelerating the phasing out of nuclear power in her country. Aging plants would not be replaced, while the buildup of wind and solar power was greatly expanded. The decision has hurt the financial performance of the big German utilities and raised electricity rates for consumers, but some observers think Germany could wind up looking smart.

“The risk of having those old plants up and running after their useful life is just not worth it,” said Francesco
Starace, the chief executive of Enel, an Italian utility.

Britain’s push to build new nuclear power plants is risky, he said. “The sheer size, long time scale and the recent history of cost increases in the nuclear industry around the world only add to the uncertainty that these projects can be completed on time and at a reasonable cost to consumers,” Mr. Starace said.

9. **No-strings £40m for nuclear dumps**

Ben Webster

The Times July 25

[http://www.thetimes.co.uk/tto/environment/article4157272.ec](http://www.thetimes.co.uk/tto/environment/article4157272.ec)

Communities are to be paid millions of pounds just for considering whether to host an underground nuclear waste dump in their area

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10. **Biomass power plants “less green than coal fired”**

Ben Webster

The Times July 25

[http://www.thetimes.co.uk/tto/environment/article4157258.ece](http://www.thetimes.co.uk/tto/environment/article4157258.ece)
Biomass power plants could be worse for the environment than coal-fired stations, analysis has suggested.

Burning wood from North America in British power stations can result in higher greenhouse emissions than burning coal, a report by David Mackay, the government’s chief scientific adviser on energy, said.

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11. Engineers Australia
30 July 14
Harnessing stellar power


The international research project to develop fusion power into a reliable and clean source of energy will be boosted with the recent launch of the $7.9 million upgrade to the Australian Plasma Fusion Research Facility (APFRF) at the Australian National University.

The APFRF includes Australia’s largest toroidal magnetic fusion experiment, the newly upgraded H-1 Heliac toroidal helical-axis stellarator device, which forms a complex and precise 3D form in a magnetic coil in which to study plasmas that can reach temperatures hotter than the core of the sun.

The facility also includes a new plasma-materials machine, MagPIE (Magnetized Plasma Interaction Experiment), which will focus on research into the extreme materials to be used in future experiments involving even higher temperatures and radiation levels.

The APFRF’s work will feed into the International Thermonuclear Experimental Reactor (ITER) Organization’s international project, overseen by a global consortium of 35 nations and under construction in France, which seeks to better understand the fusion of hydrogen into helium – the force that powers the stars. If utilised on Earth, it could provide vast amounts of clean and safe power.

The Australian H-1 experiment uses strong magnetic fields to confine the extremely hot fuel inside a doughnut-shaped vessel, which is a design that feeds into the ITER. ITER will have a volume 10 times larger than any existing magnetic fusion experiment and is planned to produce a substantial 500MW of power.

Dr Adi Paterson, CEO of the Australian Nuclear Science and Technology Organisation (ANSTO) which partly funded the project, said that the choice of materials in use at ITER is an active research area, which APFRF and the MagPIE machine will seek to contribute to.
“Power plant fusion plasmas present an extreme materials challenge; the plasma shield has to withstand enormous neutron and heat flux damage. The APFRF enables us to test new prototype materials in a plasma environment, complementing ANSTO irradiation facilities,” Paterson said.

A five-year plan for fusion research has been launched as part of the facility’s opening, which sets out pathways to Australia/ITER collaboration and enhancements to national experimental fusion science capabilities.

Other upgrades included in the project are an upgrade to the RF heating system, the installation of new radiofrequency antennas, a precise current regulator, and upgrades to the vacuum and diagnostic systems.

This news item has been posted by Engineers Media, a wholly owned subsidiary of Engineers Australia.

12. Fusion for Energy

24 July 2014

F4E collaborates with IDOM on high tech ITER systems


A multimillion contract for engineering integration of many state of the art instruments that will measure the biggest plasma generated by a fusion device has been signed between F4E and IDOM ADA, the Advanced Design and Analysis division of IDOM, a multinational company specialising in engineering, architecture and consultancy services based in Spain. The value of the contract is in the range of 20 million EUR and is expected to run for at least four years. IDOM ADA will work with instrument designers in several public European fusion laboratories as well as experts in Japan, India, China and the US to deliver designs for the systems integration. Professor Henrik Bindslev, Director of F4E, emphasized that “through this contract we are seeing a clear example of knowledge transfer from laboratories to industry. Europe’s contribution to ITER, has been a catalyst encouraging the two poles of knowledge and competitiveness to work closer. A new chapter in the field of Diagnostics is opening that will help us analyse the ITER plasma, monitor it and improve our understanding of physics”. Mr. Fernando Querejeta, President of IDOM, stated that “we are very proud of the opportunity that we have been given to collaborate in what most likely will be the most important research project of the XXI century in the field of energy and engineering. This contract is another big step in our already important activity as science system providers for large scientific installations and instruments”.

The role of Diagnostics in ITER The Diagnostics system will help us understand what exactly will be happening in the machine during the fusion reaction. Thanks to it we will able to study and control the plasma behaviour,
measure its properties and extend our understanding of plasma physics. In simple terms, the system will act as the eyes and ears of the scientists offering them insight thanks to a vast range of cutting edge technologies. ITER will rely on approximately 50 diagnostic instruments that will offer experts an unparalleled view of the entire plasma and ensure the smooth operation of the machine. Given the duration of the plasma pulse, which will be 100 times longer than any fusion device currently in operation, the strong fluctuation levels and the extreme environment in the vessel, the diagnostic system will act as the guardian of the safe and sound operation of ITER. Europe is responsible for roughly 25% of all Diagnostics in ITER.

The scope of this contract This contract will deliver a comprehensive engineering design integrating around 20 diagnostics instruments into five of the ports giving access to the ITER plasma. In-vessel metallic containers will also be designed through this contract in order to protect the diagnostic equipment from the fierce plasma temperatures that may reach 150 million °C, and shield other parts of the machine from neutron radiation. The metallic shields will weigh between 5 tonnes and 20 tonnes each and will have to cope with extreme conditions like the high vacuum, colossal electromagnetic forces and high heat fluxes. In addition, other structures will be designed to house diagnostic instruments that will be mounted onto the Divertors cassettes of the machine, and even outside the vacuum vessel, as well as specialist flanges providing water and electrical connections to the diagnostic instruments whilst preserving the ITER vacuum.

13. ENERGY SHOT

The Telegraph

Tuesday, July 22, 2014

http://www.telegraphindia.com/1140722/jsp/opinion/story_18639939.jsp#.U9sPD RagG_V

The International Thermonuclear Experimental Reactor is an experimental fusion reactor being constructed at Cadarache in the south of France. It is the most challenging of all the research and development taking place in science and technology in the world today, and promises to go a long way in solving the world’s energy problems. This is an instance when Homi Bhabha was quite wrong; he had predicted in the 1950s that fusion power was just round the corner, but we are still thinking of uncertain dates at least 10 to 20 years hence.

The atomic nucleus holds the key to both nuclear fusion and fission. The energy in the fission reactor leads to electricity but one has to take great precautions against radioactivity. In the fusion process, deuterium and tritium are produced and there is no radioactive fallout. If and when the fusion experiment is eventually successful, it will provide unlimited energy to mankind that will last for more than 1,000 years.

The ITER is a magnetic toroidal device and is being built by several countries in a collaborative venture; the European Union, China, India, Japan, South Korea, Russia and
the United States of America. An agreement was signed on November 2006 by India with ITER for this unprecedented partnership covering more than half the world’s population.

The ITER will produce 500 MW of fusion power with an amplification of 10, that is, the generation of ten times the input energy of 50 MW, from fusion reactions between deuterium and tritium atoms. It will start its first plasma operations around 2023 and the D-T operations around 2030. Even at that stage, it will still be a long way from commercial production.

India is participating as part of its plans to develop fusion as a source of abundant and environmentally-friendly energy. India was not a part of the initial design phase, but it was able to negotiate to join the ITER because, basically, it was invited to do so by the EU and the US, the latter because of the fact that the Indo-US civil nuclear deal was then being negotiated.

India’s capability in nuclear power and its knowledge based on research and development — being done at the Institute for Plasma Research at Bhat — were important in the assessment of the partners in the project. At present, about 300 scientists and engineers are working at the Indian end on India’s procurement and design activities.

India is obligated to supply a number of packages in kind to the project site. Among these are the Cryostat, the largest refrigerator in the world in the form of a stainless steel container to maintain the cryogenically cooled superconducting magnets of the ITER at liquid helium temperature, the Vacuum Vessel Pressure Suppression System, which is a large stainless steel pressure tank, the Vacuum Vessel In-Wall Shields, which are blocks of special steel to shield the neutrons produced in the fusion reaction, and other highly specialized items.

India is a participant in several international mega-science projects, such as the European Council for Nuclear Research at Geneva, the Electron Synchrotron and Facility for Antiproton and Ion Research in Germany, the Fermi National Accelerator Laboratory in the US and the Japanese synchrotron radiation facilities. Our prestigious involvement in the ITER project could therefore be considered only natural and proper.

Yet, it may be reasonable to raise a few questions in a spirit of inquiry. The Institute for Plasma Research was originally the brainchild of Vikram Sarabhai but its first tokamak fusion reactor did not work too well. The Superconducting Tokamak at Ahmedabad is yet to be commissioned but work is continuing steadily. Even the Saha Institute of Nuclear Physics in Calcutta has a small tokamak used for research purposes.

When we have inherent ability and capacity, can we not be more self-confident and follow in the footsteps of Homi Bhabha and Raja Ramanna, who had emphasized independence of action and self-reliance? It is probably true that we lack the financial resources to fund the whole project package, and that in today’s world, advanced industrialized countries would be loath to follow the lead taken by any developing nation. But it may have been fitting for us to take a leadership position rather than be admitted as a petitioner into a club of countries, not all of which are better endowed technologically than we are.

BIKASH SINHA & KRISHNAN SRINIVASAN
Australia’s first nuclear waste dump in limbo after Muckaty Station ruled out


THE Federal Government always suspected a radioactive waste dump on Aboriginal land was too good to be true. Now their fears have been realised. The Northern Land Council, after seven years heavily backing Aboriginal land at Muckaty station for the site of the nation’s radioactive waste facility, has withdrawn its nomination for the site in the midst of a Federal Court case.

The Muckaty dump site is dead. Some are celebrating, but Australia has a problem. It needs a dump, yet no state or territory wants it. The Commonwealth would not — you would think — succeed in asking a regional neighbour to store our radioactive waste, in the way they store asylum-seekers on our behalf in offshore detention.

Australia needs to find a home for reprocessed nuclear fuel rods that will be returned from France in late 2015, and something needs to be done about low-level radioactive waste currently stored in hospital car parks.
Industry Minister Ian MacFarlane has bravely expressed hope that another Aboriginal group from the Territory will now step forth to nominate their land, but it is doubtful the Commonwealth would want to risk another Muckaty. The battle over the location of the dump, for all these years contained to the relative obscurity of the remotest parts of northern Australia, could well now shift to country towns in WA, Queensland, SA or NSW as the Commonwealth continues an urgent quest to locate suitable land.

They thought they had it covered in 2005 when the then chief executive of the NLC, Norman Fry, came up with a scheme to locate the dump on Aboriginal land. The Commonwealth, startled but grateful for the proposal after they had earlier lost a case to locate the dump in SA, changed the law so that Aboriginal traditional landowners could nominate their land for the dump. A group from Muckaty, north of Tennant, duly proposed their land, in exchange for $12.2m (of which only $200,000 has so far been paid). But there were constant questions as to who the proper traditional owners were.

A small band of antinuclear campaigners led by Nat Wasley, from the Beyond Nuclear Initiative, were bunkered down in Tennant Creek, pushing hard among traditional owners to rethink the nomination
and warning of radioactive contamination seeping into their drinking water. Labor had gone into the 2007 federal election campaign promising to overturn the laws that allowed an Aboriginal group to nominate it land. Instead, Labor allowed enough time to drag on so that the Muckaty nomination became mired in controversy and confusion. Some traditional Muckaty landowners who claimed to speak for the site died; others began stepping up, saying they had rights to the site.

In 2012, Labor introduced changes to the Commonwealth Radioactive Waste Management Act. It broke its promise by continuing to allow Aboriginal groups to nominate land (therefore validating Muckaty) but included another significant clause. It said if a nomination on Aboriginal land should fail, any private landholder, anywhere in Australia, could nominate their land for the waste dump, as long as vaguely specified community consultations were made.

What is likely now to happen is that some small struggling outback town — preferably one in a geologically suitable arid zone — is likely to get together and go for some of that $12m, or whatever amount the Commonwealth is prepared to offer. The Beyond Nuclear Initiative will then likely relocate and begin another campaign. And the reality is that it will be able to raise much more substantial popular opposition than it did with remote Muckaty, which was pretty much out of sight and mind.
Behind the scenes, Muckaty has been deeply divisive. As traditional owners fought each other, it became clear that few had real traditional knowledge of land they rarely, if at all, visited. And some in the NLC, the organisation that is supposed to represent the interests of traditional owners, wondered why they were involved in a dump nomination at all.
But the NLC pushed on and came to the conclusion, based on anthropology, that the right people to speak for the dump site was a clan called the Ngapa, led by the now-deceased Mrs A Lauder. In 2012, other Muckaty traditional owners launched a Federal Court action opposing the Ngapa clan nomination, and accused the NLC of engaging in deceitful conduct by ignoring them. The case got going in Melbourne several weeks ago and then moved to Tennant Creek where, last Saturday, there was explosive evidence that went widely unreported.

The man the NLC had most relied on for his evidence that the dump site was on Ngapa land, senior traditional owner, Dick Foster, testified that he was mistaken: he now thought the land did not belong to Ngapa at all. This was a major setback for the NLC and the Commonwealth. On the eve the case went to court, legal firm Maurice Blackburn, acting pro bono on behalf of Aborigines opposed to the dump, had put forward an offer for the NLC and Commonwealth to
settle the case. This would mean the Muckaty site would be abandoned and everyone could walk away and cover their own costs. Partly on the strength of Dick Foster’s new evidence, the NLC decided to have another look at the settlement offer.

On Monday evening, the NLC settled with Maurice Blackburn and announced, on Thursday morning, after consulting the Commonwealth, that it was withdrawing. The NLC has had a two-way bet, claiming it would have won the case regardless of Foster’s evidence, because it says the nomination process was conducted in good faith. However, the new chief executive of the NLC, Joe Morrison, appeared genuinely disturbed that his organisation was engaged in a bitter courtroom battle against other Aborigines that the NLC is also supposed to represent. Threats by old Aboriginal ladies saying they would throw themselves in front of trucks carrying radioactive waste did not sound good. Morrison turned up in court in Tennant Creek, where the NLC is not popular, to hear the evidence for himself. He did not like what he heard. “I’m determined those relationships at Muckaty now be repaired,” Morrison said on announcing the settlement. “These people are all related to each other and it’s a tragedy they are now divided.”
The Ngapa clan can now nominate another site on the northern part of Muckaty for a dump, and the Commonwealth has given them three months to do so. But the same disputes about who owns that site would almost certainly curse that nomination, as it would any other nomination of Aboriginal land in the Territory.

Nat Wasley, delighted with the win, said she hoped “the federal government doesn’t throw another dart at the board” and come up with another site. She is reluctant to say whether she agrees there in national need for a long-term dump.

The government is prepared to store the repatriated fuel rods at Lucas Heights near Sydney in the short term, but this case has only stalled, not ended, the search for a site.

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15. **Small Nuclear Power Reactors**

(Updated 18 July 2014)


There is revival of interest in small and simpler units for generating electricity from nuclear power, and for process heat.

This interest in small and medium nuclear power reactors is driven both by a desire to reduce the impact of capital costs and to provide power away from large grid systems.

The technologies involved are very diverse.

As nuclear power generation has become established since the 1950s, the size of reactor units has grown from 60 MWe to more than 1600 MWe, with
corresponding economies of scale in operation. At the same time there have been many hundreds of smaller power reactors built for naval use (up to 190 MW thermal) and as neutron sources, yielding enormous expertise in the engineering of small power units. The International Atomic Energy Agency (IAEA) defines 'small' as under 300 MWe, and up to about 700 MWe as 'medium' – including many operational units from 20th century. Together they are now referred to by IAEA as small and medium reactors (SMRs). However, 'SMR' is used more commonly as an acronym for 'small modular reactor', designed for serial construction and collectively to comprise a large nuclear power plant. (In this paper the use of diverse pre-fabricated modules to expedite the construction of a single large reactor is not relevant.) A subcategory of very small reactors – vSMRs – is proposed for units under about 15 MWe, especially for remote communities.

Today, due partly to the high capital cost of large power reactors generating electricity via the steam cycle and partly to the need to service small electricity grids under about 4 GWe, there is a move to develop smaller units. These may be built independently or as modules in a larger complex, with capacity added incrementally as required (see section below on Modular construction using small reactor units). Economies of scale are provided by the numbers produced. There are also moves to develop independent small units for remote sites. Small units are seen as a much more manageable investment than big ones whose cost often rivals the capitalization of the utilities concerned.

This paper focuses on advanced designs in the small category, i.e. those now being built for the first time or still on the drawing board, and some larger ones which are outside the mainstream categories dealt with in the Advanced Reactors paper. Note that many of the designs described here are not yet actually taking shape. Three main options are being pursued: light water reactors, fast neutron reactors and also graphite-moderated high temperature reactors. The first has the lowest technological risk, but the second (FNR) can be smaller, simpler and with longer operation before refueling.

Generally, modern small reactors for power generation are expected to have greater simplicity of design, economy of mass production, and reduced siting costs. Most are also designed for a high level of passive or inherent safety in the event of malfunction. Also many are designed to be emplaced below ground level, giving a high resistance to terrorist threats. A 2010 report by a special committee convened by the American Nuclear Society showed that many safety provisions necessary, or at least prudent, in large reactors are not necessary in the small designs forthcoming. Since small reactors are envisaged as replacing fossil fuel plants in many situations, the emergency planning zone required is designed to be no more than about 300 m radius.

A 2009 assessment by the IAEA under its Innovative Nuclear Power Reactors & Fuel Cycle (INPRO) program concluded that there could be 96 small modular reactors (SMRs) in operation around the world by 2030 in its 'high' case, and 43 units in the 'low' case, none of them in the USA. (In 2011 there were 125 small and medium units – up to 700 MWe – in operation and 17 under construction, in 28 countries, totaling 57 GWe capacity.) The IAEA has a program assessing a conceptual Multi-Application Small Light Water Reactor (MASLWR) design with integral steam generators, focused on natural circulation of coolant. The concept is similar to several of the integral PWR
designs below.
A 2011 report for US DOE by University of Chicago Energy Policy Institute says development of small reactors can create an opportunity for the United States to recapture a slice of the nuclear technology market that has eroded over the last several decades as companies in other countries have expanded into full-scale reactors for domestic and export purposes. However, it points out that detailed engineering data for most small reactor designs are only 10 to 20 percent complete, only limited cost data are available, and no US factory has advanced beyond the planning stages. In general, however, the report says small reactors could significantly mitigate the financial risk associated with full-scale plants, potentially allowing small reactors to compete effectively with other energy sources.

In January 2012 the DOE called for applications from industry to support the development of one or two US light-water reactor designs, allocating $452 million over five years. Four applications were made, from Westinghouse, Babcock & Wilcox, Holtec, and NuScale Power, the units ranging from 225 down to 45 MWe. DOE announced its decision in November 2012 to support the B&W 180 MWe mPower design, to be developed with Bechtel and TVA. Through the five-year cost-share agreement, the DOE will invest up to half of the total project cost, with the project’s industry partners at least matching this. The total will be negotiated between DOE and B&W, up to $226 million.

In March 2013 the DOE called for applications for second-round funding, and proposals were made by Westinghouse, Holtec, NuScale, General Atomics, and Hybrid Power Technologies, the last two being for EM2 and Hybrid SMR, not PWRs. Other (non-PWR) small reactor designs will have modest support through the Reactor Concepts RD&D program. A late application ‘from left field’ was from National Project Management Corporation (NPMC) which includes a cluster of regional partners in the state of New York, South Africa’s PBMR company, and National Grid, the UK-based grid operator with 3.3 million customers in New York, Massachusetts and Rhode Island. The project is for a HTR of 165 MWe, apparently the earlier direct-cycle version of the shelved PBMR, emphasising its ‘deep burn’ attributes in destroying actinides and achieving high burn-up at high temperatures. The PBMR design was a contender with Westinghouse backing for the US Next-Generation Nuclear Power (NGNP) project, which has stalled since about 2010.

In December 2013 DOE announced that a further grant would be made to NuScale on a 50-50 cost-share basis, to support design development and NRC certification and licensing of its 45 MWe small reactor design.

In March 2012 the US DOE signed agreements with three companies interested in constructing demonstration small reactors at its Savannah River site in South Carolina. The three companies and reactors are: Hyperion with a 25 MWe fast reactor, Holtec with a 140 MWe PWR, and NuScale with 45 MWe PWR. DOE is discussing similar arrangements with four further small reactor developers, aiming to have in 10-15 years a suite of small reactors providing power for the DOE complex. DOE is committing land but not finance. (Over 1953-1991, Savannah River was where a number of production reactors for weapons plutonium and tritium were built and run.)

In January 2014 Westinghouse announced that was suspending work on its small modular reactors in the light of inadequate prospects for multiple deployment. The company said that it could not justify the economics of its
SMR without government subsidies, unless it could supply 30 to 50 of them. It was therefore delaying its plans, though small reactors remain on its agenda. The most advanced small modular reactor project is in China, where Chinergy is starting to build the 210 MWe HTR-PM, which consists of twin 250 MWt high-temperature gas-cooled reactors (HTRs) which build on the experience of several innovative reactors in the 1960s to 1980s. Another significant line of development is in very small fast reactors of under 50 MWe. Some are conceived for areas away from transmission grids and with small loads; others are designed to operate in clusters in competition with large units.

Urenco has called for European development of very small – 5 to 10 MWe – 'plug and play' inherently-safe reactors based on graphite-moderated HTR concepts. It is seeking government support for a prototype "U-Battery" which would run for 5-10 years before requiring refueling or servicing. Already operating in a remote corner of Siberia are four small units at the Bilibino co-generation plant. These four 62 MWt (thermal) units are an unusual graphite-moderated boiling water design with water/steam channels through the moderator. They produce steam for district heating and 11 MWe (net) electricity each. They have performed well since 1976, much more cheaply than fossil fuel alternatives in the Arctic region.

Also in the small reactor category are the Indian 220 MWe pressurised heavy water reactors (PHWRs) based on Canadian technology, and the Chinese 300-325 MWe PWR such as built at Qinshan Phase I and at Chashma in Pakistan, and now called CNP-300. The Nuclear Power Corporation of India (NPCIL) is now focusing on 540 MWe and 700 MWe versions of its PHWR, and is offering both 220 and 540 MWe versions internationally. These small established designs are relevant to situations requiring small to medium units, though they are not state of the art technology.

Other, mostly larger new designs are described in the information page on Advanced Nuclear Power Reactors.

### Small (25 MWe up) reactors operating

<table>
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<th>Name</th>
<th>Capacity</th>
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<tr>
<td>CNP-300</td>
<td>300 MWe</td>
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<td>CNNC, operational in</td>
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<td></td>
<td></td>
<td>Pakistan</td>
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<tr>
<td>PHWR-220</td>
<td>220 MWe</td>
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<td>NPCIL, India</td>
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### Small (25 MWe up) reactor designs under construction

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<tr>
<td>KLT-40S</td>
<td>35 MWe</td>
<td>PW</td>
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<tr>
<td>CAREM</td>
<td>27 MWe</td>
<td>PW</td>
<td>CNEA &amp; INVAP, Argentina</td>
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<tr>
<td>HTR-PM</td>
<td>2×105 MWe</td>
<td>HT</td>
<td>INET &amp; Huaneng, China</td>
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### Small (25 MWe up) reactors for near-term deployment – development well advanced
<table>
<thead>
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<tr>
<td>VBER-300</td>
<td>300 MWe</td>
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<td>OKBM, Russia</td>
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<td>IRIS</td>
<td>100-335 MWe</td>
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<td>Westinghouse-led, international*</td>
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<td>Westinghouse SMR</td>
<td>225 MWe</td>
<td>PWR</td>
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<td>mPower</td>
<td>180 MWe</td>
<td>PWR</td>
<td>Babcock &amp; Wilcox + Bechtel, USA</td>
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<tr>
<td>SMR-160</td>
<td>160 MWe</td>
<td>PWR</td>
<td>Holtec, USA</td>
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<tr>
<td>ACP100</td>
<td>100 MWe</td>
<td>PWR</td>
<td>CNNC &amp; Guodian, China</td>
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<td>SMART</td>
<td>100 MWe</td>
<td>PWR</td>
<td>KAERI, South Korea</td>
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<td>NuScale</td>
<td>45 MWe</td>
<td>PWR</td>
<td>NuScale Power + Fluor, USA</td>
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<td>PBMR</td>
<td>165 MWe</td>
<td>HTR</td>
<td>PBMR, South Africa; NPMC, USA*</td>
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<td>Prism</td>
<td>311 MWe</td>
<td>FNR</td>
<td>GE-Hitachi, USA</td>
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<td>BREST</td>
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<td>RDipe, Russia</td>
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<td>SVBR-100</td>
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<td>FNR</td>
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Small (25 MWe up) reactor designs at earlier stages

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<tr>
<td>EM2</td>
<td>240 MWe</td>
<td>HTR, FNR</td>
<td>General Atomics (USA)</td>
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<td>VK-300</td>
<td>300 MWe</td>
<td>BWR</td>
<td>RDipe, Russia</td>
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<td>AHWR-300 LEU</td>
<td>300 MWe</td>
<td>PHWR</td>
<td>BARC, India</td>
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<td>CAP150</td>
<td>150 MWe</td>
<td>PWR</td>
<td>SNERDI, China</td>
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<tr>
<td>ACPR100</td>
<td>140 MWe</td>
<td>PWR</td>
<td>CGN, China</td>
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<tr>
<td>SC-HTGR (Antares)</td>
<td>250 MWe</td>
<td>HTR</td>
<td>Areva</td>
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<tr>
<td>Gen4 module</td>
<td>25 MWe</td>
<td>FNR</td>
<td>Gen4 (Hyperion), USA</td>
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<td>IMR</td>
<td>350 MWe</td>
<td>PWR</td>
<td>Mitsubishi, Japan</td>
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<td>Integral MSR</td>
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<td>Terrestrial Energy,</td>
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Five-year delay would spell end of ITER

Osamu Motojima, head of the international fusion project, speaks out on delays, leaks and rumours.

Elizabeth Gibney
31 July 2014

Harnessing the power of the Sun on Earth has long been a dream for physicists. In 2006, a team from the European Union, China, India, Japan, South Korea, Russia and the United States got the go-ahead to realize that ambition by building an experimental reactor designed to use nuclear fusion to generate ten times the power that is put in.

The multibillion-euro ITER facility is now being built in St-Paul-lez-Durance, southern France. But after eight years, it has become complex and unwieldy. Following an extensive design review in 2009, ITER's projected costs trebled to around €15 billion (US$20 billion), and construction delays — as well as unforeseeable events such as the 2011 Japanese earthquake, which damaged component-testing facilities — have meant that the research programme is now likely to be pared back.

Last year, a management assessment leaked by The New Yorker magazine (see go.nature.com/7ayyqe) gave a searing account of the organization’s failures. Finding that the project was “in a malaise and could drift out of control”, it recommended 11 urgent reforms. As construction of ITER's main experimental facility gets underway, outgoing director-general Osamu Motojima spoke to Nature about the report, delays and ITER's future.
The expected date of the first experiments confining super-hot plasma in ITER’s doughnut-shaped magnetic chamber, or tokamak, has been pushed back from 2016 to 2020. At this year’s meeting of the ITER Council in June, members said that the schedule needed to be updated, and stressed the need to stem slippage. What might a realistic schedule look like?
Construction is quite difficult, because a lot of integration of parts is necessary. We are trying to estimate the date of the machine’s completion and of first plasma, but it’s a bottom-up process that integrates technical data and work schedules for different components made by different countries.

Many people are openly talking about 2022 or 2023. There are a lot of rumours. I have the target date, but I need to demonstrate that we can do it with a high-enough probability. It will be around 2022 or 2023 and I will report to the ITER council next June. If the date is 2025, the project will never survive. That I know clearly. But it is important to remember that the success of ITER is not demonstrated with the first plasma, but when the deuterium–tritium plasma operation is realized — currently scheduled for 2027.

Last month, the US Senate proposed a budget that would see the United States pull out of ITER. How concerned are you? The United States has high scientific and technological capability in fusion energy and has been one of the leading countries in ITER from the beginning, so I have a strong concern about this US funding issue. I do not want to believe that the United States would pull out of ITER, because it would be a disaster to the project. However, I also believe the country might well recognize the advantage and benefit to staying in the project.

I would like to mention one important point. According to the ITER treaty, a member cannot withdraw before 2017 — and even if they do, their in-kind contribution to the construction is due. So this is more an internal problem in the United States.

The US House of Representatives’ version of the budget proposes increased funding, as long as ITER implements the recommendations of last year’s management report. How are you responding to those recommendations?
I accepted the need to address performance and make improvements, and therefore agreed to the 11 recommendations and to 31 actions. There are important actions, such as creating a ‘project culture’. I first mentioned this to my staff in 2010, and now, relying on the recommendations, I am pushing very strongly to accelerate the process. Another very important thing is to show a strong nuclear-safety culture, which I have tried to encourage. We reported improvements to the ITER council last month.

But can I say a point to you frankly? We have a big problem. The ITER council determined that the 2013 management assessment, including its executive summary and recommendations, should be a confidential document. So although I am trying to be transparent and explain the 31-point action plan, I am not comfortable talking about this in detail in public.

Would you have preferred that the report had not been leaked?
Yes. I regret that this executive summary was uploaded to websites. This makes some things difficult and has caused a lot of unnecessary rumours.

The report said that ITER leadership was “not meeting the challenge”, and one of the recommendations was to accelerate the transition to a new director-general. This seems to imply that the assessors laid some blame with you. Do you think this is fair?
No one ever said to replace me. I have the contract for five years and already four years have passed, so with or without the recommendation, I need to ask the ITER council to settle on the selection process for the new director-general.

But do you think it is fair to blame ITER’s shortcomings on you?
That is an issue of the ITER council. If, one year before the process to determine the next director-general, they say that an acceleration of the selection process is necessary, it is not because the director-general is condemned. Right now, that is all that I can answer. Given that I am accepting this recommendation, I should not mention my personal feelings to you. One year from now, perhaps I can say more.
The report identified some wide-ranging problems, such as the complex relationship between the seven ITER members and the central organization. Are these problems that can be fixed, or are they too deeply entrenched?

About two years ago, I created the Unique ITER team with the ITER organization and seven domestic agencies to tackle this problem. The situation has improved a lot, but you are right: the problem comes from the basic design, that ITER is an international project. We are working hard every day — we want each member to maximize their benefit while cooperating. But some parts of ITER’s structure that make it complex are important to fulfilling the project’s other big objective: that all the intellectual property obtained is available equally to all seven members.

**ITER seems to dominate fusion, mostly because of the enormous amount of money going into it. How important is it to test other fusion methods?**

Tokamaks are now the most advanced plasma-confinement system, which is why this design was selected for the experimental reactor. I have confidence that we will contribute to DEMO [the Demonstration Power Plant, a proposed follow-up to ITER]. But there are other concepts that are also important, such as laser fusion and stellarator reactors, including the Wendelstein 7-X reactor in Germany and the Large Helical Device in Japan. National projects are important, because how do you move to the next stage of demonstration if you don’t have any researchers or engineers in your country? In the United Kingdom, maybe 50 people work on ITER. Each country cannot contribute to the next stage of fusion with only 50 people. So to concentrate too much on ITER is dangerous. I say that even as its director-general.

**The crisis in Ukraine meant that you had to move this year’s council meeting from St Petersburg to the ITER headquarters. Are you worried that international tensions could further affect ITER?**

Yes, I have some concerns. It is quite dangerous for our project. But ITER is a scientific project aiming at a peaceful demonstration of fusion energy, and I wish it to be outside the tensions. That is why the council took the decision to move the meeting. I believe that all the members, including from the United States and Russia, also agreed that ITER should be beyond international tensions — not directly, but by sitting down together at the table.
Do you have a plan in case problems escalate?
In such a case, we are preparing a plan to mitigate the impact. We always manage to find the solution — that is the basic philosophy of the ITER project.

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17. University of Saskatchewan lab to test materials for fusion reactor

*BY JANET FRENCH, THE STARPHOENIX*  JULY 15, 2014


The plan: build a small sun and solve the world’s thirst for a guilt-free energy source.

The problem: designing a container strong enough to withstand the kinds of temperatures and pressures found inside the sun.

Enter the University of Saskatchewan physics department, which houses Canada’s only magnetic fusion reactor.

The physics whizzes who operate this metallic doughnut have paired up with a British Columbia company that’s determined to build the world’s first net-gain nuclear fusion reactor. That means developing a method of smashing atoms together that creates more energy than it consumes.

“This is the big Holy Grail. This is making energy with no pollution, and less amount of supply. No fight around everybody to get the fuel, because it’s available from the sea,” said Michel Laberge, founder and chief scientific officer at Burnaby-based General Fusion.

The company aims to develop the technology for a reactor that would fuse hydrogen into helium in a rapid flash lasting ten millionths of a second.

Doing that requires extreme conditions, like million-degree temperatures and crushing pressure. The resulting plasma can
interact with the reactor wall, and that’s not good, Laberge said.

In a project funded by the National Research Council, General Fusion will pay U of S physics Prof. Akira Hirose’s team $60,000 to use the Saskatoon-based reactor to test materials for the company.

General Fusion and Hirose’s lab will co-develop a chamber they’ll use in conjunction with existing equipment in Saskatoon that injects plasma into the reactor. The company will send Hirose’s lab samples of different metals to see how well they withstand the intense reaction conditions.

Laberge said the company needs to find a dense, heat-resistant material that doesn’t draw heat away from the reaction. Tungsten and copper are good candidates, he said.

Hirose said his lab will also analyze the metal samples to determine how well they withstood the conditions.

Nuclear fusion is different than the nuclear fission reactors currently in use across the globe. Fusion generates energy by combining atoms to make new elements. Fission breaks them apart.

A fusion reactor would create no waste to store while waiting for its radioactive decay, and hydrogen is widely available in the form of water.

Hirose’s lab has been fusing atoms for years — his reactor just isn’t big enough to generate more energy than it consumes.

A gigantic fusion reactor is currently under construction in France. Thirty-five countries are collaborating on the International Thermonuclear Experimental Reactor (ITER), which is intended to prove fusion is a viable source of energy. Construction is expected to be complete by 2020.

General Fusion aims to have a reactor that creates as much energy as it consumes within about two years. Laberge said he hopes to have a small prototype reactor built about three years after that.

Both Hirose and Laberge agree it will be at least a decade before
anyone is ready to use nuclear fusion to generate power for public consumption.

“Finally, we are in the stage to hope for fusion reactors,” Hirose said.

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18. **Fusion energy facility promises clean energy**
Jul 10, 2014


The search for star power – fusion – has received a major boost with the launch of the Australian Plasma Fusion Research Facility (APFRF) at The Australian National University.

The facility includes Australia's largest fusion experiment, the newly upgraded H1, which will now be able to heat fusion experiments to temperatures hotter than the core of the sun. The facility also includes a new machine, MagPIE, which will accelerate research into extreme materials to be used in future experiments involving even higher temperatures and radiation levels.

Senator Zed Seselja pressed the button to initiate a 30,000 degrees Celsius fusion experiment in H1 to conclude the launch. "This facility and its fine team have a reputation for world-class innovation and research excellence," Senator Seselja said. The fusion of hydrogen into helium powers the Sun and the stars. If harnessed on Earth, it could provide millions of years of greenhouse gas-free, safe, base-load power.

The H1 experiment uses strong magnetic fields to confine the hot fuel inside a doughnut-shaped vessel. The doughnut design is also the basis for the next-step fusion energy experiment, ITER, which is being built in the south of France by a global consortium of 35 nations.

ITER will have a 10-times larger volume than any existing magnetic fusion experiment and is planned to produce 500
megawatts of power, on par with a small power station. "ITER's design hinges on experiments being carried out in experiments around the world, such as the Plasma Fusion Research Facility at ANU," said the Director General of ITER, Osamu Motojima.

Dr Adi Paterson, CEO of ANSTO, said the choice of materials for use in ITER is an active research area, to which MagPIE is already contributing, in collaboration with ANSTO, which part funded the project.

"Power plant fusion plasmas present an extreme materials challenge. This facility helps us to test whether prototype new materials can withstand the heat flux damage inflicted by a fusion plasma," Dr Paterson said.

At the same event a five-year plan for fusion research was launched laying out pathways to Australian ITER involvement and enhancements to national experimental fusion science capabilities.

19. 25 June 2014

Europe signs its final contract for ITER Toroidal Field coils


A landmark multimillion contract has been signed between F4E and SIMIC S.p.A, an Italian company specialised in high-tech engineering and manufacturing, marking the successful completion of Europe’s strategy in the domain of the Toroidal Field (TF) coils, part of ITER's impressive magnet system. The Director of F4E, Professor Henrik Bindslev, explained that “thanks to this contract the last and most decisive chapter of the TF coils manufacturing is about to be written. We will produce magnets of unprecedented size and power following extremely complex techniques. This final procurement is a clear demonstration of Europe’s commitment to the project and its capacity to be competitive and meet high technical standards”.

For Marianna Ginola, Commercial Manager of SIMIC S.p.A this milestone “is an impressive achievement that enhances the proven track record of our company and associates Italian manufacturing amongst the most skilled in the world. ITER has given us the opportunity to build international collaborations. In this contract for instance, we will collaborate with Babcock Noell GmbH. This project has given us the possibility to access new markets and grow both in size and expertise”. The contract is expected to run for approximately five years and its budget will exceed the amount of 100 million EUR. Through this contract, the TF coils will be tested at extremely low temperatures reaching nearly -200 degrees Celsius/80 Kelvin and subsequently will be inserted.
within their cases in order to be finally assembled in the ITER machine.

**What is the role of TF coils and their specifications?** ITER will demonstrate the feasibility of fusion energy. The temperature of ITER’s superhot plasma is expected to reach 150 million degrees Celsius. The challenge is to keep the plasma burning without touching the walls of the vessel of the reactor. The TF coils are “D” shaped gigantic superconducting magnets whose main task will be to create a magnetic cage where the plasma will be confined. Europe is responsible for the manufacturing of 10 out of the 18 TF coils of the machine.

**Magnets of unprecedented size, weight, power and technique** The TF coils are composed of a winding pack and its stainless steel coil case. Each TF coil is 15m high, 9m wide and has a cross section of about 1m². It weighs approximately 340 tonnes, which compares to six Boeing 737-800 planes! These will be the biggest Nb3Sn magnets ever manufactured, which once powered with 68000 A, they will generate a magnetic field that will reach 11.8 Tesla- about one million times stronger the magnetic fields of the earth.

**The scope of this contract** First, the winding packs will be cold tested at -200 degrees Celsius/80 K using a combined cycle of nitrogen and helium. Next, they will be inserted into the TF coil cases, which will require sophisticated laser dimensional controlled technology and complex tooling in order to move and fit hundreds of tonnes with millimetric precision. Then, the cases will be welded in compliance with the stringent ISO standard 5817 in order to close the metallic structure. Two important characteristics will add to the complexity: the thickness of the weld which will reach 130mm and the fact that welding will have to be carried out only from one side. For these reasons, ultrasonic technology will be deployed to inspect the quality of welding. The gap between the winding pack and the TF coil case will have to be filled with reinforced resin to mechanically link the components. The high density of the resin makes this task particularly challenging. Try and imagine filling a tight gap that is 4mm thick and 35m long with 1m³ of resin that has the thickness of honey. ITER is a puzzle of many different interfaces that will need to be managed in a seamless way. Most TF coil components, like the winding packs and the radial plates are manufactured in Europe. The TF coil cases however, are manufactured in Japan while the thermal shields of the Vacuum Vessel that will be ultimately welded on the TF coils, in Korea. In other words, the multiple interfaces and their careful management will be fundamentally important for the successful execution of this contract.

20. **Though Scorned by Colleagues, a Climate-Change Skeptic Is Unbowed**
HUNTSVILLE, Ala. — John Christy, a professor of atmospheric science at the University of Alabama in Huntsville, says he remembers the morning he spotted a well-known colleague at a gathering of climate experts.

“I walked over and held out my hand to greet him,” Dr. Christy recalled. “He looked me in the eye, and he said, ‘No.’ I said, ‘Come on, shake hands with me.’ And he said, ‘No.’ ”

Dr. Christy is an outlier on what the vast majority of his colleagues consider to be a matter of consensus: that global warming is both settled science and a dire threat. He regards it as neither. Not that the earth is not heating up. It is, he says, and carbon dioxide spewed from power plants, automobiles and other sources is at least partly responsible.

But in speeches, congressional testimony and peer-reviewed articles in scientific journals, he argues that predictions of future warming have been greatly overstated and that humans have weathered warmer stretches without perishing. Dr. Christy’s willingness to publicize his views, often strongly, has also hurt his standing among scientists who tend to be suspicious of those with high profiles. His frequent appearances on Capitol Hill have almost always been at the request of Republican legislators opposed to addressing climate change.

“I detest words like ‘contrarian’ and ‘denier,’ ” he said. “I’m a data-driven climate scientist. Every time I hear that phrase, ‘The science is settled,’ I say I can easily demonstrate that that is false, because this is the climate — right here. The science is not settled.”
Dr. Christy was pointing to a chart comparing seven computer projections of global atmospheric temperatures based on measurements taken by satellites and weather balloons. The projections traced a sharp upward slope; the actual measurements, however, ticked up only slightly.

Such charts — there are others, sometimes less dramatic but more or less accepted by the large majority of climate scientists — are the essence of the divide between that group on one side and Dr. Christy and a handful of other respected scientists on the other.

“Almost anyone would say the temperature rise seen over the last 35 years is less than the latest round of models suggests should have happened,” said Carl Mears, the senior research scientist at Remote Sensing Systems, a California firm that analyzes satellite climate readings.

“Where the disagreement comes is that Dr. Christy says the climate models are worthless and that there must be something wrong with the basic model, whereas there are actually a lot of other possibilities,” Dr. Mears said. Among them, he said, are natural variations in the climate and rising trade winds that have helped funnel atmospheric heat into the ocean.

Dr. Christy has drawn the scorn of his colleagues partly because they believe that so much is at stake and that he is providing legitimacy to those who refuse to acknowledge that. If the models are imprecise, they argue, the science behind them is compelling, and it is very likely that the world has only a few decades to stave off potentially catastrophic warming.

And if he is wrong, there is no redo.

“It’s kind of like telling a little girl who’s trying to run across a busy street to catch a school bus to go for it,
knowing there’s a substantial chance that she’ll be killed,” said Kerry Emanuel, a professor of atmospheric science at the Massachusetts Institute of Technology. “She might make it. But it’s a big gamble to take.”

By contrast, Dr. Christy argues that reining in carbon emissions is both futile and unnecessary, and that money is better spent adapting to what he says will be moderately higher temperatures. Among other initiatives, he said, the authorities could limit development in coastal and hurricane-prone areas, expand flood plains, make manufactured housing more resistant to tornadoes and high winds, and make farms in arid regions less dependent on imported water — or move production to rainier places.

Dr. Christy’s scenario is not completely out of the realm of possibility, his critics say, but it is highly unlikely.

In interviews, prominent scientists, while disagreeing with Dr. Christy, took pains to acknowledge his credentials. They are substantial: Dr. Christy, 63, has researched climate issues for 27 years and was a lead author — in essence, an editor — of a section of the 2001 report of the United Nations Intergovernmental Panel on Climate Change, the definitive assessment of the state of global warming. With a colleague at the University of Alabama in Huntsville, Dr. Roy Spencer, he received NASA’s medal for exceptional scientific achievement in 1991 for building a global temperature database.

That model, which concluded that a layer of the atmosphere was unexpectedly cooling, was revised to show slight warming after other scientists documented flaws in its methodology. It has become something of a scientific tit for tat. Dr. Christy and Dr. Spencer’s own recalculations scaled back the amount of warming, leading to further assaults on their methodology.
Dr. Christy’s response sits on his bookshelf: a thick stack of yellowed paper with the daily weather data he began recording in Fresno, Calif., in the 1960s. It was his first data set, he said, the foundation of a conviction that “you have to know what’s happening before you know why it’s happening, and that comes back to data.”

Dr. Christy says he became fascinated with weather as a fifth grader when a snowstorm hit Fresno in 1961. By his high school junior year, he had taught himself Fortran, the first widely used programming language, and had programmed a school computer to make weather predictions. After earning a degree in mathematics at California State University, Fresno, he became an evangelical Christian missionary in Kenya, married and returned as pastor of a mission church in South Dakota.

There, as a part-time college math teacher, he found his true calling. He left the pastoral position, earned a doctorate in atmospheric sciences at the University of Illinois and moved to Alabama.

And while his work has been widely published, he has often been vilified by his peers. Dr. Christy is mentioned, usually critically, in dozens of the so-called Climategate emails that were hacked from the computers of the University of East Anglia’s Climatic Research Center, the British keeper of global temperature records, in 2009.

“John Christy has made a scientific career out of being wrong,” one prominent climate scientist, Benjamin D. Santer of the Lawrence Livermore National Laboratory, wrote in one 2008 email. “He’s not even a third-rate scientist.”

Another email included a photographic collage showing Dr. Christy and other scientists who question the extent of global warming, some stranded on a tiny ice floe labeled
“North Pole” and others buoyed in the sea by a life jacket and a yellow rubber ducky. A cartoon balloon depicts three of them saying, “Global warming is a hoax.”

Some, including those who disagree with Dr. Christy, are dismayed by the treatment.

“Show me two scientists who agree on everything,” said Peter Thorne, a senior researcher at Norway’s Nansen Environmental and Remote Sensing Center who wrote a 2005 research article on climate change with Dr. Christy. “We may disagree over what we are finding, but we should be playing the ball and not the man.”

Dr. Christy has been dismissed in environmental circles as a pawn of the fossil-fuel industry who distorts science to fit his own ideology. (“I don’t take money from industries,” he said.)

He says he worries that his climate stances are affecting his chances of publishing future research and winning grants. The largest of them, a four-year Department of Energy stipend to investigate discrepancies between climate models and real-world data, expires in September.

“There’s a climate establishment,” Dr. Christy said. “And I’m not in it.”

21. California dreaming is nuts in NSW

Maurice Newman
The Australian
July 30, 2014 12:00AM

NSW Environment Minister Rob Stokes told a Clean Energy Week forum last week, “We are making NSW No 1 in energy and environmental policy.” He added: “When it comes to clean energy, we can be Australia’s answer to California.”

Really? This is an extraordinary decision that flies in the face of the Abbott government’s efforts to arrest the alarming slide in Australia’s international competitiveness and the evident failure of these policies in California and elsewhere. It suggests appalling lack of judgment and is a measure of the degree to which green fantasies have penetrated the thinking of otherwise sensible governments.

Macquarie Street’s decision overlooks what Joel Kotkin refers to in New Geography as “the futility and delusion embodied in California’s ultra-green energy policies”. Kotkin reveals, “By embracing solar and wind as preferred sources of generating power, the state promotes an ever-widening gap between its declining middle and working-class populations and a smaller, self-satisfied group of environmental campaigners and their corporate backers”.

The NSW government must also be oblivious to the steady exodus of Californian businesses and jobs. Companies like Toyota, which after 60 years has moved its US headquarters to Texas, or Occidental Petroleum, which after 50 years has left for Houston. Chevron is next. Other stalwarts like ARCO, Getty Oil, Union Oil, Fluor, Calpine and Intel have all
moved in search of a more business friendly environment and lower energy costs. Texas has been the main beneficiary. It has added 200,000 jobs in the energy sector in the past decade while California has barely managed 20,000. Texas leads California in the export of hi-tech goods.

“Big Oil” may be unwelcome in his brave new world, but California’s Governor Jerry Brown is not doing well at replacing jobs and investments lost to the Lone Star state. Brown promised to create 500,000 clean-energy jobs by the end of the decade, but this is now accepted as just a pipe dream.

Meanwhile, in the real world, California’s unemployment rate is 7.4 per cent (fourth highest in the country). It compares to 5.1 per cent for Texas and the national rate of 6.1 per cent. California’s relative joblessness lends weight to the UK Versa Economics study, which found that for every job created in the wind industry 3.7 jobs are lost elsewhere.

While it is America’s biggest economy, (it’s outside the top 10 for growth), California has serious fiscal imbalances with huge off-balance sheet unfunded pension and medical liabilities. To achieve a surplus this year, it borrowed $500 million from the state’s cap-and-trade emissions reduction program. It remains the country’s highest taxer.

This is not a strong position from which to pursue growth-limiting green policies. San Francisco and LA are already the most expensive cities in the US to
create a startup. In its agricultural and manufacturing regions, one person in five lives in poverty. Economist John Husing observes, “California’s green-energy fixations are widening an ever-growing chasm based on geography, class and race”.

Yet, with electricity prices already 40 per cent above the national average and twice as high as Texas, its aggressive policies are set to push up prices 47 per cent in real terms over the next 16 years. Is this really what the Baird government wants?

California is not alone in experiencing significantly adverse unintended consequences from large-scale integration of renewable power. Europe, too, has learned that it increases costs to consumers, leads to unreliable electricity supply, relegates base-load generators to inefficient back-up services and yields problematic emissions reduction. The European Commission has been forced to acknowledge the macroeconomic effects are just too negative, particularly for manufacturing industries and job creation.

As in California, energy poverty in Europe is a growing green phenomenon. So, in deference to reality, the EC has approved new guidelines for renewable energy which will see the removal of all feed-in tariffs from 2017. Previous support mechanisms will be replaced by technology agnostic auctions, which will effectively create a level playing field for all generators. This poses a serious threat to further investment in renewables.
The financial markets are alive to this. Last year, *The Economist* ran a story (“How to lose half a trillion euros. Europe’s electricity providers face an existential threat”) highlighting the dreadful performance of utility stocks.

A recent article in the *Financial Times* was headed “Private equity retreats from renewables fad” with CalPERS, the world’s sixth largest pension fund, admitting to annualised losses of 12 per cent from this sector. CalPERS’s chief investment officer describes clean tech as “a noble way to lose money”.

Last December, ratings agency Fitch warned: “The outlook for the overall renewables sector is negative. This reflects increased political risk and the expectations that the industry will need to adapt to less favourable operating requirements and economic incentives.”

Windfarm operators are warning they will abandon the Australian market if the Renewable Energy Target is adjusted downwards to a true 20 per cent from what has become in reality a 27 per cent to 28 per cent target. This is a measure of their rent-seeking dependence. But NSW is indicating that, regardless, it will stay with the old RET.

It is an extraordinary stance to take at such a late stage, especially given the compelling evidence against it. It will certainly set back planned reform of the national economy, already beset with too many self-imposed rigidities.
While NSW will offer fresh opportunities to Queensland and Victoria, there will be national fallout as our biggest state comes to grips with the economic and social consequences of its actions.

However strong Mr Stokes’s faith in green delusions, belief and enthusiasm are insufficient grounds for him and his government to find noble ways to squander pensioners’ and taxpayers’ money.

*Maurice Newman is chairman of the Prime Minister’s Business Advisory Council. The views expressed here are his own.*