

1. The Opinion Pages | EDITORIAL

# The Right Lessons From Chernobyl

By THE EDITORIAL BOARD MAY 1, 2014

[http://www.nytimes.com/2014/05/02/opinion/the-right-lessons-from-  
chernobyl.html?\\_r=0](http://www.nytimes.com/2014/05/02/opinion/the-right-lessons-from-chernobyl.html?_r=0)

Twenty-eight years after Unit 4 at the Chernobyl power plant in what was then Soviet Ukraine erupted into a volcano of radioactivity, its name has become synonymous with the nightmarish side of nuclear power. It is also the site today of an extraordinary international project, the construction of a vast steel shield to cover the leaky concrete “sarcophagus” in which the highly radioactive remains of the reactor are to be entombed for at least 100 years.

The construction of what is called the New Safe Confinement by an international team of engineers and workers is already almost a decade behind schedule, and current plans call for it to be completed by 2017. Given the decrepit state of the sarcophagus, it is a race against time. Add to that the uncertainty and near-bankruptcy of Ukraine, and Chernobyl continues to stand as a fearsome testament to the dangers of nuclear power — more powerful than Three Mile Island before it or Fukushima after it.

Yet it is also noteworthy that these civilian nuclear disasters did not and have not overcome the allure of

nuclear power as a source of clean and abundant energy. Only Germany succumbed to panic after the Fukushima disaster and began to phase out all nuclear power in favor of huge investments in renewable sources like wind and sun. One consequence has been at least a temporary increase in greenhouse emissions as Germany has been forced to fire up old coal- and gas-powered plants.

The dangers of nuclear power are real, but the accidents that have occurred, even Chernobyl, do not compare to the damage to the earth being inflicted by the burning of fossil fuels — coal, gas and oil. The latest [dire warning](#) from the Intergovernmental Panel on Climate Change should leave no doubt that reducing carbon emissions must be an urgent priority and that nuclear energy must be part of the mix.

It leaves no doubt, either, that the world must do what it can to increase energy efficiency and harness sun, wind, ocean currents and other renewable sources to meet our ever-expanding needs for energy. But the time when these can replace all fossil and nuclear fuels is still far off, and in the meantime nuclear energy remains an important means of generating electricity without adding to the steadily increasing concentration of greenhouse gases in the atmosphere.

For much the same reason, the Center for Climate and Energy Solutions, an independent group formerly known as the Pew Center on Global Climate Change, urged policy makers this week to pay attention to the withering away of America's fleet of 100 nuclear reactors. In the past year and a half, four power companies have announced the early retirement of five nuclear reactors, which supplied 4.2 percent of America's total nuclear generating capacity. Two are in California and one each in Florida, Wisconsin and Vermont. Another company is considering closing as many as three financially struggling reactors in Illinois.

The reasons for the shutdowns vary. In some cases, competition from cheap natural gas and from nearby wind farms has forced reactors to operate at a loss. In other cases, a marginal plant's economic viability has been jeopardized by the cost of replacing steam generators to extend the life of a plant or by the cost of upgrading safety systems to meet new requirements imposed after the disaster in Fukushima.

Whatever the reasons, these sobering trends, if left unattended, will make it harder for the United States to meet its goal of reducing carbon emissions by 17 percent below 2005 levels by 2020. The center notes that since 1990 nuclear power has consistently supplied about one-fifth of the nation's electricity and more than 60 percent of all zero-carbon electricity.

The watchword here and in the world at large should be prudence. Prudence in the design, maintenance and operation of all nuclear facilities. Prudence also in the sense that policy makers not be spooked into shutting down a vital source of clean energy in a warming world. The great shield over Chernobyl should also entomb unfounded fears of using nuclear power in the future.

## 2. Livermore ends LIFE

David Kramer

Physics Today

April 2014

<http://scitation.aip.org/content/aip/magazine/physicstoday/article/67/4/10.1063/PT.3.2344>

Lawrence Livermore National laboratory has quietly shelved a program that was developing a design for a plant that generates electricity from laser fusion.

(The complete article can be purchased).

3.

**Power Engineer - Nuclear Power**

## **Europe continues fusion reactor funding**

<http://www.engineerlive.com/content/europe-continues-fusion-reactor-funding>

**The ITER experimental fusion reactor has secured funding to take it to the operational level. Sean Ottewell reports.**

Following the European Parliament's endorsement of the EU budget for the next seven years, a research budget of EUR80 billion has been secured. Part of this will ensure funding until at least 2020 for ITER, the thermonuclear experimental reactor currently under construction by the ITER International Fusion Energy Organisation at the Cadarache facility in the city of Saint-Paul-lès-Durance in south-eastern France.

A fusion reactor is an apparatus that takes the enormous volume of fusion energy generated when light atomic nuclei in the reactor's fuel, such as deuterium and tritium, fuse in a plasma environment to become heavier nuclei such as helium. The energy

released by this reaction is used to generate power.

Seven partners are participating in this large-scale international project: Japan, the EU, the US, Russia, Korea, China and India. Start-up is planned for 2020.

The funding agreement has been welcomed by Tim Hender, fusion programme manager at Culham Centre for Fusion Energy (CCFE) in the UK. The centre has gained long experience in fusion reactions with its JET and MAST tokamak reactors. "This is good news for European fusion research, for JET and, of course, for CCFE. JET and MAST can continue to address key issues for ITER and the planned work will also make significant strides in developing the DEMO prototype fusion power plant," he said.

Key to the success of ITER is the series of toroidal field (TF) coils around the central vacuum vessel. These form a magnetic 'cage' that confines and shapes the hot plasma (Fig. 1).

CCFE has gained experience of these with its MAST and JET work, but the coils on ITER will be much larger and create a stronger magnetic field. Any failure here could be catastrophic.

Based on its work on the back-up systems it has

developed, CCFE has won a contract from ITER to update its magnet failure predictions systems.

"My role is to look at the 'what ifs'," said project leader Shangliang Zheng. "If a magnet fails, what effect will there be on the current and temperature? What will the consequences of thermal damage be? Recent advances in computing mean we're able to run more detailed scenario models so ITER can build on the comprehensive plans they already have in place."

In addition to the obvious need to guard against accidents, there is another, more immediate reason for carrying out the work. If French nuclear regulators are not satisfied that all safety questions continue to be fully addressed, they have the power to step in and halt design and construction of the magnets, which would be a setback for the whole ITER project.

"It makes sense to get as much information as we can about the risks, however minimal," says Zheng. "With something as important as this, prevention is far better than cure."

Another beneficiary of the ongoing funding is Mitsubishi Heavy Industries (MHI). The company has received an order from the Japan Atomic Energy Agency

(JAEA) for the manufacture of two TF coils. The JAEA is the Japan's designated domestic agency for the ITER project and this is the third order that it has placed with MHI for TF coils. The ITER is to be configured from a total of 19 TF coils, including one in reserve, of which Japan has been contracted to provide nine.

MHI's role in the manufacture of Japan's TF coils is to provide the plates for inserting the superconductors and the containers to hold the actual coils. Mitsubishi Electric Corporation is in charge of producing the coil winding packs.

JAEA has been undertaking development of fusion reactors since the 1960s, and MHI has been participating in this effort from an early stage. To date the company has taken responsibility for developing and manufacturing many related devices, including the JT-602, a core apparatus within Japan's own fusion research and development programme.

In other developments, ITER's council has approved a proposal that operations will commence with a full beryllium and tungsten divertor (inner wall). The original plan was to use a carbon-fibre divertor that would have been replaced during the second phase of operations with a beryllium/tungsten solution. This significant

decision, which will result in cost savings of hundreds of millions of Euros for the project, comes after more than two years of R&D on the tungsten divertor that was supported by successful experiments and testing carried out in the Institute of Electrophysical Apparatus in St Petersburg, Russia, and on the European Tokamak JET at Culham.

In addition, the ITER test convoy - an 800 tonne trailer replicating the dimensions of ITER's largest and heaviest component loads- has successfully travelled the 104 km required from the site of manufacture to Saint-Paul-lès-Durance in order to assess the route. This successful precursor paves the way for the deliveries of actual ITER components which will begin this summer.

### **UK offers £13 million for nuclear technologies**

The UK's Nuclear Decommissioning Authority (NDA) has joined with other public bodies to open up opportunities for UK businesses, offering a total of up to £13 million investment for new technologies covering new build, current operations and decommissioning.

The collaboration is aimed at helping UK-based businesses take advantage of the opportunities arising following the recent agreement on Hinkley Point C, the

first nuclear power station to be built in the country for almost 20 years.

The funds will be made available this year as part of a drive to grow a robust, sustainable UK supply chain through the development of innovative products and services for the nuclear sector. The initiative will focus on key technology areas such as construction, manufacturing, operation, maintenance, and decommissioning and waste.

Business and energy minister Michael Fallon said: "We are committed to nuclear power as part of the low carbon mix of our future energy supply. And through our nuclear industrial strategy we are working in partnership with industry to grasp the multi-billion pound long-term opportunities for UK companies and for thousands of highly skilled jobs. We want to build a robust UK based supply chain for existing and future nuclear power stations."

In 2012, £18 million was invested in nuclear R&D through a partnership between the TSB bank, NDA, the Department of Energy and Climate Change (DECC) and the Engineering and Physical Sciences Research Council (EPSRC). The 35 projects, which received funding following a competitive submission process, are

ongoing.

4. 6 May 2014

## Hinkley Point nuclear power contract 'may be invalid'

<http://www.bbc.com/news/uk-politics-27291087>

**The contract for building the UK's first nuclear power station in a generation might not be "valid", a leading legal academic has warned.**

Former Liberal Democrat MP David Howarth, who lectures at Cambridge, said the deal with EDF over a plant at Hinkley Point could be seen as an "unjustifiable subsidy" under EU law.

The contract fixes a price for energy provided if the scheme goes ahead.

The government said the deal was "robust" and would give a "fair deal".

The government announced last autumn that EDF, a French firm, would lead a consortium to build the Hinkley Point C station in Somerset, expected to supply around 7% of the UK's electricity.

The company and ministers agreed a "strike price" of £92.50 for every megawatt hour, almost twice the current wholesale cost of electricity.

But Mr Howarth told BBC Radio 4's Today programme there was a "problem with whether this is a valid contract at all".

He argued that, under EU law, its terms could be described as an "unjustifiable subsidy" and that "because the system doesn't allow for non-British generators to come within it, it might be a violation of the basic principle of EU law of freedom of movement of goods".

Mr Howarth added that English law could also be violated, as "the contract simply says what price it will get if it happens to supply a nuclear power station", rather than compelling the company to build one.

Setting the price paid for the energy produced could also undermine the "long-standing legal doctrine that contracts which unduly bind the future discretion of governments to act in the public interest are void as being against public policy".

"It's quite possible that a contract of this size, over a period of 40 years, might find itself being caught by it," he added.

But Tim Yeo, the Conservative MP and chairman of the Commons Energy and Climate Change Committee, said Mr Howarth, who stood down as an MP in 2010, was "mistaken".

He added: "Building a nuclear power station isn't like buying ice cream for the school lunch. It's a very long-term business and requires an investment of probably £10bn, on which probably not a penny of income will be received for at least six years.

"So there has to be a pretty strong and very long-term contract to get a private investor to do something that's never been done in Britain before. This is to have an entirely privately funded nuclear power station."

He added that EDF was a French firm and that efforts were being made to encourage a freer transfer of energy across borders within the EU.

The government estimates that energy bills will be £77 lower by 2030.

A Department of Energy and Climate Change spokesman said: "Last year's agreement of principles is robust, presents a fair deal for consumers, is in line with electricity market reform and we are confident it will meet EU tests on state aid.

"There is no final contract for Hinkley Point C yet. As we negotiate that contract, we are taking strong legal advice at every step."

He added: "The reasons to invest in home-grown energy sources like nuclear, renewables and carbon capture storage have never been clearer. We must reduce our reliance on foreign imports and protect bill-payers from shocks caused by volatile world markets, by securing long-term investment in British energy security."

Chinese companies China National Nuclear Corporation and China General Nuclear Power Corporation will be minority shareholders in the Hinkley Point project.

## 5. **New student organization aims to educate, achieve nuclear fusion**

[http://www.purdueexponent.org/campus/article\\_19499f78-e100-5aa2-b0b4-af9b376accb9.html](http://www.purdueexponent.org/campus/article_19499f78-e100-5aa2-b0b4-af9b376accb9.html)

Posted: Friday, May 2, 2014 10:00 am

**By AARON KAISER Staff Reporter**

Imagine powering the entire United States for 10,000 years using only the top quarter inch of water from the ocean – this is a future reality made possible with nuclear fusion.

Peter de Vietien, a graduate student studying nuclear engineering, and Chris Smith, a senior in the School of Nuclear Engineering, have begun Purdue's Fusion Awareness Organization to educate Purdue students, local high school students and the general public on the benefits and misconceptions of nuclear fusion.

The organization is also developing a small scale fusion reactor on campus that is expected to be completed by next semester. Often confused with nuclear fission, nuclear fusion is actually much safer and only produces one-thousandth the radioactive waste of nuclear fission.

De Vietien explained the biggest issue with developing nuclear fusion on a commercial scale is a lack of focus and funding.

"There are many different designs (for fusion reactors) but we keep

putting all of our eggs in one basket,” said de Vietien. “There’s 10 different reactors that are very promising but there’s no funding to build them. For all we know, the next generation of one of those 10 could be (successful).”

Nuclear fusion was discovered before nuclear fission, but it was difficult to obtain. It was also easier to weaponize fission, which was a priority during the time each was discovered. De Vietien explained one third of the United States’ budget was allocated to developing fission for the Manhattan Project, and if those funds were spent on researching and creating fusion, it would be commercially produced today.

The benefits of fusion include an unlimited fuel supply, no environmental impact from oil spills, mining or greenhouse gasses and no chance of reactor meltdown. There would also be a reduction in geopolitical conflicts over energy and a huge increase in the difficulty of producing nuclear weapons. A major waste product, helium-3, can also be harvested and sold for around \$50,000 per kilogram due to a world helium shortage.

“What happened at Fukushima is impossible (for fusion),” said de Vietien. “It’s not a technical thing. By the physics of fusion, it’s impossible for (an explosion) to happen.”

The organization also aims to provide public speaking skills for its members so engineers can properly communicate to the public information regarding nuclear fusion. Smith used the Three Mile Island incident, a reactor meltdown in Pennsylvania, as an example of companies providing faulty information.

“Most of the time it was a spokesperson (presenting information), not an engineer. They weren’t telling (the public) what they needed to know,” said Smith. “You’re going to have radiation get into the water, but it’s so small it’s not going to hurt anything. Did (the public) know that? No.”

Norman Augustine, a previous president and CEO of Lockheed Martin, an advanced technology company, recently stated in a Forbes magazine article he believes nuclear fusion could be achieved commercially in 10 years if backed by proper funding and support by the American public. Purdue’s Fusion Awareness Organization hopes to help this vision become a reality.

“People need to understand what the reason for doing this is. It’s a huge investment and you have to know why you’re making that investment ... otherwise you won’t make it,” said de Vietien.

In the future, the Fusion Awareness Organization plans on holding

more seminars, creating YouTube videos, writing Wikipedia entries and finishing the construction of Purdue's small scale fusion reactor. To learn more about the organization and how you can get involved, visit [purduefao.com](http://purduefao.com).

## 6. Nuclear fusion research powers ahead with switch-on of new €1B German reactor

Éanna Kelly, Science|Business

<http://www.sciencebusiness.net/news/76540/Nuclear-fusion-research-powers-ahead-with-switch-on-of-new-€1B-German-reactor>

**It's more than 8 years late and cost more than twice the original budget. But the Wendelstein machine to be unveiled this month provides fresh momentum for fusion research and will complement the ITER project**

On 20 May, the world will witness a welcome staging post in the quest to develop nuclear fusion, when Germany's Max Planck Institute for Plasma Physics switches on the Wendelstein 7-X, an earth-bound machine built to mimic the way in which stars generate energy.

The project is part of the German national fusion research programme but has received significant support at nearly 30 per cent of the total cost from the EU's Euratom programme.

Despite its schedule slipping eight years, from 2006 to 2014, and the cost doubling from an original €500 million to more than €1 billion, the anticipation among fusion scientists is palpable.

Eventually, it is hoped, the Wendelstein 7-X will provide a baseline for a future commercial power plant that like the sun and the stars derives energy from the fusion of atomic nuclei.

Encased in a chamber and surrounded by high-precision equipment, the Wendelstein 7-X will try to produce a searing hot cloud of hydrogen that will be lashed with electricity and radiation.

The result will be the tremendous heat and energy of a synthetic star – more than ten times hotter than the sun's core – and controlled by superconducting magnets, because no physical item could hold such a thing.

"It's the culmination of a fascinating physics story," said Andreas Dinklage, scientist at Max Planck and project leader for Europe's fusion association (EUROfusion).

It's also something of a comeback: the Wendelstein 7-X belongs to a class of fusion devices called stellarators which reigned supreme from the 1950s to

the 70s. They fell out of favour as a result of the remarkable success of a reactor type called the tokamak, used today in the world's largest fusion experiment, the International Thermonuclear Experimental Reactor (ITER).

Why is the stellarator back? The scientific director of Wendelstein 7-X, Thomas Klinger, once described both machines as, "terrible beasts."

"Ours is a beast to build; [the tokamak] is a beast to operate," he said.

While there are different routes to nuclear fusion there is one common difficulty: how to master the extremely punishing conditions needed for it to work.

Whether you're working with a tokamak or a stellarator, learning the long list of do's and don't's from the Wendelstein 7-X experience will be invaluable for the fusion community, says ITER's chief physicist, David Campbell.

"There's a lot of cross-fertilisation. Testing the software they developed for simulating plasma behavior against what we've got will be interesting and useful," he said. "On the engineering side, it's going to be interesting to learn from their operational experience too."

### **The rocky road to fusion**

The Max Planck Institute of Plasma Physics named its machine Wendelstein after a 1,838-metre high mountain in the Bavarian Alps. For many, the association with an uphill climb is apt: fusion has remained stubbornly elusive.

The most audacious fusion reactor, ITER, currently under construction in Southern France, has been falling behind schedule and running over budget almost since it began.

After decades of preparation, it's due to clock in as the most expensive scientific instrument ever assembled, with some €15 billion already spent. In March, Stefano Chicchio, ITER's head of design integration, told the New Yorker magazine that even a delay of a day costs close to €1 million.

Complicated physics and engineering is one thing but then there's the effort of coordinating it all. Organising big science is a big challenge.

With ITER, especially so. None of the thirty five partners has full control of the complex jigsaw, and there is no overall central budget. As a model for future scientific cooperation, many suggest ITER's makeshift structure is best avoided. It even requires its own currency – the ITER unit of account.

"We have a pretty established framework in Europe for international research," says Campbell. "When you take it and extend it, it's more complex. With ITER, we're implementing a large scale project under a novel organisational structure."

Despite its difficulties, the painstaking work of ITER's scientific installation continues. Construction is being geared towards 2020 – when experiments are due to start. Fusion fuels will be added in 2027 after years of testing.

“The whole manufacturing experience can throw up some issues – assembly is quite a challenge when components are coming in from all over the world,” admits Campbell, “but we have a lot of design under our belts already.”

### **Widening the debate**

The supporters of ITER take a different view on costs and delays in nuclear fusion’s research.

Some commentators note that fusion’s ballooning costs are dwarfed by global subsidies to renewables, of \$45 billion dollars, and subsidies to fossil fuels, of some \$500 billion.

There will also be environmental benefits. Fusion is a clean energy, generating no carbon dioxide and only small amounts of radioactive waste.

There’s also a built-in negative effect of a public support that waxes and wanes on ITER and this can affect the whole fusion enterprise, says Dinklage.

“Fusion is frequently accused of taking too long – this may become a self-fulfilling prophecy with policymakers delaying funding decisions,” he said.

### **Fusion funding in good nick**

But overall, scientists appear happy with the level of planning and money the EU is bringing to the table.

“EU funding is at a pretty healthy level,” said Campbell. He’s particularly happy that Europe is already laying the basis for life after ITER. “There’s a very forward looking perspective. They’re even looking beyond ITER to DEMO [DEMONstration power plant] in 2040,” he adds.

“Funding from the EU is adequate,” agrees Duarte Borba, senior adviser in the widely-praised JET (Joint European Torus) tokamak project. “For the longer term, my opinion is that fusion coming to the market will obviously require a step-up in funding and investment from industry though.”

In Horizon 2020, the EU’s largest research programme, €636 million is set aside for nuclear fusion research. A separate pot of €2.5 billion is earmarked for ITER.

The newly created EUROfusion consortium, the umbrella organisation of Europe’s fusion research laboratories, is charged with manning the EU’s fusion research coffers: the so-called Euratom funding.

The European Commission says the rationale for creating EUROfusion is to bring about an, “even more effective pooling of national research efforts” for, “increasingly complex and large-scale projects” like ITER.

## **7. Renewables pave path to**

# poverty

BJORN LOMBORG  
THE AUSTRALIAN  
APRIL 29, 2014 12:00AM

<http://www.theaustralian.com.au/opinion/columnists/renewables-pave-path-to-poverty/story-fni1hfs5-1226898730123#>

**THE Australian government recently released an issues paper for the review of the renewable energy target. What everyone engaged in this debate should recognise is that policies such as the carbon tax and the RET have contributed to household electricity costs rising 110 per cent in the past five years, hitting the poor the hardest.**

A Salvation Army report from last year found 58 per cent of low-income households were unable to pay their electricity bills on time. Lynne Chester of the University of Sydney estimated last year that 20 per cent of households are now energy poor: “Parents are going without food, families are sitting around the kitchen table using one light, putting extra clothes on and sleeping in one room to keep warm, and this is Australia 2013.”

What is true in Australia is true globally. According to the UN Secretary-General Ban Ki-moon, “Climate change harms the poor first and worst.” But we often forget that current policies to address global warming harm the world’s poor much more.

Solar and wind power was subsidised by \$65 billion in 2012. And because the total climate benefit was a

paltry \$1.5bn, the subsidies essentially wasted \$63.5bn. Biofuels were subsidised by another \$20bn, with -essentially no climate benefit. All of that money could have been spent on healthcare, education, better roads or lower taxes.

Forcing everyone to buy more expensive, less-reliable energy pushes up costs throughout the economy, leaving less for other public goods. The average of macroeconomic models indicates the total cost of the EU's climate policy will be \$US310bn a year from 2020 until the end of the century.

The burden of these policies falls overwhelmingly on the world's poor, because the rich can easily pay more for their -energy. In the US, well-meaning and well-off environmentalists often cavalierly suggest petrol prices should be doubled or electricity exclusively sourced from high-cost green sources.

That may be OK in affluent suburbs, where residents reportedly spend just 2 per cent of their income on petrol. But the poorest 30 per cent of the US population spends almost 17 per cent of its after-tax income on petrol.

Similarly, environmentalists boast that households in Britain have reduced their electricity consumption almost 10 per cent since 2005. But they neglect to mention that this reflects a 50 per cent increase in electricity prices, mostly to pay for an increase in the share of renewables from 1.8 per cent to 4.6 per cent.

The poor, no surprise, have reduced their consumption by much more than 10 per cent, whereas the rich have not reduced theirs at all.

Over the past five years, heating a home has become 63 per cent more -expensive in Britain while real wages have declined. About 17 per cent of households are now energy-poor — they have to spend more than 10 per cent of their income on energy; and, because the elderly are typically poorer, about a quarter of their households are energy poor. Pensioners burn old books to keep warm because it is cheaper than coal; they ride on heated buses all day, and a third leave part of their homes cold.

In Germany, where green subsidies will cost \$US35bn (\$37.6bn) this year, household electricity prices have increased 80 per cent since 2000, causing 6.9 million households to live in energy poverty. Wealthy homeowners in Bavaria can feel good about their inefficient solar panels, receiving lavish subsidies essentially paid by poor tenants in the Ruhr who cannot afford solar panels, but still have to pay more for power.

In Greece, where tax hikes on oil have driven up heating costs 48 per cent, more and more Athenians are cutting down park trees, causing air pollution from wood burning to triple.

It is even worse in the developing world, where three billion lack access to cheap energy. They cook and keep warm by burning twigs and dung, producing

indoor air pollution that causes 3.5 million deaths a year — by far the world’s biggest environmental problem.

Access to electricity could solve that while allowing families to read at night, own a refrigerator or use a computer. It would also allow businesses to operate more competitively, creating jobs and economic growth.

Consider Pakistan and South Africa, where a dearth of generating capacity means recurrent blackouts wreak havoc on businesses and cost jobs. Yet funding new coal-fired power plants in both countries has been widely opposed by well-meaning Westerners and governments.

Instead, they suggest renewables. This is hypocritical. The rich world gets just 1.2 per cent of its energy from hugely expensive solar and wind technologies, and we would never accept having power only when the wind was blowing. In the next two years, Germany will build 10 coal-fired power plants.

In 1971, 40 per cent of China’s energy came from renewables. Since then it has lifted 680 million people out of poverty using coal. Today, China gets a trifling 0.23 per cent of its energy from wind and solar. Africa gets 50 per cent of its energy today from -renewables — and remains poor.

New analysis from the Centre for Global Development shows that, investing in renewables, we

can pull one person out of poverty for about \$US500.

But, using gas electrification, we could quadruple that. By -focusing on our climate concerns, we deliberately choose to leave more than three out of four people in darkness and poverty.

Addressing global warming requires long-term innovation that makes green energy affordable. Until then, wasting enormous sums of money at the expense of the world's poor is no solution at all.

## 8. **Russia awards icebreaker contracts**

09 May 2014

**The Baltiysky Zavod shipyard is to build Russia's next two LK-60 nuclear icebreakers after being the sole company to submit an acceptable tender in an open competition.**

<http://www.world-nuclear-news.org/NN-Russia-awards-icebreaker-contracts-0905147.html>

Baltiysky Zavod is already working on the first LK-60, the *Arctica*, for which the keel was laid in November 2013. The tender competition announced by Rosatom in January 2013 called for the second and third LK-60s to be completed in 2019 and 2020 respectively. At the time, the cost of the second LK-60 was expected to be RUB 42 billion (\$1.2 billion), with the third expected to cost slightly more to allow for inflation, at RUB 44 billion (\$1.3 billion).

Rosatom has now declared Baltiysky Zavod's bid to be the sole entry consistent with the requirements of the tender and therefore the winner of the contract, according to a statement released by the shipyard.

The three LK-60 icebreakers, including the *Arctica*, come under Rosatom's Project 22220. Described as the largest and most powerful icebreaker in the world, the *Arctica* will be equipped with two 175 MW RITM-200 reactor units delivering about 60 MWe of power to the ship's propellers. It is due to be completed by the end of December 2017. The 173m-long vessel will be able to sail through ice up to 3m thick, making it suitable for operation in Arctic

waters and in the mouths of Russia's most northerly rivers. Their suitability for use in both the open sea and in rivers has led to the LK-60 type being dubbed "universal" icebreakers.

*Researched and written by World Nuclear News*

## 9. Landmarks for Chinese reactors

28 April 2014

<http://www.world-nuclear-news.org/NN-Landmarks-for-Chinese-reactors-2804147.html>

The 168-hour test-run at China General Nuclear Power Corporation's (CGN's) Ningde 2 is the last of a series of online operational exercises before the 1020 MWe unit begins full-power operations. The CPR-1000 pressurized water reactor was connected to the grid in January, and will be one of four at the site in north-east Fujian province, co-owned by CGN (46%), China Datang Corp (44%) and Fujian Energy Group (10%).

Ningde 1 entered commercial operation in 2013, and Ningde 3 and 4 are expected to begin operations in 2014 and 2015 respectively. Meanwhile, CGN has announced that Hongyanhe 2 has reached 100% power for the first time. The unit, also a CPR-1000, was declared in commercial operation in February after being connected to the grid last November.

Hongyanhe is owned and operated by Liaoning Hongyanhe Nuclear Power Co, a joint venture in which CGN holds a 45% stake alongside China Power Investment Corp (45%) and Dalian Municipal Construction Investment Co (10%). Two further units at the site are expected to start up by the end of 2015.

*Researched and written by World Nuclear News*

## 10. Taking on Fukushima

02 May 2014

<http://www.world-nuclear-news.org/WR-Taking-on-Fukushima-0205141.html>

**One month after being put in charge of decommissioning Fukushima Daiichi, Naohiro Masuda talked to *World Nuclear News* about his priorities for the site and its workforce.**

Masuda was superintendent of the Fukushima Daini nuclear power plant at the time of the Great East Japan Earthquake and tsunami. Under plant blackout conditions Masuda and his staff systematically repaired equipment to safely bring all four reactors to cold shutdown. Tepco has acknowledged that his 'decisive actions' in the

crisis 'were credited with avoiding an accident' - under Masuda's leadership the entire Daini staff worked to restore grid power by laying an 8.8 kilometre heavy-duty cable by hand in a single day. Now appointed head of the Fukushima Daiichi Decontamination and Decommissioning Company, Masuda is equally direct in setting his priorities: "Our promise to the prime minister of Japan is that we should reduce the risk this financial year [ending March 2015]. My target is that point."

This means eliminating leaks from the tanks holding water that has been contaminated by being used to cool the reactor remains, and getting better performance from the decontamination systems. Some 480,000 cubic metres of this water must be processed by the deadline. Uncontrolled contamination of groundwater also remains a problem and a water bypass needs to be set up, while research continues on the best ways to freeze the ground and prevent groundwater being contaminated.

Masuda said, "In the first place, I put my effort on improving site conditions so that the site would not cause any threat to society even if something unexpected happens." In parallel, he must guide Fukushima Daiichi and its staff through a transition for long-term cleanup. The staff need to update their mindset from operation of a clean power plant to decommissioning of a highly complex site.

"We should become conscious that the status is very different," he said. Tepco had long experience of operating a fleet of 17 reactors, so a task like transferring some water, for example, "is easy - because we have manuals and numbered valves and we can easily follow the procedure. And if anything goes wrong - a defect or a rupture - the facility maintains integrity because we have a containment dam to stop release to the environment and we have alarms etc. We have good reliability."

"In normal operation we can understand the equipment and the relative importance of each part. But now, the facility is dramatically changed. We use a temporary tank and plastic piping for transfer of much higher contaminated water and in case of a rupture the water could reach the environment immediately."

The components that form the backbone of nuclear safety in an operating power plant - for example the primary circuit pumps or the reactor pressure vessel - are now irrelevant. "The temporary tank is the important thing now, but the mindset has not yet changed. I tell them every day!"

The second part of Masuda's transition should take the site from "fire-fighting" mode to a steady mode for the long term. "In three years our staff has made a big effort and improved the facilities to stabilise the plant. I appreciate and respect that very much. Now we should change the mindset to one of a stable state. We will use these facilities for the next 30-40 years and set up good procedures

and manuals for that timescale. At present we have a risk of leaks to sea and we should protect against those and improve reliability."

## **The Fukushima 5000**

Supporting the Daiichi staff is important to Masuda. He is establishing a nine-storey building where some 1200 workers can rest at once, and he wants to reduce the use of full-face masks where he can. These masks have a range of effects: they are used to reduce internal radiation dose, but they slow down work hugely and lead to problems with communication and the quality of work done. Properly zoning the use of masks is Masuda's top priority to improve conditions for staff. He will also increase Tepco's oversight of contractors and change the scope of workers' contracts to longer terms of two to three years, giving them more job security and giving him flexibility to combine higher- and lower-dose work. "We must emphasise safety culture in everything we do," he said, "both to protect the workers and to remove distractions from their ability to safely perform the complex task at hand."

The new arrangement, where Masuda's decommissioning company is a subsidiary of Tepco and separate from its power generation business, means that "organisational responsibilities and objectives are now very clearly defined." He is pleased that he can "work more closely with local communities and make decisions faster."

"I thank Hamadori [the coastal portion of Fukushima prefecture] for my personal growth as well as my growth as an engineer with Tepco. I deeply regret and feel sorry for forcing people in the region to evacuate their hometowns. I am going to communicate with them in an understandable manner, based on what local communities would like to know."

*By Jeremy Gordon for World Nuclear News*

## **11. UK and Japan join forces on nuclear energy**

01 May 2014

<http://www.world-nuclear-news.org/NP-UK-and-Japan-join-forces-on-nuclear-energy-0105147.html>

**Nuclear energy has been highlighted as a key area for increased cooperation between the UK and Japan as the two countries pledge to work together to tackle climate change and energy security in the run-up to the next meeting of G7 energy ministers.**

In a joint statement issued at the start of a two-day visit to the UK by Japanese prime minister Shinzo Abe, the two nations recognise the "severity" of the challenge posed to the world by climate change. Citing the findings of the Intergovernmental Panel on

Climate Change's (IPCC's) Fifth Assessment Report, the statement says that the UK and Japan share the view that "ambitious" action is needed at the national and international level to combat the "urgent and potentially irreversible threat" posed by climate change.

To that end, the two countries wish to promote public and private sector cooperation, emphasising the need for investment in a "diverse, efficient and clean energy mix" to ensure both emissions reductions and security of energy supplies. The low-carbon policies vital for achieving these goals also bring economic opportunities, and the two governments have said they will continue to "maximise" UK-Japan commercial partnerships in the growing global low-carbon services and goods sector which they estimate to be worth \$5 trillion per year.

The statement recognises the jointly-held beliefs of Japan and the UK that nuclear energy provides a "consistent and affordable" source of energy and has a key role in the future low carbon energy mix. It welcomes the "significant investment from Japanese industry, notably Hitachi and Toshiba", in the UK's nuclear new-build program. Horizon Nuclear Power, owned by Hitachi since late 2012, plans to build new Advanced Boiling Water Reactor (ABWR) plants in the UK at Wylfa and Oldbury, while Toshiba owns a 60% stake in the NuGen consortium which is proposing to build AP1000 reactors at a new site at Moorside in north-western England.

Japan and the UK have a long-standing history of nuclear cooperation dating back to the 1960s, and hold an annual bilateral Nuclear Dialogue, which has led to extensive cooperation over the years. The statement recognises ongoing developments through the dialogue leading to close collaboration, cooperation and information exchange in areas ranging from nuclear research to regulatory regimes, communication practices and nuclear decommissioning. Energy security was reaffirmed by the G7 group of countries as a priority during their last round of meetings, held in The Hague in March, when it charged G7 energy ministers to meet to discuss ways to strengthen the group's collective energy security. The next round of G7 meetings is to be held in Brussels in June, and the UK-Japanese statement notes that the two intend to cooperate closely both leading up to and beyond the meeting of the energy ministers.

*Researched and written by World Nuclear News*

## **12. Nuclear bond between France and Japan**

06 May 2014

<http://www.world-nuclear-news.org/NP-Nuclear-bond-between-France-and-Japan->

[0605141.html](#)

**Nuclear power remains important for France and Japan, the leaders of both countries have affirmed. The nations will cooperate on future reactor technology, while French and Japanese companies pursue commercial nuclear opportunities.**

Nuclear power policy has been completely revised in Japan since the accident at Fukushima Daiichi, eventually resulting in the conclusion that nuclear would remain an important source for the country. In France a nationwide consultation has taken place on a potential 'energy transition' which is likely to mandate a big increase in renewable energy. What this means for nuclear, which already supplies 75% of electricity with low cost and low environmental impact, remains to be seen when new policies are announced later this year.

Despite the uncertainty French President Francois Hollande announced: "We reached agreement, because nuclear energy will remain important for us in the future." He added, "We are committed to Generation IV nuclear reactors."

This refers to reactor technology in advance of that widely deployed now at power plants, which would give gains in fuel efficiency, waste management, economics and safety. But despite this technological path being mapped out for nuclear power decades ago, much research remains.

Japanese prime minister Shinzo Abe named the Astrid (Advanced Sodium Technological Reactor for Industrial Demonstration) project as one area where Japan, through the Japan Atomic Energy Agency, would cooperate with France, through the CEA. The 600 MWe Astrid prototype would operate from about 2025, with a series of 1500 MWe units to follow. They would be fuelled by depleted uranium and plutonium in mixed-oxide fuel.

Two commercial nuclear interests were represented by France's willingness to offer goods and services to Japan in its mission to clean up and decommission Fukushima Daiichi, and that companies from both countries are jointly pitching to build new reactors in Turkey.

A package based on the Atmea1 design, from Areva and Mitsubishi Heavy Industries, is in the late stages of negotiation for build at Sinop in Turkey. Apart from the Franco-Japanese design, the plant would be operated by GDF Suez with equity from Itochu. The same design is to be put forward for projects in Vietnam, said Hollande, apparently referring to Vietnam's nuclear power plant project at Vinh Hai, where four units are planned to start in the 2020s.

### **Decommissioning joint venture**

During Abe's visit a joint venture company was created between

Areva and Japan's Atox to focus on decommissioning and dismantling Japanese nuclear power plants. Areva said it would "provide its know-how and technology in the field of decommissioning while Atox... will adapt the solutions proposed by Areva to the specific needs of Japan." Atox has developed a heavy involvement in work at Fukushima Daiichi on top of its previous business areas of nuclear power plant maintenance, radioactive waste disposal and decommissioning.

*Researched and written by World Nuclear News*

## 13. **Obama touts energy plans, W. House trumpets solar panels**

**David Jackson, USA TODAY** 2:24 p.m. EDT May 9, 2014

<http://www.usatoday.com/story/news/nation/2014/05/09/obama-council-on-environmental-quality-michael-boots/8856363/>

President Obama promoted new plans Friday designed to boost solar power and promote energy efficiency, saying both will reduce the environmental threats from climate change.

"There are cost-effective ways to tackle climate change and create jobs at the same time," Obama said during a visit to a Wal-Mart in Mountain View, Calif., near San Jose.

White House officials said Obama's commitment begins at home, as they announced the completion of solar panels on the White House roof. Spokesman Matt Lehigh said the panels on the first family's residence are "part of an energy retrofit that will improve the overall energy efficiency of the building."

President Jimmy Carter also installed solar panels at the White House, but President Ronald Reagan had them removed.

Obama's 14-minute speech at the Mountain View Wal-Mart wrapped up a three-day trip to California that involved mostly campaign fundraisers.

The president outlined what aides called some 300 "private and public sector commitments" designed to create jobs and reduce carbon pollution.

The remarks came three days after the administration issued a report saying that climate change caused by pollution is already damaging the environment and triggering extreme weather conditions.

Washington still has "some climate deniers who shout loud, but they're wasting everybody's time on a settled debate," Obama said. "Climate change is a fact."

The initiatives Obama announced Friday include programs aimed at financing new solar business ventures, training and developing a solar workforce, and enforcing new building codes to promote efficiency.

Private companies, including Wal-Mart, are committing to similar projects, the White House said.

The plans are projected to create enough new solar energy to power more than 130,000 homes, and energy savings that are the equivalent of taking 80 million cars off the road for one year, the White House said.

"Cities, schools, businesses, the federal government -- we're all going to pledge to waste less energy and we've got concrete strategies that we know work," Obama said.

And because more American homes and businesses are going solar every day, "solar is getting cheaper and is getting easier to use than before," Obama said.

#### 14. Ontario pilots worried about wind turbines after U.S. crash

<http://london.ctvnews.ca/ontario-pilots-worried-about-wind-turbines-after-u-s-crash-1.1809128>

CTV London

Published Tuesday, May 6, 2014 6:13PM EDT

Fears have re-ignited in southwestern Ontario after a fatal plane crash involving a wind turbine in South Dakota that left four people dead.

Garry Sheperd has been flying for over 30 years. He's a seasoned pilot, and he's not pleased about the wind turbines he's now sharing the skies with.

"The ones we've got coming to our backyards here are 400 feet at present, but the new generation are 500 feet. In Europe they're over 700 feet and it's just a matter of time before there's a conflict."

Four men were killed in April after their plane apparently collided with a wind turbine in South Dakota during foggy weather.

And Sheperd fears that he and his fellow pilots are just as at risk, especially those flying in and out of the Kincardine Municipal Airport, where 10 of 92 soon-to-be-built turbines in the Armow Wind farm could be flight risks.

"We pilots have been adamant that these aircraft and these turbines don't mix."

But the company disagrees, Jody Law of Pattern Energy says, "At Armow, we have worked closely with the federal regulatory agencies to ensure that the project will be in complete compliance with all safety regulations and standards."

In fact, the Armow Wind farm has been approved by all provincial and federal bodies.

But it's not just the size or the fact they are spinning that concerns pilots. Sheperd explains it's an invisible force unique to turbines that can cause problems flying past.

"As the blades turn there are vortices that come off them and rotate downwind...so we're climbing up through that invisible hazard and we shouldn't have to do that."

Eight turbines near the Chatham airport were ordered removed by Transport Canada last June for safety issues, but remain standing.

## 15. Utah a hotbed for nation's geothermal growth in 2013

By [Amy Joi O'Donoghue](#), Deseret News  
Published: Friday, May 2 2014 5:00 p.m. MDT  
Updated: Monday, May 5 2014 1:54 p.m. MDT

<http://www.deseretnews.com/article/865602325/Utah-a-hotbed-for-nations-geothermal-growth-in-2013.html>

SALT LAKE CITY — Geothermal power that came online in Utah and two other Western states helped keep the industry on the map in 2013 in what would have otherwise been a flat year domestically for new geothermal power production.

Enel's Cove Fort geothermal plant in Beaver County began operations late last year, adding 25 megawatts of installed capacity to Utah's renewable energy portfolio.

A recent industry report by the Geothermal Energy Association shows 13 potential geothermal projects in varying stages of development in the state, mostly concentrated in a central Utah cluster.

Ben Matek, an analyst with the association, said the Utah interest eclipses that of many foreign countries.

"The resources in Utah are a good quality resource, with the vast majority of countries having less than 10 projects for potential development. Utah ranks in the top 10 for developing projects," Matek said.

The newly released report notes that geothermal

resources in the tri-state area of California, Nevada and Utah remain largely untapped, with as much as 60 percent of Utah's resource, for example, ripe for development.

The Utah Geological Survey's Rick Allis agrees the potential for more development is promising.

"If you ask where the best potential is in the country, we definitely got that," said Allis, who heads up the survey.

The Utah Geological Survey has been working in conjunction with the state Office of Energy Development on a \$100,000 electrical survey to assess the geothermal potential in the southern Black Rock Desert and Twin Peaks area halfway between Delta and Milford.

Completed in late April, the study now moves into its secondary phase in which the results of the measurements will be analyzed over the next couple of months.

"Bottom line is we suspect there is a very hot zone that extends between Delta and Milford (likely about 450 degrees at 10,000 feet). We know either end is hot because oil exploration wells around 1980 encountered these temperatures at depth," Allis said "We are excited to get a handle on it."

Research on the vast resource was the talk of the industry at the geothermal conference a couple of years ago, and the field continues to draw interest.

"Industry is really interested in what we are doing," Allis said. "We have had a couple of contracts from

the Department of Energy to help us figure out what the geothermal potential is in this area. The size of this inferred resource is large and may be able to generate several hundred megawatts of power."

The problem is the geothermal resource is deep — thousands of feet farther under the surface of the Earth than industry is used to going, Allis said.

"We have to convince the industry of the scale of possible development and that it is economic to drill that deep," he said. "Because it is a little deeper, we have to gradually fill in the jigsaw."

Allis said the ultimate goal is to compile enough exploration data that when the timing is right for industry, they start to look seriously at the Black Rock Desert area for production.

"This is a big resource," he said.

While U.S. production of geothermal energy remains No. 1 in the world — well ahead of the Philippines and Indonesia — other countries are rapidly tapping into the resource as demand for new power sources far outstrips what is needed in the United States.

"The growth in new power demand in the United States is less than 1 percent. There is just not that much demand for new power plants," Matek said. "We see geothermal power coming on rapidly in those countries because of the demand and because of national energy policies."

Overall, the country added 85 megawatts of geothermal capacity last year, bringing the U.S. to

3,442 megawatts. A megawatt is a million watts of power, and a typical U.S. household uses 10,000 kilowatt-hours of electricity in a year.

## 16. **Days After Climate Report, White House Makes Clean-Energy Push**

Following the climate report, the Obama administration announced new investment in energy efficiency and solar programs.

By Alan Neuhauser  
May 9, 2014

<http://www.usnews.com/news/articles/2014/05/09/white-house-unveils-new-solar-energy-efficiency-programs>

From washing machines to light poles to solar arrays, the White House is redoubling its efforts to expand the country's **solar power** capacity and reduce the greenhouse gas emissions that contribute to **global warming**.

On Friday morning, the Obama administration announced a new round of investments in **energy-efficiency upgrades** for federal buildings; new standards for walk-in coolers, freezers, refrigerated display cases and the electric motors that power escalators and elevators; an "Outdoor Lighting Accelerator" to replace more than 500,000 aging light posts in five cities; and a new program to train tens of thousands of community-college students to work in the solar industry.

“The commitments represent more than 850 megawatts of solar deployed – enough to power nearly 130,000 homes – as well as energy efficiency investments that will lower bills for more than 1 billion square feet of buildings,” the White House said in a statement.

The new appliances will also reduce carbon pollution by more than 380 million metric tons, it added, “equivalent to taking 80 million cars off the road for one year.”

The White House made the announcement just four days after the release of the [third U.S. National Climate Assessment](#), a four-year study that found that communities across the country are already experiencing the effects of global warming through more frequent floods, worse droughts, stronger storms, longer allergy seasons and shorter frost freezes, and that the U.S. will need to take drastic action to avert far worse consequences.

The report and this latest announcement also fit within the [Climate Action Plan](#) that President Barack Obama unveiled in June 2013 to address climate change by reducing the country’s carbon footprint. In his State of the Union address in January, Obama [added](#) that he largely intends do so by working through the executive branch, cutting out a Congress that’s been hampered by partisan gridlock.

It’s a theme the White House returned to Friday:

“Obama is committed to making 2014 a year of action and has pledged to use the power of his phone and his pen to expand opportunity for all Americans,” the statement said.

Environmental groups have welcomed the administration’s green efforts.

"We must confront the underlying cause of climate change by cutting carbon pollution, investing in clean energy and saying no to dirty energy," Patty Glick, senior global warming specialist with the National Wildlife Foundation and a co-author of the National Climate Assessment, said in a statement following the

assessment's release Monday.

Industry groups, though, have called the assessment's findings overblown, adding that environmental action could hamper the economy.

Laura Sheehan, senior vice president of communications for the American Coalition for Clean Coal Electricity, lambasted "the misguided priorities of this administration, which are completely out of sync with those of everyday, hardworking Americans – jobs and the economy, not political legacies."

While polls have found that environmental issues do rank low on Americans' list of concerns compared to jobs and national security, they've also revealed that a wide majority does support efforts to reduce global warming, even at some economic cost.

"The report confirms what numerous scientific authorities have been saying: Climate change is fundamentally altering our nation's environment and poses a significant threat to our health and our economy," Kevin Kennedy, director of the U.S. Climate Initiative at the World Resources Institute, said in a statement. "Thankfully, there are solutions available if leaders act quickly to tackle climate change head on."

## 17. **Antarctic wind 'steals our rain'**

DANIEL MERCER The West Australian  
May 12, 2014, 5:20 am

<https://au.news.yahoo.com/thewest/wa/a/23436013/antarctic-wind-steals-our-rain/>

Winds circling Antarctica have sped up over the past 70 years, shielding the continent from the effects of a warming climate but drawing rain away from areas such as southern WA.

Amid long-held questions over why southern Australia was drying out as Antarctica bucked the warming trend, researchers claim to have found the answers.

According to a team of scientists from Australian National University, rising carbon dioxide concentrations in the atmosphere were strengthening storm systems in the Southern Ocean.

The effect was helping to keep Antarctica relatively cool by effectively "trapping" cold air over the icy continent.

However, it was also making southern Australia drier by pulling storm bands that brought winter rains southwards, lead researcher Nerilie Abram said.

"With greenhouse warming, Antarctica is actually stealing more of Australia's rainfall," Dr Abram said.

"It's not good news - as greenhouse gases continue to rise we'll get fewer storms chased up into Australia.

"As the westerly winds are getting tighter they're actually trapping more of the cold air over Antarctica.

"This is why Antarctica has bucked the trend. Every other continent is warming, and the Arctic is warming fastest of anywhere on Earth."

## 18. Back to the future: are we about to crack energy fusion?

Limitless renewable energy from nuclear fusion has been "30 years away" for several decades, but now experts believe they're finally closing in on a self-sustaining reaction

## Duncan Jefferies

theguardian.com, Thursday 8 May 2014 01.40 AEST

<http://www.theguardian.com/big-energy-debate/nuclear-fusion-energy-research>

Can we harness the **energy** of an earth-bound sun? It's a question that has obsessed and perplexed scientists for more than half a century. According to Professor Steve Cowley, director of the Culham Centre for Fusion Energy (CCFE) and chief executive of the United Kingdom Atomic Energy Authority, it remains one of the "great quests" in science.

For the uninitiated, it's the kind of big idea that makes your head spin: we're talking about mimicking the process that powers the stars, heating hydrogen atoms to temperatures in excess of 100 million degrees celsius – the point at which they fuse into heavier helium atoms – and releasing energy in the process.

The creation of a self-sustaining reaction here on earth would be a revolutionary moment for humanity. It would mean we'd have a near-limitless source of energy that is clean, safe and cheap. The fuel used for fusion (two isotopes of hydrogen, deuterium and tritium) is so abundant it will effectively never run out; one kilogram of it provides the same amount of energy as 10 million kilograms of fossil fuel.

And while some fusion reactor components would become mildly radioactive over time, they should be safe to recycle or dispose of conventionally within 100 years, according to fusion experts.

Although the science underpinning fusion research is solid, the amount of energy these reactions produce has yet to exceed the amount needed to instigate them. Breaking through this barrier and achieving a self-sustaining reaction (a process known as ignition) is the holy grail of fusion research.

Some scientists say we'll never reach this point, that fusion power is nothing but an expensive pipe dream. Their scepticism is partly due to the overly optimistic attitude of scientists in the 1950s who, having cracked open atoms, thought they'd also be able to fuse them together in a similar timeframe, with commercial fusion reactors on the grid by the 1970s. But the 70s came and went and

today, by most estimates, we're still another 40 or 50 years away from fusion power.

But Cowley insists real progress has been made over the years. Current research focuses on two means of achieving a fusion reaction: inertial confinement fusion, which uses lasers to compress fuel pellets and create a reaction, and magnetic confinement fusion, which uses magnetic fields to control and contain the extremely hot hydrogen plasma.

A team at the US defence-funded National Ignition Facility (Nif), in California, are working on the laser method. By firing 192 lasers at a fuel pellet the size of a pinhead, and compressing it 35 times to produce the pressure and heat needed to start a fusion reaction, the scientists succeeded in producing slightly more energy than the fuel absorbed from the lasers – a breakthrough after years of setbacks and slipped timescales.

However, the 17 kJ of energy released during the reaction is equivalent to around 1.5% of the energy contained in a Mars bar and the reactor itself still needs much more energy to operate than it produces. Nevertheless, many hailed this finding as a significant step.

Magnetic confinement fusion, arguably the more advanced strand of research, is the basis of the Joint European Torus (JET) experiment, situated at CCFE. In 1997, the JET team achieved a major breakthrough, generating a world record 16MW of fusion power. But, says Cowley, the lack of political interest in climate change relative to today meant their achievement didn't get the attention it deserved – something he hopes to rectify in 2017, when the team will attempt to break their previous record in a new series of tests.

JET's ring-shaped 'tokamak' magnetic confinement chamber design is also at the heart of the International Thermonuclear Experimental Reactor (ITER), a £13bn project which aims to demonstrate that fusion can work at a power plant scale. Construction of the reactor is underway in the south of France, albeit two years behind schedule. A truly international effort, ITER involves 35 nations, many of which are building complex components that are then shipped to France for assembly. Once completed ITER is expected to release 500 MW of power from a 50MW input and, as many hope, might even achieve ignition.

"When Iter gets to self-sustainment that will be one of those moments in science that happen very rarely," says Cowley. "I think we will then be able to say it's completely scientifically possible to make a commercial fusion reactor. The real question then is cost and scale."

Iter has been beset by delays, funding issues and political and administrative problems. As head of communications Michel Claessens says: "The main challenge for the project is not the science and technology itself, but the management as a whole, the way these 35 countries cooperate."

If Iter proves successful in its aims, a prototype commercial reactor will likely be put into production. Ultimately, it could take an Apollo-style push to overcome the barriers to commercialisation of fusion power – something that is more likely to happen if Iter achieves ignition.

But will the political and economic hurdles derail the scientists' work before it can bear fruit? "It can't possibly be that we've got this close and we can't see it through to the end," says Cowley. "Once this problem is cracked, we'll have it [fusion energy] forever. It's just taking a long time to get there."

## 19. **Collapse of Antarctic ice sheet is underway and unstoppable but will take centuries**

[http://www.washingtonpost.com/national/health-science/2014/05/12/70c26750-da00-11e3-b745-87d39690c5c0\\_story.html](http://www.washingtonpost.com/national/health-science/2014/05/12/70c26750-da00-11e3-b745-87d39690c5c0_story.html)

By Darryl Fears, Published: May 13

The collapse of the giant West Antarctica ice sheet is underway, two groups of scientists said Monday. They described the melting as an unstoppable event that will cause global sea levels to rise higher than projected earlier.

Scientists said the rise in sea level, up to 12 feet, will take centuries to reach its peak and cannot be reversed. But they said a decrease in greenhouse gas emissions could slow the melt, while an increase could speed it slightly.

Warm, naturally occurring ocean water flowing under the glaciers is causing the melt. “We feel it is at the point that it is . . . a chain reaction that’s unstoppable,” regardless of any future cooling or warming of the global climate, said Eric Rignot, a professor of Earth science at the University of California at Irvine. He was the lead author of a NASA-funded study that was one of the two studies released Monday.

The only thing that might have stopped the ice from escaping into the ocean and filling it with more water “is a large hill or mountains,” Rignot said. But “there are no such hills that can slow down this retreat,” he added.

The peer-reviewed [NASA study](#) has been accepted by the journal *Geophysical Research Letters* and is expected to be published within days.

The NASA announcement coincided with the release of a University of Washington study that contained similar findings. It will be published Friday in the journal *Science*.

Both studies observed ice retreating from four massive glaciers in West Antarctica — Pine Island, Thwaites, Smith and Kohler.

The Thwaites glacier alone holds enough water to increase sea level by two feet, the University of Washington study said. Together, the glaciers hold enough water to raise it by several feet.

Sea levels will not rise suddenly, in spite of what the word “collapse” implies, said [a statement by the university](#) announcing its report. “The fastest scenario is 200 years, and the longest is more than 1,000 years.”

The statement said university scientists used detailed maps and computer models to reach their conclusion “that a collapse appears to have already begun

“Scientists have been warning of its collapse, based on theories, but with few firm predictions or timelines,” the statement said.

The new projections of sea-level rise by both studies are higher and potentially more devastating than earlier projections by international scientists who authored an [Intergovernmental Panel on Climate Change report](#) last year and U.S. scientists who wrote the federal government’s National Climate Assessment, which was issued this month.

The findings probably will force the IPCC to increase its current estimate of up to three feet of sea-level rise by 2100, said Sridhar Anandakrishnan, a professor of geosciences at Pennsylvania State University.

The IPCC bases its results on reviews of earlier studies, and the recent observations on polar ice “are only now starting to come together,” said Anandakrishnan, who was not involved in the NASA study.

Tom Wagner, cryosphere program scientist at NASA’s Earth Science Division in Washington, said this is not the first time scientists have said West Antarctica ice will collapse.

“That idea that this is unstoppable has been around since the 1970s,” Wagner said. “We’ve finally hit this point where we have enough observation to put this together” and say it is happening.

Earlier projections of a collapse are one reason scientists criticized some IPCC projections as overly conservative.

In the [National Climate Assessment](#), released last week, scientists already predicted a harsh scenario for the Chesapeake Bay. “As sea levels rise,” they said, “the Chesapeake Bay region is expected to experience an increase in coastal flooding and drowning of . . . wetlands” that protect against storm surge.

Sea-level rise would be made worse because the land is sinking in the lower bay region because of ancient geological forces.

## 20. **Melting of Antarctic glaciers ‘unstoppable’**

GRAHAM LLOYD  
THE AUSTRALIAN  
MAY 14, 2014 12:00AM

<http://www.theaustralian.com.au/news/health-science/melting-of-antarctic-glaciers-unstoppable/story-e6frg8y6-1226916448158#>

**POINT of no return” has been reached in the long-term collapse of glaciers on the west of Antarctica, according to two new reports.**

Two papers published this week claim instability of the West Antarctic ice sheet could have a big impact on sea level rises during the next several hundred to 1000 years.

The West Antarctica ice sheet is considered “unstable” because the majority of ice is “grounded” below sea level.

In addition, there is geological evidence that West Antarctica’s ice changed considerably many millennia ago at times when the ice sheet of East Antarctica and Greenland did not.

A NASA study focused on three different lines of

evidence to identify the rate of change on the ice sheet, which if fully melted had the potential to raise global sea levels by 1.2m.

These included changes in the flow speeds of the glaciers, how much of each glacier was floating on seawater and the slope of the terrain over which they were flowing.

In conclusion, glaciologist and lead author of the NASA paper, Eric Rignot, professor of earth system science at the University of California Irvine, said: “The collapse of this sector of West Antarctica appears unstoppable.

“The fact that the retreat is happening simultaneously over a large sector suggests it was triggered by a common cause, such as an increase in the amount of ocean heat beneath the floating sections of the glaciers.”

Scientists claim warmer water is being pulled upward towards the ice sheet by the intensification of winds around Antarctica.

Recent studies have linked -increased winds in Antarctica with higher levels of atmospheric carbon dioxide.

The increased winds have also been linked to the growth in Antarctic sea ice, which has continued to set records, increasing by 110,000sq km a day during April to nine million square kilometres.

Meanwhile, a separate study published in the journal *Science* on Monday found that melting of the Thwaites glacier had begun and could eventually raise global sea levels by 61cm.

Study author Ian Joughin, a glaciologist at the University of Washington, said the melt was expected to take between 200 and 1000 years.