ITER Forum website Update 1/15

B.J.Green (17/1/15)

1. PETER LEE: ETHICS AND CLIMATE CHANGE POLICY

Date: 16/12/14

Global Warming Policy Foundation
http://www.thegwpf.org/peter-lee-ethics-and-climate-change-policy/

A new paper by Dr Peter Lee and published today by the Global Warming Policy Foundation explores many of the ethical disputes that characterise climate science and policy in the twenty-first century.

"Science has spoken. There is no ambiguity in their message… Leaders must act." These words by Ban Ki-moon, United Nations Secretary-General, welcomed the latest IPCC Report as certain and indisputable.

But actions require choices to be made – each with economic and often overlooked ethical dimensions – and the uncertainties involved are greater than Ban Ki-moon and many of the IPCC authors publicly acknowledge.

A new paper by Dr Peter Lee and published today by the Global Warming Policy Foundation explores many of the ethical disputes that characterise climate science and policy in the twenty-first century.

Dr Lee is a lecturer in Ethics and Political Theory at the University of Portsmouth and the author of *Truth Wars: The Politics of Climate Change, Military Intervention and Financial Crisis* (Palgrave Macmillan).

Dr Lee shows that ethical considerations have arisen and continue to arise at every stage of the climate debate, from climate science to the current and future implementation of climate change mitigation and adaptation policies.

"In a field characterised by extensive uncertainty a combination of good intentions and ill-informed policies can result in damaging unintended outcomes for humans and for the natural environment alike," Dr Lee said.

"Democratic consent to whatever is decided will not be forthcoming if the

climate debate is not engaged in the depth which Dr Lee demonstrates is necessary," writes the Rt Revd Peter Forster, the Bishop of Chester, in the foreword.

2. MIT: The future of fusion power

googleon: all
December 17, 2014
By Jake Jurewicz | Department of Nuclear Science and Engineering MIT
http://www.pennenergy.com/articles/pennenergy/2014/12/nuclear-energy-mit-and-the-future-of-fusion-power.html

The next two years in MIT's Department of Nuclear Science and Engineering (NSE) may see fusion research embark on a landmark period of innovation. In his address to the NSE community in the inaugural Del Favero Doctoral Thesis Prize Lecture, Zach Hartwig PhD '14 not only described his group's research achievements but also explained why, in his view, fusion research should now be at the top of the department's agenda. Hartwig argued that U.S. fusion research, which has been focused on physics for the past two decades, now needs to incorporate more attention to engineering, utility integration, and economics as it transitions to building devices that will produce energy — and that this can be achieved by leveraging the tremendous engineering and systems expertise of NSE.

Much of Hartwig's PhD research centered on developing a new and substantially improved method for studying materials in fusion environments. Thanks to the geometry and power density of tokamak reactors, the materials on their plasma-facing walls must withstand power fluxes higher than the space shuttle upon re-entry, as well as a host of complex physical and chemical interactions that completely remake the material surfaces. The diagnostic that Hartwig helped develop, Accelerator-Based In-Situ Materials Surveillance (AIMS), utilizes recent advances in detector technology to offer scientists a more comprehensive view, over large areas of the surface, of how the plasma affects these materials on a very granular timescale. Prior to AIMS, scientists were only able to analyze a small sample of the first-wall material every six months. AIMS will enable the research team at MIT's Alcator C-mod reactor to study multiple important sections of the wall between every plasma shot, approximately one location every 30-60 seconds.

In a separate project focusing on the design of fusion devices to solve the plasma-surface problem, Hartwig and several other graduate students working with Professor Dennis Whyte identified the potential for a new class of compact tokamaks. Hartwig pointed out that new developments in high-temperature superconductors could enable higher magnetic fields and consequently much smaller and lower-cost fusion experiments. Reducing the size of experiments could accelerate the pace of advance in fusion science affecting key problems such as divertor materials and tritium breeding.

Hartwig and the rest of Whyte's group also believe that experiments should be

moving the field toward nuclear fusion's ultimate purpose: putting power on the grid. In this regard, Hartwig described two new experiments, the Advanced Divertor Experiment (ADX) and the Affordable, Robust, Compact (ARC) reactor. The first studies materials and divertor problems in greater depth, while the second — a fusion reactor that is half the size of conventional designs — incorporates lessons from fission engineering to simplify the tritium-breeding blanket and maintenance problems. Hartwig argued that MIT has a unique opportunity to direct the future of fusion energy research by building these two new experiments to address both the surfaces (ADX) and the scale (ARC) of an operating fusion power reactor.
The Del Favero Thesis Prize, established in 2014 with a generous gift from James Del Favero SM '84, will be awarded annually to a PhD graduate in NSE whose thesis is judged to have made the most innovative advance in the field.

3. US will stay in ITER

Omnibus spending bill removes the threat of US withdrawal from project. The measure also boosts US domestic fusion program.

David Kramer

December 2014

http://scitation.aip.org/content/aip/magazine/physicstoday/news/10.1063/PT.5.1034

The US won't be backing out of ITER, the international fusion test reactor under construction in France, for at least another year. Funding of $150 million is provided for ITER within the $1.1 trillion bill that will fund most of the government through the rest of fiscal year 2015. The figure is the same amount that the Obama administration had requested for the project. The Senate version of the bill funding the Department of Energy had ordered the US to withdraw from the project, and had provided $75 million to close out contracts with US industry to build and ship components.
But the Senate measure was never brought to the floor for a vote. The House, which did pass its version of the DOE bill, had included $225 million for ITER, and had chided the administration for unnecessarily delaying the project. The compromise bill stipulates that no less than $125 million of the appropriation fund US in-kind contributions of hardware, with the remainder a cash contribution to ITER's central organization.
In a departure from the regular appropriations process, the differences in the two bills were reconciled by House and Senate appropriators—a process that is supposed to occur in a House–Senate conference committee after passage by both chambers.
In calling for a US withdrawal, Senators Dianne Feinstein (D-CA) and Lamar Alexander (R-TN), the respective chair and ranking member of the DOE appropriations subcommittee, pointed to the rising cost of US participation and to a scathing 2013 review of ITER's management. Alexander said quitting the project would save US taxpayers between $3.9 billion and $6.5 billion, depending on which of two DOE estimates were correct. DOE won't be able to precisely estimate the US commitment until a new baseline cost and

schedule is completed by the central office this summer.
The US in 2006 agreed to contribute 9.1% of the components and the cash for ITER construction. At that time, however, the value of the US contribution was put at $1.1 billion, the reactor was estimated to cost €5 billion ($6.2 billion) and construction was to be completed in 2013. Today, ITER has no official cost estimate, and US officials say that experiments won't begin there until 2023. The House appropriations bill warned that the administration's stingy requests for ITER would further delay construction by up to two years and result in additional cost overruns.
The spending bill also increases funding for the US domestic fusion program, which the administration has pinched in recent years to help pay for ITER. The appropriation of $318 million is 16% above the $266 million requested by the administration. That amount includes $22 million for the Alcator C-Mod tokamak at MIT, which appropriators warned they will stop funding after FY 2016.

4. Fossil Fuels Must Stay in Ground to Stop Warming, Scientists Say

By Thomas Biesheuvel Jan 8, 2015 2:00 AM GMT+0800
http://www.bloomberg.com/news/2015-01-07/fossil-fuels-must-stay-in-ground-to-stop-warming-scientists-say.html

Two-thirds of the world's fossil-fuel reserves must remain unburnt to hold temperature increases below dangerous levels, according to researchers at University College London.
Half the world's known gas reserves, one-third of the oil and 80 percent of the coal should remain in the ground and unused before 2050 to limit temperature increases to 2 degrees Celsius (3.6 degrees Fahrenheit), the maximum

climate scientists say is advisable, according to a report from the UCL Institute for Sustainable Resources.
"Policy makers must realize that their instincts to completely use the fossil fuels within their countries are wholly incompatible with their commitments to the 2 degrees Celsius goal," UCL research associate and lead author Christophe McGlade said in the report, which will be published today in the scientific journal Nature.
The research will heighten the debate about so-called stranded assets, the idea that the reserves of oil drillers and coal miners have little value because the fight against climate change will require them to be left in the ground. While disputed by energy companies, the issue has been gaining greater prominence in recent months. Bank of England Governor Mark Carney said last year he'd instructed staff to consider whether stranded assets posed a threat to banks, investors and the financial system.

Remaining Unburnt

The UCL report, funded by the U.K. Energy Research Centre, said that the "overwhelming majority" of coal reserves in China, Russia and the U.S. must remain unburnt, along with 260 billion barrels of Middle East oil and 60 percent of its gas reserves.
Governments are adopting policies to cut carbon dioxide emissions and meet the 2 degrees Celsius target agreed in Copenhagen six years ago.
The International Energy Agency estimates that based on current trends the world may warm 3.6 degrees by the end of the century, raising the risk of more violent storms, droughts and rising sea levels. The United Nations said in November that the world must halt fossil-

fuel emissions within the next six decades to prevent irreversible impacts from a warming planet.
The UN estimates that to stand a 50 percent chance of holding global warming to 2 degrees Celsius, emissions since the late 19th century need to be limited to 3,000 gigatons of carbon dioxide, with 63 percent of that already released by 2011. That means there's 1,100 gigatons left, or at best 30 percent of the 3,700 gigatons to 7,100 gigatons of CO2 contained in known fossil fuel reserves that are economically recoverable, according to the UN.

Affordable Energy

The world's biggest producers of coal, oil and gas reject the concept of stranded assets, saying fossil fuels are needed to provide affordable energy. Exxon Mobil Corp. said in March that its natural-gas reserves won't become stranded as global demand grows and the drive for higher living standards in developing nations trumps efforts to curtail carbon emissions. Glencore Plc, the biggest coal exporter, said in its sustainability report that fossil fuels will be a vital element of the world's energy sources for some time to come.
To contact the reporter on this story: Thomas Biesheuvel in London at tbiesheuvel@bloomberg.net

5. January 13, 2015, 12:00 pm

U.S. fusion program must have energy mission

By Caroline Von Wurden and Andrew Holland

http://thehill.com/blogs/congress-blog/energy-environment/229245-us-fusion-

program-must-have-energy-mission

Fusion energy research holds the promise of clean, safe, and secure energy. It is not an exaggeration to say that developing fusion energy would revolutionize America's energy security, climate policy, and global scientific leadership. However, despite decades of path-breaking scientific research, the U.S. is ceding its leadership and has no plans for how to develop a fusion power plant. In order to deliver on the promise of fusion energy, the U.S. must reorganize its fusion program and give it an explicit mission of producing energy.

The FY-15 omnibus budget, passed last month and signed into law, **supports the U.S. fusion program** with $467.5 million. However, money alone will not guarantee energy from fusion on the electrical grid.

The problem is that America's fusion research is treated as a science experiment, not as an energy program. The difference is important: science can prove the *theoretical* basis for fusion, but only detailed engineering can turn that theory into a power plant that can add electricity onto the grid. We need a more active program that would develop technologies necessary for a fusion power plant along with the plasma physics that form fusion science.

Fusion energy is a national priority for America's foreign competitors. China, South Korea, and Europe all have specific goals, timescales, and funding to implement successful fusion energy programs. South Korea is running K-STAR, a superconducting tokamak, the South Korean Ministry on Education, Science, and Technology said in 2012 that developing technologies to build K-STAR would be a priority for the next 10 years. The country is designing a fusion power demonstration reactor called K-DEMO. The country's National Fusion Research Institute has plans to complete it in the 2030's.

We can take lessons in how Americans rapidly developed advanced fission nuclear technology in the 40s and 50s. The first nuclear fission reactor (Chicago Pile 1) was built in 1942. Less than a decade later, the USS Nautilus – the world's first nuclear powered submarine - was authorized (1951) and

launched (1954). Admiral Hyman Rickover led and managed that transition, and the path he set us on still defines the U.S. nuclear fleet, both civilian and military. We can get the U.S. on a similar track with fusion development.

It is clear that the U.S. fusion program needs a jolt.

In December 2014, ASP convened an expert-level roundtable to discuss recommendations for how to build a viable US fusion program. This roundtable outlined the large challenges the U.S. fusion program has to overcome. Political will, good management, and sufficient funding are needed to develop it into an energy program. At present, these ingredients to achieve success are missing.

The roundtable **concluded that the country** needs strong political leadership to develop fusion as an energy program. At the moment, due to declining and sort –term budgets, there is in-fighting between different experiments and no unified plan for how to advance the U.S. fusion program. Just as the Manhattan project had Lieutenant General Groves to direct the development of the nuclear bomb, and the nuclear fission program had Admiral Rickover to direct the creation of the Nuclear Navy, so too does the fusion program need a leader charged with the political directive to build a working fusion power plant.

Some of these problems could be solved by creating the position of “Deputy Under Secretary for Fusion Energy” within the Office of the Under Secretary for Science and Energy. This person would be politically responsible for fusion energy development and would report directly to the Under Secretary for Science and Energy.

We need a strong, inspiring vision on how to develop fusion energy. The mission of the new official must be on energy. If this were the explicit goal for the official, that would then drive future evolution of the program and enable many changes. It is possible to have a fusion experiment in the near term (10-15 years) that would produce energy, as outlined in a 10 Year Plan in ASP’s **Fusion White Paper**. To achieve this, many parallel efforts and proportionate funding increases would be required. Until a funding increase is possible, a new position leading the U.S. fusion program could set the program on a path towards energy.

Fusion must be an energy program centered on developing a path to safe and economical fusion power on the electrical grid. It is a national security imperative that America demonstrate practical fusion power in a short timeframe. This will set the stage for full-scale commercial power that will drive American prosperity for the next century.
Von Wurden is an adjunct junior fellow at the American Security Project. As a recent graduate of the University of California, Berkeley, where she received a B.A. in physics, she has published seven scientific papers on her research at Los Alamos National Laboratory and the ALPHA Antihydrogen Collaboration at UC Berkeley. Holland is the American Security Project's senior fellow for Energy and Climate. He is a Washington-based expert on energy, climate change, and infrastructure policy.

6. Fusion energy is the way of the future

13 January 2015
http://www.comsdev.canterbury.ac.nz/rss/news/?feed=news&articleId=1572

A scientist from one of the world's leading universities says fusion energy is the future of clean energy and can solve the looming global energy crisis, though challenges remain.
Associate Professor Anne White from the Massachusetts Institute of Technology says fusion generates more energy per reaction than any other energy source. It produces nearly 10 million times more energy than the same amount of fossil fuel. Dr White is visiting the University of Canterbury and presented a paper on her research today.
Fusion is the nuclear process that powers the stars. It is two light elements coming together in a fusion reaction to make a heavier element. The fuel for fusion is hydrogen, and more specifically, isotopes of hydrogen, she says. Fusion is a nuclear reaction that releases energy not by splitting heavy atomic nuclei apart, as happens in nuclear power stations, but by fusing light nuclei together.
"Fusion is better than hydro or thermal power like you have in New Zealand in that a fusion power plant requires very little land or space to build. You don't have to dam up a river and you don't have to alter a naturally beautiful and unique geothermal area to make energy."

"Of course, there are pros and cons to every energy option. The world needs to pursue all options on the table. Fusion is generally very good because it is a clean option, with abundant fuel".
"The huge downside to fusion is that we haven't yet built a working demonstration power plant. While we generally know how to do it, a fusion reactor would be very expensive. Making fusion able to economically compete with coal, gas, hydro, solar, fission or geothermal will be tough.
"A new international experiment (ITER) to show the viability of fusion energy is being built now in France, with seven partners - China, the European Union, India, Japan, Korea, Russia and the United States.
"Although ITER will not produce electricity, it will show the way to solve key issues and will take fusion to the next step, where a demonstration fusion power plant can be designed. ITER is a very large very complex project, in the cost-scale of $US10 billions. In terms of big science, this is similar to things like the International Space Station project or the Large Hadron Collider at CERN.
"But with refinement of physics and advances in technology and engineering, fusion electricity could be competitive in the future. Given the nearly zero environmental impact in terms of space or land and nearly no waste and abundant fuel, countries could choose fusion even if it weren't the cheapest option.
"That is what is so great about fusion is it would be clean, inexhaustible energy that would be available to every nation. Given how important conservation and environmental issues are to New Zealand, I imagine that nuclear energy -- fission and fusion -- would be of interest to this country generally.
"And there is enough fusion fuel on Earth to produce energy for thousands of years. The fuel for fusion is readily available in the Earth's oceans and can be easily created from natural lithium deposits with supplies allowing fusion to meet the world's energy needs for thousands of years," Associate Professor Anne White says.

Almost 2000 students studied physics and astronomy at the University of Canterbury last year including more than 40 postgraduate students.
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7. Robotic technology development

centre for Fukushima

13 January 2015

http://www.world-nuclear-news.org/RS-Robotic-technology-development-centre-for-Fukushima-1301158.html

A new centre will develop and test remote-controlled equipment for use in decommissioning the Fukushima Daiichi plant while boosting the local economy in Fukushima prefecture.

Work began on the Naraha Remote Technology Development Centre, which is being built by the Japan Atomic Energy Agency (JAEA), in September 2014. The centre at Nahara-Minami industrial park is due to begin full operations in the 2016 fiscal year. The complex will house a mock-up of the lower part of a reactor containment vessel, representing the interior of the Fukushima Daiichi nuclear power plant, as well as an indoor demonstration test area for disaster response robots which will also be used to train operators and workers.

The centre will provide facilities for the development of simulators and remote-controlled robots to demonstrate technology for use in situations such as repairing leakages in the lower parts of Fukushima's primary containment vessel and inside the reactor buildings. The facility will enable devices to be tested in environments including a water tank, barriers, slopes, stairs and rubble. Virtual reality systems will be developed to evaluate operating procedures and for training.

As well as the buildings where experimental work will take place, the facility will also include living accommodation for researchers and staff as well as conference and training facilities. The facility is within 20 km of the Fukushima Daiichi plant, and it is hoped that its work will contribute to the revitalization of the local economy.

In an interview with the Japan Atomic Industrial Forum's(JAIF) *Atoms in Japan*, Hiroshi Kawamura, director of nuclear plant decommissioning research at JAEA, outlined his vision for the new centre, saying he was keen to attract creative researchers and engineers from Japan and elsewhere, "We should see our work as taking steps forward, not as cleaning up a mess," he said.

The project is already drawing interest from overseas, and Kawamura said that as well as tackling the immediate challenges posed by Fukushima, the facilities could be used to test robots for use in other challenging working environments.

Researched and written
by World Nuclear News

8. Cigar Lake output seen at 6-8 million pounds in 2015

14 January 2015

http://www.world-nuclear-news.org/ENF-Cigar-Lake-output-seen-at-up-to-8-million-pounds-in-2015-14011501.html

Cameco expects that the Cigar Lake mine will produce between 6 and 8 million pounds of uranium oxide (2308 to 3077 tU) this year. The mine produced 340,000 pounds U3O8 in 2014, its first year of operations.

Cameco said it was providing its 2015 forecast for Cigar Lake production in order to co-ordinate with the disclosure of information by Denison Mines Corp.

Ore mined at Cigar Lake is transported by truck to the McClean Lake mill, operated by Areva Resources Canada Inc, where it is processed to uranium concentrate. The McClean Lake mill is located about 70 km northeast of the mine site in northern Saskatchewan, Canada. Mining at Cigar Lake began in March 2014 and the first uranium concentrate was packaged at McClean Lake in October 2014.

Cameco said it "continues to expect" Cigar Lake to ramp up to its full annual production rate of 18 million pounds (100% basis) by 2018 - with Cameco's share of that being 9 million pounds. The annual production rates during ramp-up will be adjusted as necessary based upon operating experience, it said.

The Cigar Lake mine is owned by Cameco with 50.025%, Areva Resources Canada Inc. with 37.1%, Idemitsu Canada Resources Ltd with 7.875% and Tepco Resources Inc with 5.0%. It is operated by Cameco. The McClean Lake mill is owned by Areva Resources Canada Inc with 70%, Denison Mines Inc with 22.5% and OURD Canada Co Ltd with 7.5%. It is operated by Areva.

Cameco said it will report its 2014 annual results, including 2014 production and 2015 outlook information for all other operations, after markets close on 6 February.

Mining commenced at Cigar Lake in 2014. The proven and probable ore reserves at Cigar Lake are extremely large and very high grade. A 480-metre-deep underground mine was developed in very poor ground conditions – the orebody is actually in the soft Athabasca sandstone. Hence it uses ground freezing and remotely-controlled high pressure water jets at this level to excavate the ore. Known resources are 130,000 tonnes U3O8 at about 17% average grade, and with other resources the mine is expected to have a life of at least 30 years. Production is expected to ramp up to 8,200 t/yr U3O8 (7,000 tU/yr) over four years from late 2014.

Researched and written
by World Nuclear News

9. Milestone for Barakah 1 containment

13 January 2015
http://www.world-nuclear-news.org/NN-Milestone-for-Barakah-1-containment-1301157.html

The concrete dome for Barakah 1 has been completed and the unit is on track to start operations in 2017, the Emirates Nuclear Energy Corporation (ENEC) has announced.

The dome is the final structural component of the reactor containment building which will house the nuclear reactor itself. Designed to confine and contain radiation, work began on the steel-reinforced concrete building in July 2012 with the fabrication of the basemat. The containment liner plate, which forms the inner floor, wall and ceiling of the reactor containment building, was then fabricated and installed in 19 stages over a period of ten months. The dome, which measures 51.4 metres in diameter, 24 metres in height and weighs approximately 9000 tonnes, has been constructed over the past five months in nine stages.

ENEC CEO Mohamed Al Hammadi praised the commitment to quality and safety shown by the thousands of workers involved in the project. "We are proud to maintain our track record of achieving key construction milestones safely and on time," he said. The unit is now more than 60% complete.

The next phase of work on the containment building will involve installation of the containment post tensioning system, which is used for pre-stressing the concrete structure, followed by a three-month structural integrity test.

Barakah will comprise four Korean-designed APR-1400 reactors and is being built by a consortium led by the Korea Electric Power Corporation (Kepco). Construction work is also under way at units 2 and 3, which are scheduled to start up in 2018 and 2019. Work has yet to begin on the fourth Barakah unit ,which is expected to start up in 2020.

Researched and written
by World Nuclear News

10. Physics World names National Ignition Facility fuel gain top 10

breakthrough of the year

https://www.llnl.gov/news/physics-world-names-national-ignition-facility-fuel-gain-top-10-breakthrough-year

Physics World an international monthly magazine published by the Institute of Physics has named the National Ignition Facility's (NIF) achievement of fuel gain one of its top 10 breakthroughs of the year.

Ignition — the process of releasing fusion energy equal to or greater than the amount of energy used to confine the fuel — has long been considered the "holy grail" of inertial confinement fusion science. Before achieving ignition, a key step along the path is to have "fuel gains" greater than unity, where the energy generated through fusion reactions exceeds the amount of energy deposited into the fusion fuel and alpha-particle self-heating of the fusing region.
NIF — the world's largest and most energetic laser — was the first facility to ever reach the milestone of achieving fuel gains greater than 1 with significant levels of alpha-heating. In a paper published in the Feb. 12 online issue of the journal *Nature*, scientists detailed a series of experiments conducted on NIF, which showed an order of magnitude improvement in yield performance over past experiments.

"Creating the conditions for sustained nuclear fusion to occur in the laboratory has proved notoriously challenging, but persevering is essential because success could lead to safe and clean sources of energy," said Hamish Johnston, editor of *physicsworld.com*

. “By obtaining a fuel gain of greater than one, the team working at the National Ignition Facility has taken an important step toward realizing fusion energy.”

The *Physics World* editorial team recognized the achievements from 2014 in a range of topics from nuclear physics to nanotechnology. The top 10 breakthroughs were selected using the following criteria: fundamental importance of research, significant advance in knowledge, strong connection between theory and experiment and general interest to all physicists.

Tags: Energy / Lasers / NIF / National Ignition Facility

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https://www.llnl.gov/news/physics-world-names-national-ignition-facility-fuel-gain-top-10-breakthrough-year

11. Stanford Report, January 12, 2015

Estimated social cost of climate change not accurate, Stanford scientists say

The "social cost" of carbon dioxide emissions may not be $37 per ton, as estimated by a recent U.S. government study, but $220 per ton.

BY KER THAN

http://news.stanford.edu/news/2015/january/emissions-social-costs-011215.html

The economic damage caused by a ton of carbon dioxide emissions – often referred to as the "social cost" of carbon – could actually be

six times higher than the value that the United States now uses to guide current energy regulations, and possibly future mitigation policies, Stanford scientists say.

A recent U.S. government study concluded, based on the results of three widely used economic impact models, that an additional ton of carbon dioxide emitted in 2015 would cause $37 worth of economic damages. These damages are expected to take various forms, including decreased agricultural yields, harm to human health and lower worker productivity, all related to climate change.

But according to a new study, published online this week in the journal *Nature Climate Change*, the actual cost could be much higher. "We estimate that the social cost of carbon is not $37 per ton, as previously estimated, but $220 per ton," said study coauthor Frances Moore, a PhD candidate in the Emmett Interdisciplinary Program in Environment and Resources in Stanford's School of Earth Sciences.

Based on the findings, countries may want to increase their efforts to curb greenhouse gas emissions, said study co-author Delavane Diaz, a PhD candidate in the Department of Management Science and Engineering at Stanford's School of Engineering. "If the social cost of carbon is higher, many more mitigation measures will pass a cost-benefit analysis," Diaz said. "Because carbon emissions are so harmful to society, even costly means of reducing emissions would be worthwhile."

For their study, Moore and Diaz modified a well-known computer model for calculating the economic impacts of climate change, known as an integrated assessment model, or IAM. Their alternative formulation incorporated recent empirical findings suggesting that climate change could substantially slow economic growth rates, particularly in poor countries.

IAMs are important policy tools. Because they include both the costs and benefits of reducing emissions, they can inform governments about the optimal level of investment in emission reduction. The U.S. Environmental Protection Agency, for example, uses the $37 average value from three IAMs to evaluate greenhouse gas regulations. Canada, Mexico, the United Kingdom, France, Germany and Norway have also used IAMs to analyze climate and energy policy proposals.

While useful, IAMs have to make numerous simplifying assumptions. One limitation, for example, is that they fail to account

for how the damages associated with climate change might persist through time.

"For 20 years now, the models have assumed that climate change can't affect the basic growth rate of the economy," Moore said. "But a number of new studies suggest this may not be true. If climate change affects not only a country's economic output but also its growth, then that has a permanent effect that accumulates over time, leading to a much higher social cost of carbon."

In the new study, Moore and Diaz took a widely used IAM, called the Dynamic Integrated Climate-Economy (DICE) model, and modified it in three ways: They allowed climate change to affect the growth rate of the economy; they accounted for adaptation to climate change; and they divided the model into two regions to represent high- and low-income countries.

"There have been many studies that suggest rich and poor countries will fare very differently when dealing with future climate change effects, and we wanted to explore that," Diaz said. Poor countries may be more vulnerable to changes in rainfall and rising sea levels.

One major finding of the new study is that the damages associated with reductions in economic growth rates justify very rapid and very early mitigation that is sufficient to limit the rise of global temperature to 2 degrees Celsius above pre-industrial levels. This is the target that some experts say is necessary to avert the worst effects of global warming.

"This effect is not included in the standard IAMs," Moore said, "so until now it's been very difficult to justify aggressive and potentially expensive mitigation measures because the damages just aren't large enough."

The pair's IAM also shows that developing countries may suffer the most from climate change effects. "If poor countries become less vulnerable to climate change as they become richer, then delaying some emissions reductions until they are more fully developed may in fact be the best policy," Diaz said. "Our model shows that this is a major uncertainty in mitigation policy, and one not explored much in previous work."

They note two important caveats to their work, however. First, the DICE model's representation of mitigation is limited. It doesn't take into account, for example, the fact that clean technologies take time to develop and deploy.

Second, while it explores the effects of temperature on economic

growth, the model does not factor in the potential for mitigation efforts to also impact growth.
"For these two reasons, the rapid, near-term mitigation level found in our study may not necessarily be economically optimal," Diaz said. "But this does not change the overall result that if temperature affects economic growth rates, society could face much larger climate damages than previously thought, and this would justify more stringent mitigation policy."

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12. 2014 to Be Hottest Year Ever Measured

The World Meteorological Organization thinks this year will provide a new heat record for the planet
http://www.scientificamerican.com/article/2014-to-be-hottest-year-ever-measured/

This year will likely be the hottest on record for the planet, with global temperatures 1.03 degrees Fahrenheit higher than the 1961-to-1990 average, according to a new report from the World Meteorological Organization.
This would make 2014 the 38th consecutive year with an anomalously high annual global temperature.
The estimate comes from the WMO's annual compendium on the "Status of the Global Climate." This year's report was released during the U.N. climate talks in Lima, Peru, where diplomats are negotiating a new global climate deal to be signed in Paris next year.
The report uses data from the National Oceanic and Atmospheric Administration, NASA and the United Kingdom's Met Office. To place the findings in a historical context, scientists usually compare temperatures with

"normal" temperatures averaged over a 30-year stretch, usually 1961 to 1990.

Driving the temperature rise in 2014 were the oceans -- the Pacific, the polar and subtropical north Atlantic, parts of the south Atlantic, and the Indian Ocean all experienced the warmest temperatures ever recorded. Global sea surface temperatures were 0.45 degree Celsius above the 1961-90 normal.

On land, temperatures were 0.86 C above normal.

A year for extremes

Scientists do not know what is going on with the oceans this year. In general, oceans absorb much of the heat of global warming, but scientists do not have a good grasp on the phenomenon. They are beginning to study this parameter in the deep oceans, and data for 2014 are available to a depth of 2,000 meters (*ClimateWire*, Oct. 7). Scientists have found that the ocean heat content in 2014 was similar to 2013, which set a heat-content record since measurements began in 1955.

As the oceans absorb heat, the water molecules expand and sea levels rise. In early 2014, sea levels rose to a record high. The average sea-level rise over the past two decades has been 3.2 millimeters per year.

The Arctic in 2014 saw the sixth-lowest ice cover in September, covering 1.24 million square kilometers less than the 1981-2010 normal.

Meanwhile, the Antarctic set a high record for ice cover, covering 560,000 square kilometers more than the previous record set in 2013. Scientists are studying the Antarctic to understand why its sea ice extent has been growing since 1979.

Notable heat waves were recorded in South Africa and Tunisia. High temperatures were recorded in Arctic regions of Russia, particularly in the spring.

"In April, ice break up began on the River Ob in Siberia two weeks earlier than normal, the earliest it has happened in the last 100 years," the report states.

Above-average temperatures were recorded in parts of

South America, Asia, Europe and Australia. In fact, the United States was the only cool spot in an otherwise sweltering world.

Droughts were recorded in parts of South Africa, China and Brazil, and, in the United States, California, Nevada and Texas were in exceptional drought, receiving just 40 percent of the normal expected rainfall.

India received 12 percent less rainfall than average during its monsoon season. Rainfall deficits were also recorded in New Zealand and Western Europe.

Flooding up, tropical storms down

Floods affected parts of South Africa in March and had an impact on more than 4,000 families. In Kenya, flash floods due to rainfall killed 10 in February. Floods were recorded in northern Pakistan and India in September, which killed 250 people and displaced 100,000.

Extremely heavy rainfall was recorded in parts of Russia, Japan, the United States, Argentina, Serbia and France.

Some 72 tropical storms have occurred in 2014 so far, which is below the 1981-2010 average.

Levels of CO_2 in the atmosphere climbed to 396 parts per million in 2013, the latest year for which data are available. That was 142 percent higher than the levels in the atmosphere at the start of the Industrial Revolution in the 1800s.

About 45 percent of the CO_2 emitted by humans since 2003 went into the atmosphere; the rest was taken up by oceans and land.

13. Record-breaking 2014 was hottest in modern history:

US

AFP
January 17, 2015, 4:29 am

https://au.news.yahoo.com/thewest/a/26022812/2014-was-hottest-year-in-modern-history-us-scientists/

Miami (AFP) - Record-breaking temperatures scorched the planet last year, making 2014 the hottest in more than a century and raising new concerns about global warming, US government scientists said Friday.

The much-anticipated report by scientists at the National Oceanic and Atmospheric Administration (NOAA) was confirmed by an independent analysis from the US space agency NASA that reached the same conclusion.

"Record warmth was spread around the world," said the NOAA report.

"The globally averaged temperature over land and ocean surfaces for 2014 was the highest among all years since record keeping began in 1880."

For the year, the average temperature was 1.24 degrees Fahrenheit (0.69 Celsius) above the 20th century average, beating the previous record-holding years of 2005 and 2010 by 0.07 F (0.04 C).

Parts of the world that saw record heat included Russia, western

Alaska, the western United States, parts of interior South America, parts of eastern and western coastal Australia, north Africa and most of Europe.

Record cold for the year was apparent only in some parts of the eastern and central United States.

Experts said the report offers more evidence that humans are driving global warming by burning fossil fuels that boost harmful greenhouse gases in the atmosphere.

"People are always asking, of course, why do we think this is going on," said Gavin Schmidt, director of NASA's Goddard Institute for Space Studies in New York.

"The data shows quite clearly that it is the greenhouse gas trends that are responsible for the majority of the (warming) trends that we have actually seen," he told reporters.

The research group Climate Central said the odds were one in 27 million that the warming trend -- in which 13 of the hottest 15 years on record have all occurred since 2000 -- could have happened randomly, without human-driven influence on the planet's temperatures.

"What's surprising is that anyone is surprised that 2014 was the hottest year on record. The science has been screaming at us for a long, long time," said Secretary of State John Kerry.

"The question is when and how the world will respond.

Ambitious, concrete action is the only path forward that leads anywhere worth going."

- Land and sea -

Globally averaged sea surface temperature was the highest ever, at 1.03 F (0.57 C) above the 20th century average.

Land surface temperature was 1.80 F (1.00 C) above the 20th century average, marking the fourth highest in history.

Sea ice continued to decline in the Arctic, depriving polar bears of habitat and driving global warming changes that are felt in distant corners of the world.

The average annual sea ice extent in the Arctic was the sixth smallest in the 36 years that experts have on record.

Meanwhile, sea ice in the Antarctic reached record highs for the second year in a row.

December also broke records, with the highest combined land and ocean average surface temperature for any December in modern history.

- Call to action -

"It's particularly striking that we set a global temperature

record," despite a lower than expected effect from El Nino, an ocean condition that brings warmer weather, said Brenda Ekwurzel, a senior climate scientist at the Union of Concerned Scientists.

"Long-term, we can expect this record to be broken again and again," she said.

Environmentalists said the report should serve as a call to action.

"The record temperatures last year should focus the minds of governments across the world on the scale of the risks that climate change is creating," said Bob Ward, policy and communications director at the Grantham Research Institute on Climate Change.

He called for an international deal "to strongly reduce greenhouse gas emissions, to be reached at the United Nations climate change summit in Paris in December 2015."

In the meantime, Schmidt said there are things people can and should do in their everyday lives to turn the tide.

"There are things that people individually can do to reduce their carbon footprint, like having better appliances, driving less, walking more, biking. I try and do those things," he said.

"This is an issue that is not going to go away."

14. FUKUSHIMA RICE TESTS

‘RADIATION FREE’ FIRST TIME SINCE DISASTER

JANUARY 5, 2015
http://fukushimaupdate.com/fukushima-rice-tests-radiation-free-first-time-since-disaster/

via **RT.com** / January 5, 2015 / For the first time since the 2011 disaster, all of the rice harvested in Fukushima Prefecture this year has passed radiation tests and now can be deemed safe for consumption, according to local officials.
Virtually all of the rice harvested in Fukushima in 2014 – or some 360,000 tonnes – has been checked for radiation and met the national standards of less than 100 Becquerel’s per kilogram, Reuters reports.
“The fact that the amount of rice that does not pass our checks has steadily reduced in the last three years indicates that we’re taking the right steps,” said Fukushima official Tsuneaki Oonam, who heads the department that oversees Fukushima rice farming.
Authorities began testing all rice grown in Fukushima prefecture in 2012, although the amounts harvested over the past years were insignificant. More 190 testing devices are used throughout the prefecture to ensure rice’s safety standards.
For the last 2 years, some 10 million bags of rice were checked annually. In 2012, 71 bags were found to exceed the safety standards, while in 2013, 28 bags were over the standard, the Asahi Shimbun reports. Rice farmers, according to the newspaper, succeeded in changing the fertilizer used so that radioactive cesium is not absorbed by the rice plant.
Rice that passes the Food Sanitation Law standards, is labeled as such. Those bags with radiation readings are destroyed. Despite the promise of getting a clean over-all reading, Fukushima prefecture plans to continue the radiation testing program.
Japan exported its first rice following the disaster last August – a 300-kilogram batch was delivered to Singapore. Fruit exports to Malaysia also resumed last year, according to officials, while in 2012 Fukushima peaches and apples were exported to Thailand.
SOURCE:* *Russia Today

15. THORIUM MOLTEN SALT REACTORS TO GO INTO

PRODUCTION BY 2020

JANUARY 11, 2015

http://fukushimaupdate.com/thorium-molten-salt-reactors-to-go-into-production-by-2020/

By Scott Dunn / **thedigitalfirehouse.fr** / January 8, 2015 /
When most people think of nuclear power, they think of thousands of barrels of waste that no one can touch or do anything about. They look for ways to keep the waste out of their backyards. They think of crusty old domes near their homes or freeways that could go off any day now.
As mentioned before in several articles on this blog, I'm a big, big fan of thorium as fuel for nuclear reactors. The thorium molten salt reactor has been demonstrated as a very safe technology back in the 60s by the Oak Ridge National Laboratory. Note that back then, there were zero private enterprises investing any time or effort in thorium as a fuel for power plants. Instead, a lonely team in a government agency took up the challenge and made a few megawatts for their own use. I find it very interesting how innovative some government agencies can be, NASA in particular. It seems that more than a few people have noticed that effort back in the 60s and are now replicating it. If you've been exposed to this video of Kirk Sorensen touting the virtues of the thorium molten salt reactor, you may have also found his company, Flibe. The video is 5 minutes of your time and well worth the watch. In a nutshell, the thorium molten salt reactor could give us the clean energy we need now at a fraction of the cost and about 1% of the waste of the uranium light water reactors we've been using since Nixon pointed us in that direction.
Now it seems, a company is developing modular, shipyard construction of thorium/uranium power plants that use molten salts for fuel. Better still, they believe that they can make power cheaper than coal, the power source of choice among developing countries. Those developing countries have 1400 coal power plants in the works each delivering about a gigawatt of power. That is a whole lotta carbon going into the atmosphere if they go through with their plans.
What company is doing this? Martingale with their ThorCon reactor. They are developing a thorium molten salt reactor that is built in modules, helping to reduce the costs of construction. Instead of building a powerplant that is designed to last for several decades, they are making the components easy to

replace and upgrade.
One really nice feature is that the design is walk-away safe. If the reactor overheats, the fuel drains into a cooling tank. The entire safety system is passive, so that even in the worst case scenario, there is no meltdown to worry about. The fuel is already liquid and the reactor is designed to remove the fuel from the reactor, automatically, without human intervention if something goes wrong.
Martingale plans to bring its first reactor to market by 2020. That is a short 5 years away. To put this in perspective, we have enough thorium on the planet that we're just not going to run out of it in our lifetimes. Kirk Sorensen estimates that thorium could power our civilization for 5,000 years. That could bring about a lasting peace without the endless fighting over oil. Why? Thorium is rather evenly distributed around the globe save for a few large deposits here and there. Bonus: 1 ton of thorium replaces 30 billion barrels of oil.
If thorium power is widely adopted, much of our demand for coal and oil would disappear. Cars would become electric and the Arabs and Israelis can both take a hike. We could focus on other things like, oh, I don't know, building a thriving middle class? Using some of that energy to remove the carbon from the atmosphere? How about water desalination? A universal recycler?
This is a revolution in the making. It will take time, and it can be done with no new technology. Every feature of this modular reactor is a known quantity since it's been done before. One other thing I like about Martingale is that they believe in public disclosure to provide for rapid improvement of the technology. Like I said before, I don't believe in the gloom and doom about global warming. I believe that we are capable of powering our civilization and restoring our planet to the way it was when we found it (mostly), for our children and their children. Avoiding or reversing global warming is no longer a question of technology, it is a question of political will.
SOURCE: The Digital Firehouse