

1. Sun's slowdown leaves scientists baffled

YAHOO!7

January 19, 2014, 2:00 pm

<http://au.news.yahoo.com/world/a/20864635/suns-slowdown-leaves-scientists-baffled/>

The Sun is doing something a little bit different, and it's really leaving scientists a bit confused.

The Sun is slowing down, the BBC reported.

"I've been a solar physicist for 30 years, and I've never seen anything quite like this," Richard Harrison, head of space physics at the Rutherford Appleton Laboratory in Oxfordshire, told the BBC.

"If you want to go back to see when the Sun was this inactive... you've got to go back about 100 years," he said.

Some scientists are even hinting the slowdown could be as bad as in the 17th century in a solar time known as the Maunder Minimum, when bitter, freezing cold swept through Europe.

The River Thames froze and there were bitterly cold winters during that time.

"It would feel like the Sun is asleep... a very dormant ball of gas at the centre of our Solar System," University College London's Mullard Space Science Laboratory's Dr Lucy Green said.

"There is a very strong hint that the Sun is acting in the same way now as it did in the run-up to the Maunder Minimum."

But what is particularly unusual about the Sun's low level of activity is that the star is

currently at its solar maximum, a point in an 11-year cycle where it's supposed to be at its most active.

The sudden shift has really left scientists stumped.

"It's completely taken me and many other solar scientists by surprise," Dr Green said.

2. **Wind fails test as demand soars**

GRAHAM LLOYD
THE AUSTRALIAN
JANUARY 18, 2014 12:00AM

<http://www.theaustralian.com.au/national-affairs/state-politics/wind-fails-test-as-demand-soars/story-e6frgczx-1226804532811#>

WHEN electricity demand peaked at the height of this week's heatwave in southern Australia, the total power output from the fleet of wind farms across Victoria and South Australia was almost zero.

The doldrums that stopped wind power production about midday on Wednesday coincided with warnings from the Victorian government and the national electricity market operator that electricity users faced the possibility of blackouts.

To view more text a subscription is required.

3. **Scientists Say Their Giant Laser Has Produced Nuclear Fusion**

by GEOFF BRUMFIEL
February 12, 2014 1:01 PM

<http://www.npr.org/blogs/thetwo-way/2014/02/12/275896094/scientists-say-their-giant-laser-has-produced-nuclear-fusion>

Researchers at a laboratory in California say they've had a breakthrough in producing fusion reactions with a giant laser. The success comes after years of struggling to get the laser to work and is another step in the decades-long quest for fusion energy.

Omar Hurricane, a researcher at [Lawrence Livermore National Laboratory](#), says that for the first time, they've produced significant amounts of fusion by zapping a target with their laser. "We've gotten more energy out of the fusion fuel than we put into the fusion fuel," he says.

Strictly speaking, while more energy came from fusion than went into the hydrogen fuel, only about 1 percent of the laser's energy ever reached the fuel. Useful levels of fusion are still a long way off. "They didn't get more fusion power out than they put in with the laser," says [Steve Cowley](#), the head of a huge fusion experiment in the U.K. called the [Joint European Torus](#), or JET.

The laser is known as the [National Ignition Facility](#), or NIF. Constructed at a cost of more than \$3 billion, it consists of 192 beams that take up the length of three

football fields. For a brief moment, the beams can focus 500 trillion watts of power — more power than is being used in that same time across the entire United States — onto a target about the width of a No. 2 pencil.

The goal is fusion: a process where hydrogen atoms are squeezed together to make helium atoms. When that happens, a lot of energy comes out. It could mean the answer to the world's energy problems, but fusion is really, really hard to do. Hurricane says that each time they try, it feels like they're taking a test.

"Of course you want to score real well, you think you've learned the material, but you just have to see how you do," he says.

Over the past few years, [NIF has been getting a fat "F."](#) For all its power, it just couldn't get the hydrogen to fuse, and researchers didn't know why. The failures have led NIF's critics to label the facility an enormous waste of taxpayer dollars. In 2012, the government shifted NIF away from its fusion goals to focus on its other mission: [simulating the conditions inside nuclear weapons](#). and researchers didn't know why. The failures have led NIF's critics to label the facility an enormous waste of taxpayer dollars. In 2012, the government shifted NIF away from its fusion goals to focus on its other mission: [simulating the conditions inside nuclear weapons](#).

But the fusion experiments continued, and Hurricane says researchers now understand why their original strategy wasn't working. In the journal *Nature*, [he and his colleagues report](#) that they've finally figured out how to squeeze the fuel with the lasers. By doing a lot of squeezing right at the start, they were able to keep the fuel from churning and squirting out. The lasers squeezed evenly and the hydrogen turned into helium.

The new technique can't reach "ignition," which is the point at which the hydrogen fusion feeds on itself to make more. Even so, JET's Cowley says, this is still a big moment for NIF.

"I think it's still a very important step forward, they reached fusion conditions, they made some fusion happen, and that's not been done before [with a laser]," he says.

Hurricane says no one knows for sure whether NIF can really reach the point of ignition. "It's not up to me; it's up to Mother Nature," he says. "But we're certainly going to try."

4. Fusion: Update on the International ITER Project

<http://peakoil.com/alternative-energy/fusion->

[update-on-the-international-iter-project](#)

According to Brig. General Stephen Cheney, CEO of the American Security Project, "The science is proven, the engineering is not."

That is how Wednesday, January 29, 2014's ASP hosted event "Fusion: Update on the International ITER Project" was introduced. ITER is an international fusion research and engineering project which combines the resources and intellect of China, Japan, South Korea, Russia, United States, and the European Union. Fusion is the process that powers the Sun and allows for all life to exist. Scientists are currently seeking to harvest this incredible power according to the presentation by Dr. Ned Sauthoff.

Dr. Sauthoff, US ITER Project Director, gave an overview of the process of nuclear fusion, the history of man's quest to exploit nuclear physics, and detailed ITER's current project and construction of a test reactor in Cadarache, France.

He began the presentation with the sun, the source of inspiration for nuclear fusion. The sun is rich with hydrogen, including deuterium and tritium isotopes, the fuel for fission. It has a large quantity of energy, which is necessary for fusion to overcome natural repelling forces between hydrogen atoms. The sun also has a very strong gravitational field, which prevent the matter and reactants from escaping a contained area and allows for the energy produced from one reaction to power more perpetually. It is this last aspect, confining the products and preventing energy from radiating away as waste, which has perplexed scientists. ITER hopes to solve this problem through a tokamak, a device which creates a super strong magnetic field, replicating how matter is restrained by the sun's gravity.

Magnetic confinement fusion has not yet reached breakeven point (that is, producing more energy than it uses). Fusion would have exceeded the breakeven point already, according to Dr. Sauthoff, if not for the lack of funding during the 1990s.

When fully developed, ITER expects to create 500 megawatts of energy from fusion energy, ten times the amount of the 50 megawatts needed to initiate fusion, and many times more efficient than other energy sources.

Dr. Sauthoff emphasized that fusion is a clean power source and does not produce radioactive waste nor can a fusion reactor "meltdown," two of the biggest drawbacks often associated with

nuclear power. In addition, it requires relatively little sources of fuel: "Whereas you have a hundred coal train cars pull up to a power plant every day, with fusion, you would need only two pounds of fuel to create the same amount of energy."

The United States' two biggest contributions to the ITER project are the Central Solenoid, a gigantic magnet that will control the plasma in the reactor, and the Cooling Water System which will cool the immense temperatures reached inside the reactor before it can affect external instruments. Additionally, the United States is contributing to the diagnostics system, because the US is a leader in controlling, measuring, and researching plasma.

Diplomatic representatives in attendance from the EU, Japan, China, India, and France expressed their country's continued commitment and dedication to the project.

[american security project](#)

5. FEBRUARY 2 2014 16:43h

Croatian companies interested in constructing ITER fusion reactor

<http://dalje.com/en-economy/croatian-companies-interested-in-constructing-iter-fusion-reactor/498515>

Croatia's researchers and companies have decided to apply by a concerted effort for their participation in the 13-billion-euro project to build an international ITER reactor in Cadarache, in which a further research on nuclear fusion is to be conducted.

The Croatian Employers' Association (HUP) has reported that Croatia, a member of the European Atomic Energy Community (EAEC or Euratom), is taking part in the most demanding

experiment in the energy construction of the first thermonuclear fusion reactor.

The goal of ITER, which stands for International Thermonuclear Experimental Reactor, is to demonstrate the scientific and technological feasibility of fusion power for peaceful purposes.

The project is funded and run by seven member entities — the European Union (EU), India, Japan, China, Russia, South Korea and the United States.

A score of Croatian companies such as Koncar, Elka, Alfa tim, Fleksivod, BBR Adria, MIV, DIV, MKP were given information about the ITER project at a meeting organised by the HUP and they got an insight into requirements they should meet in order to take part in the project, according to the press release issued by the HUP on Sunday.

6. **Mining the Moon: Plans Taking Off, but Rules Lacking**

By Joshua Philipp, [Epoch Times](#) | January 29, 2014

<http://www.theepochtimes.com/n3/476806-mining-the-moon-plans-taking-off-but-rules-lacking/>

Just two years before Neil Armstrong set foot on the moon, a treaty was signed by the United States, the United Kingdom, and the Soviet Union. Signed even as the race to get to the moon was well underway, the 1967 Outer Space Treaty declared that no nation-state could ever own the moon.

The treaty, however, was written at a time when current threats were too real and visions of the future were too dim. Concepts like space tourism, orbital hotels, and companies mining the moon for minerals would have been written off as science fiction.

Fast-forward to today and you'll find companies like Virgin Galactic ferrying wealthy tourists into space, a man skydiving from low orbit for a Red Bull advertisement, and companies like Planetary Resources and Deep Space Industries looking to mine the moon for its resources.

While the 1967 Space Treaty governs what countries can and cannot do on the moon, it leaves private companies unregulated. For countries like China, where many large companies are state-owned, the line separating the interests of government and business is unclear.

Before China's Yutu "Jade Rabbit" moon rover malfunctioned, it was prodding the moon dirt with a bottom-mounted ground-scanning radar system searching for valuable minerals. China's interests in these resources have been reported in Chinese media.

Ouyang Ziyuan, a senior adviser to China's lunar program, told China's state-run Xinhua newspaper, "Everyone knows fossil fuels such as gas and coal will be used up one day, but there are at least one million metric tons of helium-3 on the moon," [AFP reported](#).

Helium-3, is a valuable gas here on Earth, but its only "fuel" potential is in fusion energy—which is still highly experimental.

Russia is also eyeing the moon for helium-3, however, and plans to begin mining by 2020. [The announcement](#) was made back in January 2006 by Nikolai Sevastianov, head of Russia's Rocket and Space Corporation Energia.

NASA has outlined its own interests in lunar mining. Its Solar System Exploration Research Virtual Institute argued in a

report that mining rare minerals on the moon may be vital to national security.

The moon is rich with rare earth minerals, **but NASA points out in its report**, “Few see the moon as an alluring mining site, ripe for the picking of rare elements of strategic and national security importance.”

It adds that on Earth, where China controls about 95 percent of the global supply of rare earth minerals, Chinese authorities often limit exports.

“China is increasingly putting the pinch on quotas of such elements out of their country,” NASA states. “And as the scarcity of these valuable minerals grows, so too does the concern in other nations regarding the availability of this limited resource.”

The Next Wild West

The moon is well underway to becoming the next frontier, complete with space tycoons already surveying the business landscape, and under the current law it could be a very lawless frontier indeed.

The law has many holes. If companies like Bigelow Aerospace succeed in building lunar bases, there is currently no law saying they'll own the ground it's on. If companies like Shackleton Energy Company succeed in wrangling an asteroid to mine its resources, there is no law saying someone else can't start mining the same asteroid as well. And there are also no laws to limit damage or destruction, or to preserve historical or visible elements of the moon.

The only limiting factor is that private companies need the blessings and supervision of their host nation for any operations, and the host nation will be responsible if anything goes wrong.

The current system is based heavily on good faith, and whether each space-faring country will play nicely is yet to be

seen. A system lacking a clear legal framework has thus far worked for scientific ventures, such as the International Space Station. But history tells a different story when big businesses and competing nations turn their sights on a new frontier.

Ian Crawford, a professor in the Department of Earth and Planetary Sciences at Birkbeck College, University of London, believes that for lunar mining to go smoothly private companies will need a legal framework for their operations.

He also believes that lunar areas with scientific importance should have legal protection.

“The ’67 Treaty does not explicitly cover either of these aspects, which is why I think there is a case for updating it,” Crawford said in an email.

“Just as no nation-state can currently appropriate the moon there is a case for ensuring that private companies also cannot claim to own the moon, but nevertheless would be legally entitled to materials that they extracted from it as a result of their own private investment,” Crawford said.

As for guarding areas of scientific importance, there is proposed legislation aimed at doing just that. The 2013 Apollo Lunar Landing Legacy Act intends to create lunar national parks around historical sites, and was referred to a congressional committee in July 2013. Passing the law is going to be difficult, however, since it would **conflict with the 1967 treaty**.

NASA also **released a proposal** in 2011 to protect lunar artifacts, but following it is voluntary.

According to Dale Tietz, CEO of Shackleton Energy Company, which intends to mine the moon for water and minerals, commercialization of space started when the AT&T Telstar satellite went into orbit in 1962.

Tietz believes the 1967 treaty works as a legal framework for now, and that “In the future, as the market grows and

operational needs expand, new standards and methods may arise for the benefit of all stakeholders just like they do in terrestrial environments.”

7. UK nuclear sector to benefit from new remote handling facility

6 February 2014

<http://www.neimagazine.com/news/newsuk-nuclear-sector-to-benefit-from-new-remote-handling-facility-4173067>

Both fusion research and UK nuclear industry are set to benefit from a new remote applications facility planned to start operation in 2016 at the Culham the Centre of Fusion Energy in Oxfordshire, UK.

The UK government has pledged to invest £7.8 million (\$12.7 million) in the facility, which is expected to start construction in 2015. The funding will be matched by industry.

The facility will enable CCFE and its partner organizations - the National Nuclear Laboratory, The Welding Institute Technology Centre, National Physical Laboratory and Nuclear Advanced Manufacturing Research Centre "to offer their expertise in remote interventions and autonomous systems to a wider commercial sector."

It will offer access to an 'unparalleled concentration of test facilities' and expertise to develop and apply technology of remote applications, CCFE said.

The centre will also benefit fusion energy research by enabling "ever more complex remote handling techniques to be perfected." CCFE has over 20 years of remote handling experience on the Europe's JET nuclear fusion experiment. Its partners add further experience of remote and autonomous working in challenging environments and remote welding techniques.

"Such significant government and private sector investment in our robotics and harsh environment capabilities will enable our expertise in this area to benefit the county of Oxfordshire and the UK as a whole," commented CCFE Operations Director David Martin.

The worldwide market in remote working in harsh environments is

estimated at a potential £64 billion per annum, according to CCFE.

8. Nuclear fusion: Julich's role in ITER

February 13th, 2014

<http://phys.org/wire-news/153753050/nuclear-fusion-julichs-role-in-iter.html>

Forschungszentrum Jülich will lead a consortium of European partners to design a measuring system for the fusion experiment ITER. The facility is currently under construction in Cadarache in the south of France as part of a major international cooperation. The consortium signed a Framework Partnership Agreement with the European Union's Joint Undertaking for ITER and the Development of Fusion Energy (F4E) to develop the ITER core plasma Charge Exchange Recombination Spectroscopy (CXRS) diagnostic. This measuring system will help determine the composition and temperature of the plasma in the vacuum vessel. The Framework Partnership Agreement runs for four years with an F4E contribution of 4.9 million euros.

ITER is the next major step in international fusion research. F4E is responsible for providing the European contribution to ITER, which is scheduled to go into operation in the early 2020's and demonstrate the feasibility of fusion energy on a power-plant scale for the first time ever. The fusion of atomic nuclei will be used to generate energy. Similar processes occur inside the sun. If they can be controlled here on Earth, then we would have access to a safe and practically inexhaustible source of energy.

Once designed by the consortium, the core plasma CXRS system will be procured by F4E and assembled into a port plug, to be installed in an inset at the upper edge of the vacuum vessel. The consortium gained a significant knowledge related to this diagnostic through R&D tasks funded in the past years by the European Fusion Development Association (EFDA) and by the Federal Ministry of Education and Research (BMBF). In particular,

deployment of such a system under the extreme conditions that will be encountered in ITER necessitates complex development work and tests. Indeed, temperatures exceeding 100 million degrees Celsius are expected within the vacuum vessel and the associated plasma radiation, neutron flux, and electromagnetic forces all impact significantly on the design choices for components. In addition, maintenance and repairs are usually only possible using remote-controlled tools or robots.

The CXRS diagnostic views a region of the ITER plasma illuminated by a high-energy beam of neutral hydrogen particles injected into the plasma by a companion device being constructed by ITER's Indian partners. Collisions with particles in the fusion plasma produce visible light. Its wavelength and spatial distribution allow conclusions to be drawn on various properties of the plasma. The measurements provide information that is crucial for sustaining the fusion reaction. The density of helium, in particular, is recorded. Helium is formed during the fusion reaction and must be removed from the combustion chamber if the fusion fire is to be kept alight. Other important parameters such as the concentration, temperature and velocity of different plasma species can be determined using the diagnostic.

The design of the CXRS diagnostic device is being performed, in particular, by physicists and engineers from the Jülich Institute of Energy and Climate Research (IEK-4) and by their colleagues at Jülich's Central Institute of Engineering, Electronics and Analytics (ZEA-1) as well as by their European partners (members of the consortium) including Karlsruhe Institute of Technology (KIT), universities of technology in Budapest (BME) and Eindhoven (TU/e), the Dutch Institute for Fundamental Energy Research (DIFFER), and CCFE in the UK. Contributing third parties include the Spanish CIEMAT centre and the Hungarian Wigner-RCP institute.

Provided by Forschungszentrum Juelich

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9. Nuclear Waste Solution

Seen in Desert Salt Beds

By MATTHEW L. WALDFEB. 9, 2014

http://www.nytimes.com/2014/02/10/science/earth/nuclear-waste-solution-seen-in-desert-salt-beds.html?_r=0

CARLSBAD, N.M. — Half a mile beneath the desert surface, in thick salt beds left behind by seas that dried up hundreds of millions of years ago, the Department of Energy is carving out rooms as long as football fields and cramming them floor to ceiling with barrels and boxes of nuclear waste.

The salt beds, which have the consistency of crumbly rock so far down in the earth, are what the federal government sees as a natural sealant for the radioactive material left over from making nuclear weapons.

The process is deceptively simple: Plutonium waste from Los Alamos National Laboratory and a variety of defense projects is packed into holes bored into the walls of rooms carved from salt. At a rate of six inches a year, the salt closes in on the waste and encapsulates it for what engineers say will be millions of years.

“It’s eternity,” said Dirk Roberson, a guide for the frequent tours the Energy Department gives to visitors to the salt mine, who leave with a souvenir plastic bag filled with chunks of salt pressed into rocklike form.

The complications of the present intruded last week, however, when a truck hauling salt in the mine caught fire. Smoke forced an evacuation of workers and a shutdown of waste burial operations, which officials said was temporary. They said the fire did not affect the radioactive

waste, which is stored at the other end of the mine.

Despite the setback, [the Waste Isolation Pilot Plant](#), WIPP for short, is drawing new attention here in the New Mexico desert. At a time when the effort to find a place for highly radioactive civilian and military wastes is at a near-standstill, officials say the site might be a solution. It is of particular interest since the [demise of the plan for Yucca Mountain](#), a volcanic ridge 100 miles from Las Vegas chosen by Congress for the storage of nuclear waste from power reactors and weapons, but adamantly opposed by the state of Nevada.

The material buried at the plant, [which began accepting waste in 1999](#), is limited by law to plutonium waste from making weapons, which is exceptionally long-lived but not highly radioactive. The waste from spent nuclear fuel, which is far more radioactive in its first few centuries, is not permitted. But experts say that proper testing and analysis might show that the salt beds at WIPP are a good home for the radioactive waste that was once meant for Yucca.

Some people despair of finding a place for what officials call a high-level nuclear “repository” — they shy away from “dump” — but Allison M. Macfarlane, a geologist who is chairwoman of the Nuclear Regulatory Commission and who served on a [presidential study commission](#) established after the Yucca plan was canceled, said WIPP proves it can be done.

“The main lesson from WIPP is that we have already developed a geologic repository for nuclear waste in this country, so we can in the future,” she said. The key, she said, is a site that is acceptable to both scientists and the local community.

The salt at WIPP is not much different from what goes into

food. Phillip R. Sharp, who served on the same study commission as Ms. Macfarlane, said that when the group visited Carlsbad, about 25 miles west of the site, commission members were served cocktails — margaritas garnished with salt from the repository.

But the salt behaves strangely around nuclear waste, which is warm to the touch. When the waste is buried in salt, tiny bits of water inside the salt start to move toward the heat. As a result, the salt left behind is stronger, like a good sealant. But it is still basically salt.

“The salt is completely unaffected by any nuclear waste you could imagine, period,” said James Conca, a geologist and former director of the Carlsbad Environmental Monitoring and Research Center, a division of New Mexico State University.

With most things nuclear, however, the politics can be trickier than the science. In the case of WIPP, there is local support but skepticism farther afield.

In the nearby community, business and political leaders are agitating for expansion. John A. Heaton, a Democratic former state representative and the head of the Nuclear Opportunities Task Force, a local business group, argued that the geology was suitable. “The Permian basin is 250 million years old,” he said. “It’s been here a long, long time.” His group has bought a patch of desert and is now exploring whether the land could be used for interim storage of highly radioactive waste.

Burial here, perhaps after recycling usable components, [would be a boon for the area](#), Mr. Heaton added. “Nobody comes in and helps rural areas,” he said. “You have to live by your wits.”

State Representative Cathrynn N. Brown, a Republican, is also in favor of burying nuclear waste here. “We have a low

earthquake incidence, a dry climate, and land that's really not being used for much else," she said.

[Rev. David Wilson Rogers](#), of the First Christian Church (Disciples of Christ) in Carlsbad, said: "This facility has the opportunity to give a blessing to the world by having a safe repository."

But at the state level, there is active opposition. Don Hancock, the nuclear safety director at the [Southwest Research and Information Center](#), said he has been opposing WIPP since the 1970s, long before construction began. He said that the area was rich in oil and gas and that if someone drilled a well centuries from now, ignorant of what lay below, or if the repository expanded into drilled areas, the waste might escape. The 16-square-mile site is in a region thick with pump jacks, which have multiplied with the fracking boom.

The site should stick to its original mandate of storing plutonium waste, Mr. Hancock said. "If WIPP really is a pilot plant, as its name says, we should have WIPP do what it's supposed to do, and operate safely for 25 or 30 years, and then safely decommission it to demonstrate to us and the world that in fact geologic disposal does work."

"We should be looking for multiple other places anyway," he said.

Expanding WIPP, however, would require action by Congress.

Gov. Susana Martinez of New Mexico, a Republican, has taken what amounts to a radical position: undecided. "We haven't made any decision on any possible future mission for WIPP," said F. David Martin, the former head of the state's Environment Department and now the cabinet secretary-designate for the [New Mexico Energy, Minerals and Natural Resources Department](#). "The governor wants

to be assured by the science that it could be done safely.”

10. *Huge Leak of Coal Ash Slows at North Carolina Power Plant*

By MICHAEL WINES and TIMOTHY WILLIAMS FEB. 6, 2014 
<http://www.nytimes.com/2014/02/07/us/huge-leak-of-coal-ash-slows-at-north-carolina-power-plant.html>

A massive leak of toxic coal ash from a retired North Carolina power plant into a neighboring river dwindled on Thursday, utility officials said, but hundreds of workers had yet to seal the breach in a drainage pipe where the leak was detected more than four days ago.

State regulators promised a detailed inquiry into the accident once the area was stabilized and the Dan River's water was shown to be safe. But environmental and citizens' groups criticized the response, saying the leak was the result of decades of lax oversight.

From 50,000 to 82,000 tons of coal-ash slurry flowed into the Dan after the collapse of a corrugated metal drainpipe only a few feet beneath a 27-acre pond, known as an impoundment. Duke Energy, the utility that owns the impoundment and the Dan River Steam Station in Eden, N.C., which closed in 2012, says that 27 million gallons of contaminated water also leaked into the river. Coal ash, a murky gray sludge that is the residue from burning powdered coal to generate electricity, contains high levels of toxic elements, including lead, mercury, selenium and arsenic.

The state said it began testing the Dan's waters on Tuesday

for the presence of 28 toxic metals. A spokesman for the state [Department of Environment and Natural Resources](#), Jamie Kritzer, said Thursday that the first results would be available by Friday.

The department said that five downstream communities that take drinking water from the river were monitoring and filtering the water and had deemed it safe.

In Danville, Va., a town of 43,000, “we’ve done some testing, and it’s been verified that there is none of the heavy metals coming downstream” in the treated water, David Stiles, the chemist for the Danville Water Treatment Plant, said in an interview. The river was opaque with ash on Monday, the day after the spill was detected, he said, but the latest measurements indicated that the ash content was less than a quarter of its recent peak.

Officials in Virginia Beach closed a drinking-water intake at Lake Gaston, a reservoir fed by the Dan, The Associated Press reported.

A spokeswoman for [Duke Energy](#), Lisa Hoffmann, said the company’s own tests of river water near the plant showed that levels of lead, arsenic and selenium were below two parts per billion, well below federal Environmental Protection Agency standards.

“We’re doing water samples every four hours in 11 different places” on the river, she said. “The priority is to safely plug the pipe and at the same time conduct the necessary environmental remediation.”

The Duke samples were taken two miles or more away from the spill. The clean-water advocacy group [Waterkeeper Alliance](#) said Thursday that its own tests of water just yards from the leak showed levels of arsenic 10 times greater than the Duke tests showed.

Both Duke and the Dan River Basin Association, a regional conservation group, said the leak's impact on wildlife remained unclear. The federal Fish and Wildlife Service sent experts to help assess the damage to fish stocks that live in the river, including the endangered Roanoke logperch.

The Dan River spill is but the most recent in a string of problems in coal-ash ponds in North Carolina and nationally. But it is a particular embarrassment to state regulators and to Duke, both of which have come under attack for what critics call lackadaisical oversight of ash ponds at all 14 power plants where Duke burns or once burned coal.

The company agreed in November to spend at least \$1.5 million to install public water lines in Flemington, N.C., after tests showed that arsenic and other chemicals from a coal-ash pond had leaked into groundwater. Last March, a clutch of environmental groups threatened to sue Duke for coal-ash chemical leaks that they said had polluted Mountain Island Lake, which supplies drinking water to Charlotte.

Duke officials said then that the leak was "extremely small" and did not affect the lake's water quality.

State regulators have since filed lawsuits against Duke accusing it of allowing coal-ash leaks at Mountain Island Lake and its 13 other plants. But they came only after environmental groups served notice that they would be filing suits under the Clean Water Act unless the state compelled the utility to comply with the law.

The groups have since argued in court that the state's settlement of two lawsuits was inadequate because it required only that Duke study the leaks further, not stop them. They are seeking to intervene in other actions

against Duke that have yet to be settled.

North Carolina has all but ignored mounting problems at coal-ash basins for years, said Peter Harrison, a staff lawyer for Waterkeeper Alliance.

State discharge permits for such facilities are “extremely lax, in many cases expired, and they completely ignore the issue of leaking contamination from coal-ash impoundments,” Mr. Harrison said. “It wasn’t until citizen groups put the spotlight on the problem that the state undertook enforcement action.”

Mr. Kritzer, the state resources department spokesman, disagreed, saying that Gov. Pat McCrory was the first to take action on the ash basins.

The Environmental Protection Agency stated in 2012 that 45 ash storage sites nationwide had a “high hazard potential,” meaning that failure could cause loss of life.

Susan C. Beachy contributed research.

11. *European Lawmakers Try to Spur Market for Carbon-Emission Credits*

By STANLEY REED FEB. 6, 2014

<http://www.nytimes.com/2014/02/07/business/international/european-lawmakers-try-to-spur-market-for-carbon-emission-credits.html>

LONDON — European Union lawmakers moved on

Thursday to support the bloc's system for trading carbon-emission permits, hoping to revive Europe's flagging effort to take a market-incentives approach to reducing greenhouse gases.

The officials voted 306 to 276 to quickly put into effect a plan to stimulate the trading system by reducing the number of carbon allowances either sold in auctions or given to big carbon polluters.

Europe's market for trading carbon permits is by far the world's most ambitious effort of its type. The permits essentially give holders the right to emit a certain amount of carbon dioxide from industrial smokestacks. But prices for the permits have been so low that they give industries little incentive to stop burning coal and switch to cleaner forms of energy.

The aim of the new move is to reduce the glut of carbon credits that have been depressing prices on the market known as the Emissions Trading System, or E.T.S. If prices rise, the theory goes, then polluters will have more incentive to adopt cleaner energy alternatives.

After the vote Thursday, carbon permit prices rose about 7 percent, to about 6.60 euros, or \$9. But that price is still well under the figure of €25 or more that analysts say is needed to influence business decisions like whether to burn coal, which is a heavy carbon emitter, or natural gas.

European officials "wanted to give a signal that the E.T.S. is not dead, and they managed to get it through," said Roland Vetter, an analyst at CF Partners, a London-based trading house.

The vote was but one of several political efforts to influence Europe's energy policies and curb the climate-changing effects of carbon emissions.

Late last month, the European Commission, the executive body of the 28-nation bloc, unveiled new proposals for reducing greenhouse gases through 2030. Those included big changes for the trading system — like creating a market reserve that could absorb permits when there are too many in circulation, and release them if they become too scarce. But it will be many months before those policies are ironed out, and with a new European Parliament to be elected in May, there is no guarantee that efforts already underway will become law.

Deep divisions separate several groups, including environmentalists, who want to see greater efforts to reduce emissions, and heavy industry, which argues that high energy costs, partly the result of climate-change measures, are hurting European competitiveness.

But the vote Thursday does clear the way for European officials to begin reducing the glut of carbon credits that many see as undermining the trading system.

Beginning as early as March, European officials will reduce the number of credits released over the next three years by about 900 million tons or about half of the estimated two billion ton surplus.

The European Union introduced the trading system in 2005 as the centerpiece of its effort to force utilities and manufacturers to reduce their carbon emissions. Each carbon allowance gives the holder the right to emit one metric ton of carbon dioxide each year. To get the market started, the European Commission allocated a certain number of permits at no cost to major emitters like steel companies. The permits can also be bought at auction, or traded in the market.

Under this system, the total number of permits is scheduled to gradually fall over time. Their scarcity is

supposed to make the prices rise. By putting a heavy price on carbon, the system is meant to let investment decisions drive energy planning by companies, rather than having governments dictate investment in particular clean energy sources like solar or wind. Advocates say that this carbon pricing plan, if properly managed, is the most efficient way to lower emissions.

But after much early fanfare, the European system lost momentum. The long economic slowdown, since the financial crisis of 2008 reduced industrial activity and energy use in Europe, creating a surplus of permits in the system that has depressed the price of allowances. Heavy subsidies for renewable energy by countries like Germany have also undermined the trading system, some analysts say.

Prices declined steeply, to below €3 a ton in April, from close to €30 a ton in 2008. They have recovered as European policy makers indicate a will to shore up the system. But as the market response Thursday indicated, the prices remain well below where analysts say they must be to influence energy decisions.

12. *A Huge Solar Plant Opens, Facing Doubts About Its Future*

By DIANE CARDWELL and MATTHEW L. WALD FEB. 13, 2014

<http://www.nytimes.com/2014/02/14/business/energy-environment/a-big-solar-plant-opens-facing-doubts-about-its-future.html>

NIPTON, Calif. — The Ivanpah solar power plant stretches over more than five square miles of the Mojave Desert. Almost 350,000 mirrors the size of garage doors tilt toward the sun with an ability to energize 140,000 homes.

The plant, which took almost four years and thousands of workers assembling millions of parts to complete, officially opened on Thursday, the first electric generator of its kind.

It could also be the last.

Since the project began, the price of rival technologies has plummeted, incentives have begun to disappear and the appetite among investors for mammoth solar farms has waned. Although several large, new projects have been coming online in recent months — many in the last quarter of 2013 — experts say fewer are beginning construction and not all of those under development will be completed.

“I don’t think that we’re going to see large-scale solar thermal plants popping up, five at a time, every year in the U.S. in the long-term — it’s just not the way it’s going to work,” said Matthew Feinstein, a senior analyst at Lux Research.

“Companies that are supplying these systems have questionable futures. There’s other prospects for renewables and for solar that look a lot better than this particular solution,” he said, including rooftop solar systems that are being installed one by one on businesses and homes.

Executives involved in Ivanpah — a venture among BrightSource Energy, NRG Energy and Google — say that once the facility proves that the technology can work, it will become easier to finance others, especially as repetition brings the cost down.

When BrightSource and other companies asked NRG to invest in a second thermal project, said David Crane, NRG’s chief, he responded: “We’ve got \$300 million invested in Ivanpah — let me see that work for a few months and then we’ll decide whether we want to be

involved in more.”

At the same time, BrightSource has shifted its focus, pursuing markets overseas like China, South Africa and the Middle East and designing smaller plants involving one tower rather than Ivanpah’s three.

Addressing a tent full of officials and industry executives, including those from the construction giant Bechtel, the engineering and building contractor on the project, David Ramm, BrightSource’s chief executive, acknowledged the risk at the dedication ceremony about 50 miles south of Las Vegas.

“We will have failed as a company if the last project we built was at Ivanpah,” he said. “The challenge for BrightSource going forward, and hopefully some of the partners who worked with us here, is to enable this technology commercially and in multiple locations around the world.”

It is a daunting challenge. The Ivanpah project was conceived in the early days of the Obama administration, when dreams of creating a thriving renewable energy industry were backed by the federal government’s financial support. Ivanpah received a \$1.6 billion federal loan guarantee, without which it would not have gone forward, the developers said.

Ernest Moniz, the energy secretary, toured a tower and said the plant was an example of how the loan program — which set off a political maelstrom after the prominent failure of one of its borrowers, the solar panel maker Solyndra — was supposed to work.

“Our job is to kick-start the demonstration of these different technologies to have them available to the private sector,” he told reporters, standing on a tower platform,

soaring above a dry lake bed, two huge boilers atop the other towers glowing in the distance like something out of a clean-tech version of “The Lord of the Rings.”

But he acknowledged that solar thermal technology only worked at large scale and in certain locations.

The loan program that financed Ivanpah has now ended, and the underlying economics shifted during its construction as the price of conventional solar panels dropped. It’s a familiar story in government-sponsored energy projects, going back to efforts to make gasoline from coal in the late 1970s, which were doomed by the retreat of oil prices.

And as federal support has waned, so, too, has demand for similar large-scale projects. What’s more, an important tax credit worth 30 percent of the cost is set to decline after 2016.

“There have been some big changes in both the market and policy dynamics since we made our investment that, I think, on balance, are not terribly positive for BrightSource,” said Dan Reicher, executive director of the Steyer-Taylor Center for Energy Policy and Finance at Stanford. Mr. Reicher oversaw an early investment in BrightSource in 2008 when he was director of climate and energy initiatives at Google. (The company went on to invest \$168 million in Ivanpah.)

“Clean tech investing is way off,” he said.

Still, experts say, BrightSource’s solar thermal technology — which focuses sunlight from mirrors onto 2,200-ton boilers 339 feet in the air to make steam that drives turbines to produce electricity — may have an advantage over conventional panels, which convert sunlight directly into electricity.

The increase in renewable sources of energy, which produce intermittently, coming into the grid, has also increased the need for other services crucial to reliable operation, services that solar thermal plants could provide. Those needs include the ability to start and stop quickly, at any season or hour, when human operators give the order.

Utilities pay power plants for some of those jobs, and some conventional generating stations earn a significant income, in addition to what they receive for producing energy. Around the country, coal plants — of which there are fewer and fewer — were well suited to that work. And government regulators can simply require utilities operating on the grid to show that they have the ability to accomplish some of those jobs, which industry executives call “ancillary services.”

“In the future, there will be money to be made from technologies and systems that contribute to integrating and balancing renewables on the grid,” said Samuel Thernstrom, the executive director of the Energy Innovation Reform Project, a nonprofit in Washington that evaluates electricity policy. “That’s going to be an increasing issue as the percentage of renewables on the grid increases.”

Ivanpah could stabilize voltage but has little storage, though it does have natural gas backup. At the dedication, Mr. Ramm said that in the future, BrightSource’s boilers would use molten salt to store the heat longer. Last year, Arizona Public Service opened a solar thermal plant, Solana, that lets customers brew their morning coffee with the previous afternoon’s sunshine.

At the California Independent System Operator, the company that manages the grid on a moment-to-moment basis, Stephen Berberich, the president and chief

executive, said that “on an apples-to-apples basis, it is more expensive than photovoltaic, but it has a heck of a lot more capabilities than photovoltaic does.”

Another expert, Ron Binz, an energy consultant based in Denver and the former chairman of the Colorado public service commission, said that storage would indeed be needed as intermittent renewables grew. But solar thermal plants were not the only way to meet that need, he said, and a competition would follow. “You can’t look at any element of this without looking at all the others,” he said.

As for the federal loan guarantee program, the government has already changed its approach, looking to emphasize a range of cleaner technologies, especially in fossil fuels and nuclear power.

To that end, Mr. Moniz encouraged the crowd of industry executives to pursue new projects that would qualify for the loan guarantees. “Bring them on,” he said. “We’re ready.”

Diane Cardwell reported from Nipton, Calif., and Matthew L. Wald from New York.

13. Livermore Lab's fusion energy tests get closer to 'ignition'

David Perlman

Updated 2:57 am, Thursday, February 13, 2014

<http://www.sfgate.com/science/article/Livermore-Lab-s-fusion-energy-tests-get-closer-to-5229592.php>

Scientists at **Livermore's** multibillion-dollar National Ignition Facility reported Wednesday that they have achieved the most significant advance yet toward the costly and elusive goal of creating an unlimited source of energy that rivals the sun.

The long-dreamed aim at the facility known as the NIF is to develop a source of fusion energy that could ultimately result in power plants producing endless electricity using only the atoms of the ocean's water as fuel.

In a series of experiments, scientists said Wednesday they have fused particles of atomic hydrogen under increasingly intense heat and pressure, creating tiny implosions that for a fraction of a second yielded more energy from the reaction than the energy in the fuel itself, they said.

The NIF scientists did not claim success in reaching the far more formidable goal of a much larger energy yield termed "ignition," however.

"We can't honestly tell whether we will achieve 'ignition,' but we are working like mad," said Livermore physicist [Omar A. Hurricane](#), leader of a team of 22 scientists in the experiments. "It's anyone's guess whether we can get there, but we're closer to it than anyone's gone before."

He likened the goal of "ignition" to a mountaintop shrouded in fog so dense that no one knows where the summit actually lies.

Road to 'ignition'

To get there, scientists would not only have to generate more energy than the energy in the fuel itself, as their experiments accomplished, but also create a source of energy greater than all the energy pumped into the system by the facility's 192 high-powered lasers - a goal some scientists have argued may be unachievable.

Hurricane and his team reported their results Wednesday in the international scientific journal *Nature*.

During a telephone press conference earlier this week, the scientists said that in four experiments, the NIF's high-powered array of 192 lasers crushed a target containing

the hydrogen isotopes deuterium and tritium under pressures up to 150 billion times the pressure of Earth's atmosphere, and at three times the density of the sun's interior. Each laser "shot" was a pulse lasting less than a 200 millionth of a second.

The process - a technique known as "alpha particle bootstrapping" - not only created energy-producing alpha particles, but each particle in turn yielded more alpha particles, they said.

In the experiments, the NIF's lasers were aimed so finely that their 192 beams converged into a single beam of high-powered light to focus on a tiny gold cage called a "hohlraum" barely an inch long.

The beam struck the inside of the helium-filled hohlraum and generated a fierce shower of X-rays that, in turn, hit a final target capsule less than one millimeter in size - barely half the width of a human hair.

Yield of energy

The tiny capsule was lined with the nuclear fuel deuterium and tritium, frozen into a thin sheath of ice, and when it was hit by the X-rays, the fuel "imploded," creating a shower of alpha particles - the nuclei of helium - that yielded pure energy, and still more alpha particles again and again.

"Conditions were quite ferocious," Hurricane recalled, and added that the results matched earlier computer simulations so well that they confirmed the success of the experiments.

In an independent commentary on the team's report, [Mark Herrmann](#), director of a rival approach to fusion energy at the [Sandia National Laboratory](#) in Albuquerque, said that "fusion scientists around the world are cheering the exciting advances" reported by the Livermore team.

But the pressures achieved in their experiments are "still 1,000 times lower" than that needed to meet the criteria for "ignition," Herrmann said.

"Perhaps the biggest question is: Will 'ignition' be achievable at the NIF? The answer is uncertain," he said.

David Perlman is The San Francisco Chronicle's science editor. E-mail: dperlman@sfchronicle.com

14. NIF experiments show initial gain in fusion fuel

Breanna Bishop, LLNL, (925) 423-9802, bishop33@llnl.gov

https://www.llnl.gov/news/aroundthelab/2014/Feb/NR-14-02-06.html#.Uwa7aP2gG_V

LIVERMORE, Calif. - 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. A key step along the path to ignition 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.

Though ignition remains the ultimate goal, the milestone of achieving fuel gains greater than 1 has been reached for the first time ever on any facility. In a paper published in the Feb. 12 online issue of the journal *Nature*, scientists at Lawrence Livermore National Laboratory (LLNL) detail a series of experiments on the [National Ignition Facility](#) (NIF), which show an order of magnitude improvement in yield performance over past experiments.

"What's really exciting is that we are seeing a steadily increasing contribution to the yield coming from the boot-strapping process we call alpha-particle self-heating as we push the implosion a little harder each time," said lead author Omar Hurricane.

Boot-strapping results when alpha particles, helium nuclei produced in the deuterium-tritium (DT) fusion process, deposit their energy in the DT fuel, rather than escaping. The alpha particles further heat the fuel, increasing the rate of fusion reactions, thus producing more alpha particles. This feedback process is the mechanism that leads to ignition. As reported in *Nature*, the boot-strapping process has been demonstrated in a series of experiments in which the fusion yield has been systematically increased by more than a factor of 10 over previous approaches.

The experimental series was carefully designed to avoid breakup of the plastic shell that surrounds and confines the DT fuel as it is compressed. It was hypothesized that the breakup was the source of degraded fusion yields observed in previous experiments. By modifying the laser pulse used to compress the fuel, the instability that causes break-up was suppressed. The higher yields that were obtained affirmed the hypothesis, and demonstrated the onset of boot-strapping.

The experimental results have matched computer simulations much better than previous experiments, providing an important benchmark for the models used to predict the behavior of matter under conditions similar to those generated during a nuclear explosion, a primary goal for the NIF.

The chief mission of NIF is to provide experimental insight and data for the National Nuclear Security Administration's science-based [Stockpile Stewardship Program](#). This experiment represents an important milestone in the continuing demonstration that the stockpile can be kept safe, secure and reliable without a return to nuclear testing. Ignition physics and performance also play a key role in fundamental science, and for potential energy applications.

"There is more work to do and physics problems that need to be addressed before we get to the end," said Hurricane, "but our team is working to address all the challenges, and that's what a scientific team thrives on."

Hurricane is joined by co-authors Debbie Callahan, Daniel Casey, Peter Celliers, Charlie Cerjan, Eduard Dewald, Thomas Dittrich, Tilo Doeppner, Denise Hinkel, Laura Berzak Hopkins, Sebastien Le Pape, Tammy Ma, Andrew MacPhee, Jose Milovich, Arthur Pak, Hye-Sook Park, Prav Patel, Bruce Remington, Jay Salmonson, Paul Springer and Riccardo Tommasini of LLNL, and John Kline of Los Alamos National Laboratory.

15. *Science Linking Drought to Global Warming Remains Matter of Dispute*

By JUSTIN GILLIS FEB. 16, 2014

http://www.nytimes.com/2014/02/17/science/some-scientists-disagree-with-presidents-linking-drought-to-warming.html?_r=0

In delivering aid to drought-stricken California last

week, [President Obama](#) and his aides cited the state as an example of what could be in store for much of the rest of the country as human-caused [climate change](#) intensifies.

But in doing so, they were pushing at the boundaries of scientific knowledge about the relationship between climate change and drought. While a trend of increasing drought that may be linked to global warming has been documented in some regions, including parts of the Mediterranean and in the Southwestern United States, there is no scientific consensus yet that it is a worldwide phenomenon. Nor is there definitive evidence that it is causing California's problems.

In fact, the most recent computer projections suggest that as the world warms, California should get wetter, not drier, in the winter, when the state gets the bulk of its precipitation. That has prompted some of the leading experts to suggest that climate change most likely had little role in causing the drought.

"I'm pretty sure the severity of this thing is due to natural variability," said Richard Seager, a climate scientist who studies water issues at the Lamont-Doherty Earth Observatory of Columbia University.

To be sure, 2013 was the driest year in 119 years of record keeping in California. But extreme droughts have happened in the state before, and the experts say this one bears a notable resemblance to some of those, including a crippling drought in 1976 and 1977.

Over all, drought seems to be decreasing in the central United States and certain other parts of the world, though that is entirely consistent with the longstanding prediction that wet areas of the world will get wetter in a warming climate, even as the dry ones get drier.

What may be different about this drought is that, whatever

the cause, the effects appear to have been made worse by climatic warming. And in making that case last week, scientists said, the administration was on solid ground.

California has been warming along with most regions of the United States, and temperatures in recent months have been markedly higher than during the 1976-77 drought. In fact, for some of the state's most important agricultural regions, summer lasted practically into January, with high temperatures of 10 or 15 degrees above normal on some days.

The consequence, scientists say, has been that any moisture the state does get evaporates more rapidly, intensifying the effects of the drought on agriculture in particular. "We are going through a pattern we've seen before, but we're doing it in a warmer environment," said Michael Anderson, the California state climatologist.

The White House science adviser, John P. Holdren, said in a briefing last week: "Scientifically, no single episode of extreme weather, no storm, no flood, no drought can be said to have been caused by global climate change. But the global climate has now been so extensively impacted by the human-caused buildup of greenhouse gases that weather practically everywhere is being influenced by climate change."

The drought eased a bit with heavy rains in Northern California this month, but many major reservoirs have only half the water expected for this time of year. "I think the situation is still pretty severe," said Prof. Alex Hall, who studies climate at the University of California, Los Angeles.

California gets much of its water from snow in the winter along the western slopes of the Sierra Nevada. That means 38 million people and a \$45 billion agricultural economy

are critically dependent on about five heavy storms a year.

If a ridge of high atmospheric pressure develops off the California coast, it can easily push moisture-bearing winds to the north, so that the water falls closer to Seattle than Sacramento. Just such a ridge has been parked off California for much the last three years.

Dr. Sewall expected some sort of disturbance in the circulation of the atmosphere, but he and his adviser, Lisa Cirbus Sloan, were not prepared for the answer they received. “The surprise jumped out that, wow, all of a sudden it got a whole lot drier in the western part of North America,” Dr. Sewall recalled.

His first study on the question was published in 2004, and was based on conditions that were expected by midcentury. Arctic sea ice then fell much faster than expected, hitting a record low in 2007 and then another record low in 2012.

He and several other scientists said the loss of ice has allowed extra heat to escape from the Arctic Ocean into the atmosphere in the fall and early winter, disturbing weather patterns over vast distances. That, they said, has made extreme weather events of all kinds more likely in the Northern Hemisphere, possibly including winter extremes like the cold blasts hitting the East Coast these days.

At the same time, the California drought, now in its third year, bears a striking resemblance to the atmospheric pattern predicted in Dr. Sewall’s computer analysis.

The resemblance is so uncanny that Dr. Sewall, who now works at Kutztown University in Pennsylvania, suspects an element of coincidence, but he also calls the correlation “frightening.” If this kind of drought has indeed become more likely for California, that means the state — where

some towns are now worried about running out of drinking water — is getting a glimpse of its future.

Since his studies were published, other research has come to somewhat different conclusions. Many of those studies have found a likelihood that climate change will indeed cause the American West to dry out, but by an entirely different mechanism — the arrival of more dry air from the tropics. And the most recent batch of studies predicts that effect will not really apply to the western slope of the Sierra. Climate projections show that the area should get somewhat more moisture in the winter, not less.

It may take years to resolve the scientific uncertainty. But with California's growing population, the state faces increasing pressure to resolve tensions involved in apportioning its water among city dwellers, farmers, industry and an environment under increasing strain from global warming.

Dr. Seager of Columbia University pointed out that much of the Southwestern United States had been in a drought of fluctuating severity for 15 years. In some areas, moreover, the warmer climate is causing winter precipitation to fall as rain rather than snow, meaning less melting snowpack to help parched states through the hotter summers.

“It all adds up across the Southwest to an increasingly stressed water system,” he said. “That’s what they might as well get ready for.”

Correction: February 18, 2014

Because of an editing error, an article on Monday about the relationship between drought conditions and global warming paraphrased incorrectly from comments by Richard Seager, a climate scientist at Columbia University. He said that much of the Southwestern United

States — not the West Coast — had been in drought for the past 15 years.

16. Study Finds Methane Leaks Negate Benefits of Natural Gas as a Fuel for Vehicles

By CORAL DAVENPORT FEB. 13, 2014

<http://www.nytimes.com/2014/02/14/us/study-finds-methane-leaks-negate-climate-benefits-of-natural-gas.html>

WASHINGTON — The sign is ubiquitous on city buses around the country: “This bus runs on clean burning natural gas.”

But a surprising new report, to be published Friday in the journal *Science*, concludes that switching buses and trucks from traditional diesel fuel to natural gas could actually harm the planet’s climate.

Although burning natural gas as a transportation fuel produces 30 percent less planet-warming carbon dioxide emissions than burning diesel, the drilling and production of natural gas can lead to leaks of methane, a greenhouse gas 30 times more potent than carbon dioxide.

Those methane leaks negate the climate change benefits of using natural gas as a transportation fuel, according to the study, which was conducted by scientists at Stanford University, the Massachusetts Institute of Technology and the Department of Energy’s National Renewable Energy Laboratory.

The study concludes that there is already about 50 percent more methane in the atmosphere than previously estimated by the Environmental Protection Agency, a signal that more methane is leaking from the natural gas production chain than previously thought.

“Switching from diesel to natural gas, that’s not a good policy from a climate perspective,” said the study’s lead author, Adam R. Brandt, an assistant professor in the department of energy resources at Stanford.

But the study does conclude that switching from coal-fired power plants — the nation’s largest source of carbon pollution — to natural gas-fired power plants will still lower planet-warming emissions over all. Natural gas emits just half the carbon pollution of coal, and even factoring in the increased pollution from methane leaks, natural gas-fired plants lead to less emissions than coal over 100 years, the study found.

The report adds weight to efforts by New York and other Northeastern states to push the federal government to regulate methane emissions. Currently, there are no federal regulations on methane emissions from oil and gas production, although some states are considering such rules.

The finding on trucks and buses is a blow to years of public policy efforts to switch the vehicles from diesel to natural gas, an effort aimed at decreasing pollution as well as America’s dependence on foreign oil.

President Obama praised natural gas production in his last two State of the Union addresses, and has noted that natural gas production creates jobs while natural gas-powered electricity is more climate friendly than coal. But environmentalists say that natural gas production comes with the hidden climate risk of methane leaks from drilling

wellheads, valves and pipelines.

The report's authors conclude that the leaks can be reined in if oil and gas companies invest in technology to prevent methane from escaping into the atmosphere from gas wells and production facilities. That recommendation is in line with a petition sent by New York and other Northeastern states urging the E.P.A. to create federal methane leak regulations.

The regulations would require that oil and gas companies install equipment at wellheads to capture the leaks, use valves in production facilities that do not allow methane to escape and have regular inspections.

“This report justifies E.P.A. taking action on regulation of methane pollution and to focus that regulation on existing wells,” said Mark Brownstein, chief counsel for the American climate and energy program at the Environmental Defense Fund.

The oil and gas industry has consistently resisted new regulations. Natural gas developers say that it is in their interest to capture methane since it is a component of natural gas and can be sold as such. Allowing it to escape causes them to lose money.

“The industry has led efforts to reduce emissions of methane by developing new technologies and equipment, and these efforts are paying off,” Carlton Carroll, a spokesman for the American Petroleum Institute, which lobbies for oil and gas companies in Washington, wrote in an email. “Given that producers are voluntarily reducing methane emissions, additional regulations are not necessary.”

Friday's report is one of a series of closely watched and sometimes hotly disputed studies on the environmental impacts of natural gas production. Natural gas producers

celebrated a [September report published in The Proceedings of the Natural Academies of Science](#) that concluded that methane leaks from hydraulic fracturing sites are, on average, at or lower than levels set by the E.P.A.

However, that study also found that on some fracking rigs, valves allow methane to escape at levels 30 percent higher than those set by E.P.A. The authors of Friday's study say that despite the good news in that report, methane appears to be leaking elsewhere in the natural gas supply, production and transportation chain. For example, the authors said, methane could be leaking from facilities where natural gas is stored, compressed or transported.

17. *Water-Cleaning Technology Could Help Farmers*

By TODD WOODY FEB. 16, 2014

<http://www.nytimes.com/2014/02/17/technology/water-cleaning-technology-could-help-farmers.html>

FIREBAUGH, Calif. — The giant solar receiver installed on a wheat field here in California's agricultural heartland slowly rotates to track the sun and capture its energy. The 377-foot array, however, does not generate electricity but instead creates heat used to desalinate water.

It is part of a project developed by a San Francisco area start-up called WaterFX that is tapping an abundant, if contaminated, resource in this parched region: the billions of gallons of water that lie just below the surface.

Financed by the Panoche Water District with state funds,

the \$1 million solar thermal desalinization plant is removing impurities from drainage water at half the cost of traditional desalinization, according to Aaron Mandell, a founder of WaterFX.

If the technology proves commercially viable — a larger plant is to be built this year — it could offer some relief to the West's long-running water wars.

WaterFX faces a daunting and urgent task. The water is tainted with toxic levels of salt, selenium and other heavy metals that wash down from the nearby Panoche foothills, and is so polluted that it must be constantly drained to keep it from poisoning crops.

And with California facing a record-breaking drought, the spigot has gone dry for farmers that depend on long-term contracts with the federal government's Central Valley Project to deliver cheap water from the north. Irrigation costs are expected to double or triple as growers are forced to buy water on the spot market.

“Food prices are going to go up, absolutely,” said Dennis Falaschi, manager of the Panoche Water District, as he drove his pickup truck past bone-dry fields of almond trees and grapevines on an unseasonably warm day recently.

WaterFX's project exploits two things the Central Valley possesses in abundance — fallow land and sunshine — to cut desalinization costs.

The parabolic-shaped receiver is a standard unit made by a Colorado company called SkyFuel for solar thermal power plants. It uses a reflective film rather than expensive mirrors to focus the sun on tubes containing mineral oil that are suspended over the solar array.

As the oil warms to 248 degrees, the heat is piped into refurbished, 1960s-era evaporators to generate steam. The steam then condenses fresh water and separates the salts and heavy metals. The cycle is repeated to further concentrate the brine.

WaterFX relies on off-the-shelf equipment except for a heat pump of its own design. The pump recycles excess steam for reuse through a chemical process rather relying on an electricity-driven compressor.

“It cuts the number of solar collectors you need roughly in half,” Mr. Mandell said.

That savings means WaterFX can purify water using half as much energy as conventional desalinization.

During the pilot project, WaterFX produced 14,000 gallons of purified water a day. A commercial version of the plant, set to be built this year on 31 acres of land, will produce 2,200 acre-feet a year. That’s the amount of water that would cover an acre of land at a depth of one foot, or 717 million gallons. The company will store excess heat generated by the solar array in molten salt to allow the plant to operate 24 hours a day.

Mr. Mandell said WaterFX currently produces an acre-foot of water for \$450. That compares to about \$280 an acre-foot charged by the Central Valley Project — when water is available.

This year, farmers in the Panoche district will receive no water. Last year, they received only 20 percent of their allocation, Mr. Falaschi said. In 2012, the allocation was 40 percent. Farmers elsewhere who rely on the State Water Project to irrigate 750,000 acres of farmland will also receive no water in 2014.

For agricultural water districts like Panoche, solar thermal

desalinization promises to solve two persistent problems. One is a chronic water shortage, even in rainy years, as regulators divert water to cities and for environmental purposes, like protecting endangered fish.

The other is the growing salt contamination of agricultural land that has led farmers to abandon more than 100,000 acres in the Central Valley in recent years.

For decades, water districts like Panoche have drained salty groundwater and disposed of it in places like the San Joaquin River. But new environmental restrictions ban that practice.

WaterFX could reduce the volume of drainage water that needs to be diverted while providing a new supply of fresh water for irrigation that is not dependent on the vagaries of snowpack and rainfall in far-off parts of the state.

“This subsurface groundwater is a possible gold mine,” Mr. Falaschi said. “You’re taking a water supply that is unusable now and you’re converting it to a usable source.”

The desalinated water is of bottled-water quality, purer than what is needed for irrigation.

“We’re creating more water that can be transferred to other markets,” said Mr. Mandell, 38, a technology entrepreneur, who co-founded the renewable energy companies AltaRock Energy and Coskata. “In some instances, that may be water that goes into the municipal-industrial market, which is a higher-paying market.”

Michael Hanemann, a professor of agricultural and resource economics at the University of California, Berkeley, called desalinization a hedge against future shortages and the rising price of water. “It’s a form of insurance,” he said. “The issue isn’t turning over your whole water supply to desalinization but adding to it.”

Professor Hanemann said the economic viability of WaterFX's technology depended on how much water farmers would have to buy on expensive spot markets because of drought and climate change. The more water they buy, and the greater the uncertainty surrounding future supplies, the more attractive desalinization becomes.

He noted that traditional desalinization plants carried high capital costs as they were often built as backup sources of water and operated infrequently. A solar thermal desalinization plant that runs continuously and relies on free sunlight for fuel could make the technology more competitive, he said.

Standard desalinization plants rely on membranes to filter out salt and other impurities from seawater. The process, called reverse osmosis, is expensive. Membranes must be periodically replaced, and forcing seawater through them is energy-intensive, with electricity typically accounting for around a third of operating costs.

Given the high price of desalinization, most projects have been built in water-stressed regions, like the Middle East. But as water shortages persist in California, cities like San Diego are building desalinization plants. A project under construction north of the city, for instance, carries a construction cost of \$700 million.

A \$30 million, federally funded reverse osmosis plant, which will also treat drainage water, is being built next to the WaterFX pilot project.

Brent Giles, a senior analyst at Lux Research, said solar thermal desalinization's competitiveness with reverse osmosis remained to be seen. He noted that contaminated water like that found in the Central Valley contained far less salt than seawater and required less energy to purify.

“But for specialized applications like agriculture, I can see there being some value to solar thermal desalinization, ” Mr. Giles said.

WaterFX is among a small number of efforts to use the sun to desalinate water. A company called Sundrop Farms is using solar thermal technology similar to WaterFX’s to desalinate seawater for use in growing greenhouse crops in southern Australia.

“It’s a technology that will ultimately be able to treat hundreds of thousands of acre-feet of water without having an enormous impact on the environment or on the economics of agriculture,” Mr. Mandell of WaterFX said.

