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YEAR II - NUMBER 1 - JANUARY-MARCH 2016


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ONE
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Year II - Number 1
JANUARY-MARCH 2016

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Cover Photo:
The Earth - as seen from above Compton crater. Taken by the Lunar Reconnaissance Orbiter (NASA)

Publisher:
Sotacarbo Ltd
CO2 Technology Centre Sulcis
Grande Miniera di Serbariu 09013
Carbonia (Italy)

Paris always worth a mass?

The COP 21 final accord is seen by many as crucial to move world societies towards resilient, low-carbon economies. Not everyone agrees

By JEZ ABBOTT

ONE

Last December Paris hosted the world's biggest talks on tackling global warming and curbing emissions. More than 38,000 delegates representing countries, United Nations' agencies, charities, campaign groups, universities, companies and media organisations came together in a spirit of harmony.

After almost two weeks of discussions in the French capital, the 21st UN Climate Change Conference, or COP21, saw 195 countries agree to keep global average temperatures "well below 2°C" by cutting greenhouse gas emissions and ensuring countries can adapt.

But some left feeling "vilified as slave traders", and reaching widespread agreement has been a long time coming: for decades scientists and politicians across the globe have bickered and failed to solve threats posed by climate change.

COP21 however was different, according to he UN, which hyped the gathering as a second chance to strike a deal after a similar, ill-fated, effort six years ago in Copenhagen, Denmark, failed to produce a binding agreement.

Toward the Paris summit's end on 12 December 2015, UN secretary-general Ban Ki-moon said the talks were the "most complicated, most difficult" he had attended. But: "We have entered a new era of global cooperation on one of the most complex issues ever to confront humanity."

The final accord is seen by many as a crucial, perhaps last, chance to create the first universal agreement to move world societies towards resilient, low-carbon economies. The agreement comes into effect in four years and to help fund this ambitious goal; COP21 aims to raise $100 billion a year from 2020 through public and private sources in developed countries. While individual pledges from nations are not enough to prevent dangerous climate change, the 32-page Paris Agreement was seen by many to mark a significant, collective and positive step for international negotiations.

UN Framework Convention on Climate Change (UNFCCC) executive secretary Christiana Figueres said: "One planet, one chance to get it right and we did it in Paris. We have made history together.

"The recognition of actions by businesses, investors, cities and regions is one of the key outcomes of COP 21. The groundswell of action shows the world is on an inevitable path toward a properly sustainable, low-carbon world. This is an agreement of conviction and solidarity with the most vulnerable. Now we have to turn this deal into an engine of safe growth."

An agreement of conviction it may be, but COP21 is not a treaty. Instead of legal requirements for accurate cuts in emissions, the deal is based on voluntary pledges, known as "intended nationally determined commitments" or INDCs.

Countries are legally bound, though, to present progress reports every five years beginning in 2023, and to increase pledges every five years beginning in 2020. Lacking major enforcement mechanisms, the deal relies heavily on global peer pressure for countries to comply.

It is good enough for the business sector, with the Trans-Atlantic Business Council (TABC) chief executive Tim Bennett saying: "This is a signal to and incentive for businesses to continue developing new technologies that will contribute to the goal of redu-

"Talks in Paris were the most complicated, most difficult I had ever attended."
Ban Ki-moon, UN secretary-general

cing global emissions.

"Industry is already engaged in tackling climate change through innovation and changing business models. The private sector will continue to provide new technologies and industrial solutions to address this unprecedented challenge. We believe sustained efforts in research, development and deployment are crucial to achieving national pledges."

He said member companies of TABC, a cross-sector business association representing global companies headquartered in the US and EU, "look forward" to engaging with governments and the international community to help achieve the objectives of the agreement.

International Monetary Fund (IMF) managing director Christine Lagarde agreed: "The Paris Agreement is a critical step forward in addressing the challenge of global climate change in the 21st century. Governments must now put words into actions by implementing policies that make adequate progress on the mitigation pledges they have made."

Also happy is Local Governments for Sustainability (ICLEI), the association of cities and local governments dedicated to sustainable development and including 12 mega-cities and more than 1,000 large cities and urban regions in 84 countries.

Secretary general Gino Van Begin said: "The Paris Agreement affirms engagement with all levels of government. This inclusiveness will strengthen the power of the global coalition that will build a climate-safe and resilient future for communities across the world.

"Technical and financial support committed through the agreement will help local and subnational governments to act boldly, swiftly and purposefully on climate. Immediate allocation of necessary resources for local and subnational plans will accelerate implementation of the pre-2020 action."

However, environmental charity Friends of the Earth insisted the final draft of the climate agreement in Paris must be strengthened. Chief executive Craig Bennett said: "This draft climate deal falls far short of the soaring rhetoric from world leaders at the start of the conference.

"While the text recognizes the importance of keeping global warming low, the current commitments from countries still add up to well over three degrees of warming."
Bill McKibben, co-founder of 350.org

"At least it puts fossil fuels on the wrong side of history, but it doesn't contain the solid commitments that science and natural justice require to cut emissions and protect people from increasing floods, droughts and superstorms. "The insistence of the EU and US on a clause that rules out compensating underdeveloped countries for the damage caused by climate change is a major issue. Rich nations have benefited most from burning fossil fuels that wreck our environment – they must take their fair share of the responsibility for helping the developing world to deal with the impacts."

HelpAge International, a group of organisations in Canada, Colombia, Kenya, India and the UK supporting older people worldwide, warned that climate change strategies must reflect the ageing world in which we live because they would experience the greatest impacts of climate change over the coming century.

Others were more forthright in their criticism. A leading European coal lobbying association said the deal to cap global warming meant the sector would "be hated and vilified in the same way that slave traders were once hated and reviled". European Association for Coal and Lignite (Euracoal) secretary-general Brian Ricketts wrote to his members saying the "climate bandwagon is rolling and gathering speed such that the fossil fuel industry will spend the coming years and decades in the spotlight for all the wrong reasons."

He accused governments and the European Commission of being "in cahoots with protest movements" and urged his industry to "no longer acquiesce". Fossil fuels, including coal, contribute to carbon emissions and global warming, but Ricketts said the UN

Four Details on the Paris Agreement

- All countries will submit adaptation communications, in which they may detail their adaptation priorities, support needs and plans. Developing countries will receive increased support for adaptation actions and the adequacy of this support will be assessed.
- The agreement includes a robust transparency framework for both action and support. The framework will provide clarity on countries' mitigation and adaptation actions, as well as the provision of support. At the same time, it recognizes that Least Developed Countries and Small Island Developing States have special circumstances.
- The agreement includes a global stocktake starting in 2023 to assess the collective progress towards the goals of the agreement. The stocktake will be done every five years.
- The agreement includes a compliance mechanism, overseen by a committee of experts that operates in a non-punitive way.

was portraying them as "public enemy number one".

Meanwhile, the deal represented the first step to a "global government" and was based on a "UN lie" about the future potential of renewables: "If emotional energy could power the planet, then COP21 has provided us with enough to keep the lights on for the next hundred years."

Euracoal has 34 members from 20 countries including national associations, importers associations, research institutes and individual companies in Italy, France, Germany, Spain, Poland and Great Britain. This view was poles apart from that of Bill McKibben, co-founder of 350.org, the international effort to decrease carbon dioxide concentration in the atmosphere to 350 parts per million. Every government, he said, at last, seemed to recognize the fossil fuel era must end soon.

"But the power of the fossil fuel industry is reflected in the text, which drags out the transition so far that endless climate damage will be done. Since pace is the crucial question now, activists must redouble our efforts to weaken that industry."

The final text still had "some serious gaps", he insisted: "We're very concerned about the exclusion of the rights of indigenous peoples and the lack of finance for loss and damage. And while the text recognizes the importance of keeping global warming low, the current commitments from countries still add up to well over three degrees of warming."

However, environmental charity WWF praised the deal, with energy policy officer Darek Urbaniak insisting: "agreement sent a strong signal to the governments around the world to continue phasing-out of fossil fuels. While EU coal is already in decline the EU coal-power carbon emissions needs to be cut three times faster than currently planned to avoid the worst impacts of climate change."

That said the COP21 agreement was "a monumental success for the planet and its people," UN secretary general Ban Ki-moon concluded, hailing the deal as "ambitious, credible, flexible and durable".

"History," he added at the dropping a gavel in the shape of a green leaf to close the most far-reaching deal on climate change to date, "will remember this day". ONE

"If emotional energy could power the planet, then COP21 has provided us with enough to keep the lights on for the next hundred years."

Brian Ricketts, Eurocoal secretary-general

Carbon capture and storage: the black sheep of green energy?

Mixed fortunes for this unloved carbon-cutting technology

By TOBY LOCKWOOD

ONE

Solar panels gleaming in the midday sun while turbine blades turn peacefully in the breeze – the appealing idea of harnessing nature's power has had no trouble in winning fans. The idea of sucking up our CO2 emissions and piping them underground has, unsurprisingly, struggled to drum up as much enthusiasm as a means of lessening our impact on the environment, with its reminiscence of sweeping the problem under the carpet and hoping it will go away.

Despite being a regular feature in proposals for reducing global CO2 emissions to safe levels, carbon capture and storage, or CCS, is opposed by environmental groups such as Greenpeace, who tend to see the technology as a ploy for the fossil fuel sector to continue its dirty work. While scientists have been busy trying to bring CCS to practical reality over the last decade, this kind of ideological resistance to the idea of CCS has probably done more to limit its use than any of the technological issues encountered.

Although frequently criticised as an unproven technology which may not work, some examples of CCS have actually been around for decades, and 15 installations worldwide are currently storing around 40 million tonnes per year of CO2 which would otherwise be released into the atmosphere.

Much of the confusion comes from the fact that nearly all these facilities take CO2 from industrial processes rather than the primary carbon culprits – the coal-fired power stations which account for a quarter of the world's emissions and are usually considered the real goal for CCS. This CO2 is much less concentrated, and therefore much harder to capture than oil and gas industry processes which have so far been targeted. Following a decade of cancelled plans, only one coal power plant has so far been fitted with CCS, the Boundary Dam plant in Canada whose opening in late 2014 was seen as a landmark moment for the technology. However, early technical problems at this facility which limited the amount of CO2 it could actually capture have been seized upon by CCS critics as further evidence of its shortcomings, despite protests from the owners that such teething problems are standard for a new technology.

What was to be a pioneering year for CCS power generation then ended on a sour note following the recent announcement by the UK government that, as part of widespread budget cuts, it was cancelling £1 bn in funding previously earmarked for building a CCS power plant. Perhaps more significantly, the USA is still betting big on CCS, with two large coal plants set to open this year, although the massive de-

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The official launch of the Boundary Dam carbon capture and storage facility in Estevan (Canada) on Oct. 2, 2014. Photo: © SaskPower

lays and cost-overruns suffered by the Kemper County plant have also helped cast a shadow over the future of carbon capture.

Like many carbon-free energy sources, power from CCS is expensive. At the moment, government grants of the kind once proposed in the UK are usually required to help companies build a plant and set up an infrastructure for transporting and storing the CO2, but this should quickly become unnecessary as other investors begin to see the technology can actually work.

More importantly, there is obviously no business case for undertaking the costly task of storing CO2 without any financial reward. Regulations which put some price on CO2 emissions are one means of valorising the carbon capture business, but existing schemes like the EU emissions trading system currently set this price far too small to be profitable. Of course, renewable energies like solar panels and wind turbines usually need both these kinds of financial help as well, and have taken off largely thanks to subsidies which effectively charge the customer more for their clean energy. The cost of carbon-free power from CCS is generally estimated to be cheaper than many renewables such as photovoltaics and offshore wind turbines. Otherwise, it would not even be on the table as a viable option.

So why does CCS struggle to find the same level of support? Part of the answer may lie in the nature of the cost of CCS, which is mainly associated with the large amount of energy needed to separate and purify CO2 from other gases. To drive the current processes available for this task, a power plant needs to consume almost half again as much fuel as normal – also having to capture and store the extra CO2 produced.

Burning that much coal just to clean up the original coal is an idea which sits uneasily with many. Critics point to the fact that more coal mining will be nee-

ded, and even if the CO2 is disposed of, does it really make sense to produce so much more of it? This ties into a second source of concern dogging CCS, which is a lack of faith that CO2 will actually stay underground reliably.

Some of this disbelief may stem from a popular misconception that the gas sits in vast subterranean caverns when in reality it is soaked into porous rocks as a pressurised liquid – much like the oil and gas we have removed to produce it. In fact, even if leaks were to occur from these CO2 stores over time, it would probably do little to diminish the value of such large repositories for carbon which would serve a similar role as the oceans and forests.

However, while CCS proponents have fought to convince politicians and the public over the scientific and economic sense of the idea, it is clear that the technology will inevitably be held to a higher standard than its more popular, renewable energy cousins. There is a strong feeling that if we are to resort to this inelegant solution to our climate problems, it should cost much less than the alternatives, and not require so much help to get going.

The main trump card of CCS over most renewables is its ability to produce power on demand, not just when the wind blows or the sun shines – a service which energy markets are still struggling to put a suitable value on. Without CCS, new energy storage technologies will be needed to even out the supply of renewable energy, rendering these already costly energy sources even more expensive.

The alarming extent to which the batteries that power our phones and laptops have lagged behind the devices themselves is some indication of how challenging these technologies are to develop. Nevertheless, the aesthetic superiority of this brave new world of energy is such that people and governments may well be prepared to pay more to avoid any reliance on the comparatively antiquated practice of burning fossil fuels.

The major international climate change talks held in Paris at the end of last year brought little attention to CCS, with only Norway and Canada specifically mentioning the technology in the official action plans submitted by each country. However, a closer look at the hugely ambitious targets laid down by the meeting can only emphasise the inevitable role of CCS if these goals are to be achieved.

Melkøya-Snøhvit-Photo-Øyvind-Hagen-Statoil.
Photo: © Norskpetroleum

The real challenge with the famous 'two-degree scenario' or 2DS agreed to in Paris, is that it effectively allocates humanity a fixed amount of CO2 which can safely be emitted. At our current rate (around 40 billion tonnes per year), this budget of roughly 400 billion tonnes will not last very long, and most predictions show we are almost certain to overshoot it.

The new '1.5-degree scenario' proposed as an aspirational target in Paris presents an even greater challenge. Even if the energy industry is completely decarbonised without recourse to CCS, we will still need to start storing CO2 just to get the atmosphere back to a healthy state. What's more, carbon-intensive industries such as steel and cement production which are much more difficult to clean up will have no choice but to turn to CCS under this strict new regime.

It may seem strange, therefore, that there is so much focus on CCS for power generation, where it needs to compete with far more appealing alternatives. In reality, we are so perilously close to exceeding our carbon budget that CCS needs to be developed now, and applying it to clean up some of the vast number of coal plants worldwide makes more sense than trying to suck CO2 out of the atmosphere in the future. All the more so when many of these plants are brand new and predicted to run for decades, regardless of the impressive growth in renewable generation.

The belief is that CCS is primarily in need of a dramatic image makeover if it is to fulfil its potential role in decarbonising our society. Much of the necessary change in perception can be driven by new technologies which are promising to capture CO2 at far less cost and energy.

As the use of CCS slowly increases, people are also likely to become more used to the idea of storing CO2 underground. However, the industry could do worse than look to another black sheep of clean energy for proof that attitudes can change – nuclear power, which in many countries has gone from environmental pariah to climate change hero in less than two decades. ONE

Welcome to a New Planet

Climate Change "Tipping Points" and the Fate of the Earth

By MICHAEL T. KLARE

TomDispatch.com

Not so long ago, it was science fiction. Now, it's hard science – and that should frighten us all. The latest reports from the prestigious and sober Intergovernmental Panel on Climate Change (IPCC) make increasingly hair-raising reading, suggesting that the planet is approaching possible moments of irreversible damage in a fashion and at a speed that had not been anticipated.

Scientists have long worried that climate change will not continue to advance in a "linear" fashion, with the planet getting a little bit hotter most years. Instead, they fear, humanity could someday experience "non-linear" climate shifts (also known as "singularities" or "tipping points") after which there would be sudden and irreversible change of a catastrophic nature. This was the premise of the 2004 climate-disaster film The Day After Tomorrow. In that movie – most notable for its vivid scenes of a frozen-over New York City – melting polar ice causes a disruption in the North Atlantic Current, which in turn triggers a series of catastrophic storms and disasters. At the time of its release, many knowledgeable scientists derided the film's premise, insisting that the confluence of events it portrayed was unlikely or simply impossible.

Fast forward 11 years and the prospect of such calamitous tipping points in the North Atlantic or elsewhere no longer looks improbable. In fact, climate scientists have begun to note early indicators of possible catastrophes.

Take the disruption of the North Atlantic Current, the pivotal event in The Day After Tomorrow. Essentially an extension of the Gulf Stream, that deep-sea current carries relatively warm salty water from the South Atlantic and the Caribbean to the northern reaches of the Atlantic. In the process, it helps keep Europe warmer than it would otherwise be. Once its salty water flows into sub-Arctic areas carried by this prolific stream, it gets colder and heavier, sinks to lower depths, and starts a return trip to warmer climes in the south where the whole process begins again.

So long as this "global conveyor belt" – known to scientists as the Atlantic Meridional Overturning Circulation, or AMOC – keeps functioning, the Gulf Stream will also continue to bring warmer waters to the eastern United States and Europe. Should it be disrupted, however, the whole system might break down, in which case the Euro-Atlantic climate could turn colder and more storm-prone. Such a disruption might occur if the vast Greenland ice sheet melts in a significant way, as indeed is already beginning to happen today, pouring large quantities of salt-free fresh water into the Atlantic Ocean. Because of its lighter weight, this newly introduced water will remain close to the surface, preventing the submergence of salty water from the south and so effectively shutting down the conveyor belt. Indeed, exactly this process now seems to be underway.

By all accounts, 2015 is likely to wind up as the hottest year on record, with large parts of the world suffering from severe heat waves and wildfires. Despite all this, however, a stretch of the North Atlantic below Iceland and Greenland is experiencing all-time cold temperatures, according to the National Oceanic and

Tasiilaq, Greenland. Photo: © Christine Zenino.

Atmospheric Administration. What explains this anomaly? According to scientists from the Potsdam Institute for Climate Impact Research and Pennsylvania State University, among other institutions, the most likely explanation is the arrival in the area of cold water from the Greenland ice sheet that is melting ever more rapidly thanks to climate change. Because this meltwater starts out salt-free, it has remained near the surface and so, as predicted, is slowing the northern advance of warmer water from the North Atlantic Current.

So far, the AMOC has not suffered a dramatic shutdown, but it is slowing, and scientists worry that a rapid increase in Greenland ice melt as the Arctic continues to warm will pour ever more meltwater into the North Atlantic, severely disrupting the conveyor system. That would, indeed, constitute a major tipping point, with severe consequences for Europe and eastern North America. Not only would Europe experience colder temperatures on an otherwise warmer planet, but coastal North America could witness higher sea levels than those predicted from climate change alone because the Gulf Stream tends to pull sea water away from the eastern U.S. and push it toward Europe. If it were to fail, rising sea levels could endanger cities like New York and Boston. Indeed, scientists discovered that just such a slowing of the AMOC helped produce a sea-level rise of four inches from New York to Newfoundland in 2009 and 2010.

In its 2014 report on the status of global warming, the IPCC indicated that the likelihood of the AMOC collapsing before the end of this century remains relatively low. But some studies suggest that the conveyor system is already 15%-20% below normal with Greenland's melting still in an early stage. Once that process switches into high gear, the potential for the sort of breakdown that was once science fiction starts to look all too real.

Tipping Points on the Horizon

In a 2014 report, "Impacts, Adaptation, and Vulnerability," Working Group II of the IPCC identified three other natural systems already showing early-warning signs of catastrophic tipping points: the Arctic, coral reefs, and the Amazonian forest. All three, the

report suggested, could experience massive and irreversible changes with profound implications for human societies.

The Arctic comes in for particular scrutiny because it has experienced more warming than any other region on the planet and because the impact of climate change there is already so obvious. As the report put it, "For the Arctic region, new evidence indicates a biophysical regime shift is taking place, with cascading impacts on physical systems, ecosystems, and human livelihoods."

This has begun with a massive melt of sea ice in the region and a resulting threat to native marine species. "For Arctic marine biota," the report notes, "the rapid reduction of summer ice covers causes a tipping element that is now severely affecting pelagic [sub-surface] ecosystems as well as ice-dependent mammals such as seals and polar bears." Other flora and fauna of the Arctic biome are also demonstrating stress related to climate change. For example, vast areas of tundra are being invaded by shrubs and small trees, decimating the habitats of some animal species and increasing the risk of fires.

This Arctic "regime shift" affects many other aspects of the ecosystem as well. Higher temperatures, for instance, have meant widespread thawing and melting of permafrost, the frozen soil and water that undergirds much of the Arctic landmass. In this lies another possible tipping-point danger, since frozen soils contain more than twice the carbon now present in the atmosphere. As the permafrost melts, some of this carbon is released in the form of methane, a potent greenhouse gas with many times the warming potential of carbon dioxide and other such gases. In other words, as the IPCC noted, any significant melting of Arctic permafrost will "create a potentially strong positive feedback to accelerate Arctic (and global) warming." This, in fact, could prove to be more than a tipping point. It could be a planetary catastrophe.

Along with these biophysical effects, the warming of the Arctic is threatening the livelihoods and lifestyles of the indigenous peoples of the region. The loss of summer sea ice, for example, has endangered the marine species on which many such communities depend for food and the preservation of their cultural traditions. Meanwhile, melting permafrost and coastal erosion due to sea-level rise have threatened the very existence of their coastal villages. In September, President Obama visited Kotzebue, a village in Alaska some 30 miles above the Arctic Circle that could disappear as a result of melting permafrost, rising sea levels, and ever bigger storm surges.

Coral Reefs at Risk

Another crucial ecosystem that's showing signs of heading toward an irreversible tipping point is the world's constellation of coral reefs. Remarkably enough, although such reefs make up less than 1% of the Earth's surface area, they house up to 25% of all marine life. They are, that is, essential for both the health of the oceans and of fishing communities, as well as of those who depend on fish for a significant part of their diet. According to one estimate, some 850 million people rely on coral reefs for their food security.

Corals, which are colonies of tiny animals related to sea anemones, have proven highly sensitive to changes in the acidity and temperature of their surrounding waters, both of which are rising due to the absorption of excess carbon dioxide from the atmosphere. As a result, in a visually dramatic process called "bleaching," coral populations have been dying out globally. According to a recent study by the Worldwide Fund for Nature, coral reef extent has declined by 50% in the last 30 years and all reefs could disappear as early as 2050 if current rates of ocean warming and acidification continue.

"This irreversible loss of biodiversity," reports the IPCC, will have "significant consequences for regional marine ecosystems as well as the human livelihoods that depend on them." Indeed, the growing evidence of such losses "strengthens the conclusion that increased mass bleaching of corals constitutes a strong warning signal for the singular event that would constitute the irreversible loss of an entire biome."

Manaus Amazon rainforest.
Photo: © Neil Palmer/CIAT for Center for International Forestry Research (CIFOR)

Amazonian Dry-Out

The Amazon has long been viewed as the epitome of a tropical rainforest, with extraordinary plant and animal diversity. The Amazonian tree cover also plays a vital role in reducing the pace of global warming by absorbing vast amounts of carbon dioxide from the atmosphere during the process of photosynthesis. For years, however, the Amazon has been increasingly devastated by a process of deforestation, as settlers from Brazil's coastal regions clear land for farming and ranching, and loggers (many operating illegally) harvest timber for wood products. Now, as if to add insult to injury, the region faces a new threat from climate change: tree mortality due to a rise in severe drought and the increased forest fire risk that accompanies it.

Although it can rain year-round in the Amazon region, there is a distinct wet season with heavy rainfall and a dry season with much less of it. An extended dry season with little rain can endanger the survival of many trees and increase the risk of wildfires. Research conducted by scientists at the University of Texas has found that the dry season in the southern Amazonian region has grown by a week every decade since 1980 while the annual fire season has lengthened. "The dry season over the southern Amazon is already marginal for maintaining rainforest," says Rong Fu, the leader of the research team. "At some point, if it becomes too long, the rainforest will reach a tipping point" and disappear.

Because the Amazon harbors perhaps the largest array of distinctive flora and fauna on the planet, its loss would represent an irreversible blow to global biodiversity. In addition, the region hosts some of the lar-

gest assemblages of indigenous peoples still practicing their traditional ways of life. Even if their lives were saved (through relocation to urban slums or government encampments), the loss of their cultures, representing thousands of years of adaptation to a demanding environment, would be a blow for all humankind.

As in the case of the Arctic and coral reefs, the collapse of the Amazon will have what the IPCC terms "cascading impacts," devastating ecosystems, diminishing biodiversity, and destroying the ways of life of indigenous peoples. Worse yet, as with the melting of the Arctic, so the drying-out of Amazonia is likely to feed into climate change, heightening its intensity and so sparking yet more tipping points on a planet increasingly close to the brink.

In its report, the IPCC, whose analysis tends, if anything, to be on the conservative side of climate science, indicated that the Amazon faced a relatively low risk of dying out by 2100. However, a 2009 study conducted by Britain's famed Meteorological (Met) Office suggests that the risk is far greater than previously assumed. Even if global temperatures were to be held to an increase of 2 degrees Celsius, the study notes, as much as 40% of the Amazon would perish within a century; with 3 degrees of warming, up to 75% would vanish; and with 4 degrees, 85% would die. "The forest as we know it would effectively be gone," said Met researcher Vicky Pope.

Of Tipping Points and Singularities

These four natural systems are by no means the only ones that could face devastating tipping points in the years to come. The IPCC report and other scientific studies hint at further biomes that show early signs of potential catastrophe. But these four are sufficiently advanced to tell us that we need to look at climate change in a new way: not as a slow, linear process to which we can adapt over time, but as a non-linear set of events involving dramatic and irreversible changes to the global ecosphere.

Lagoons and reefs of New Caledonia. **Photo: © NASA.**

The difference is critical: linear change gives us the luxury of time to devise and implement curbs on greenhouse gas emissions, and to construct protective measures such as sea walls. Non-linear change puts a crimp on time and confronts us with the possibility of relatively sudden, devastating climate shifts against which no defensive measures can protect us.

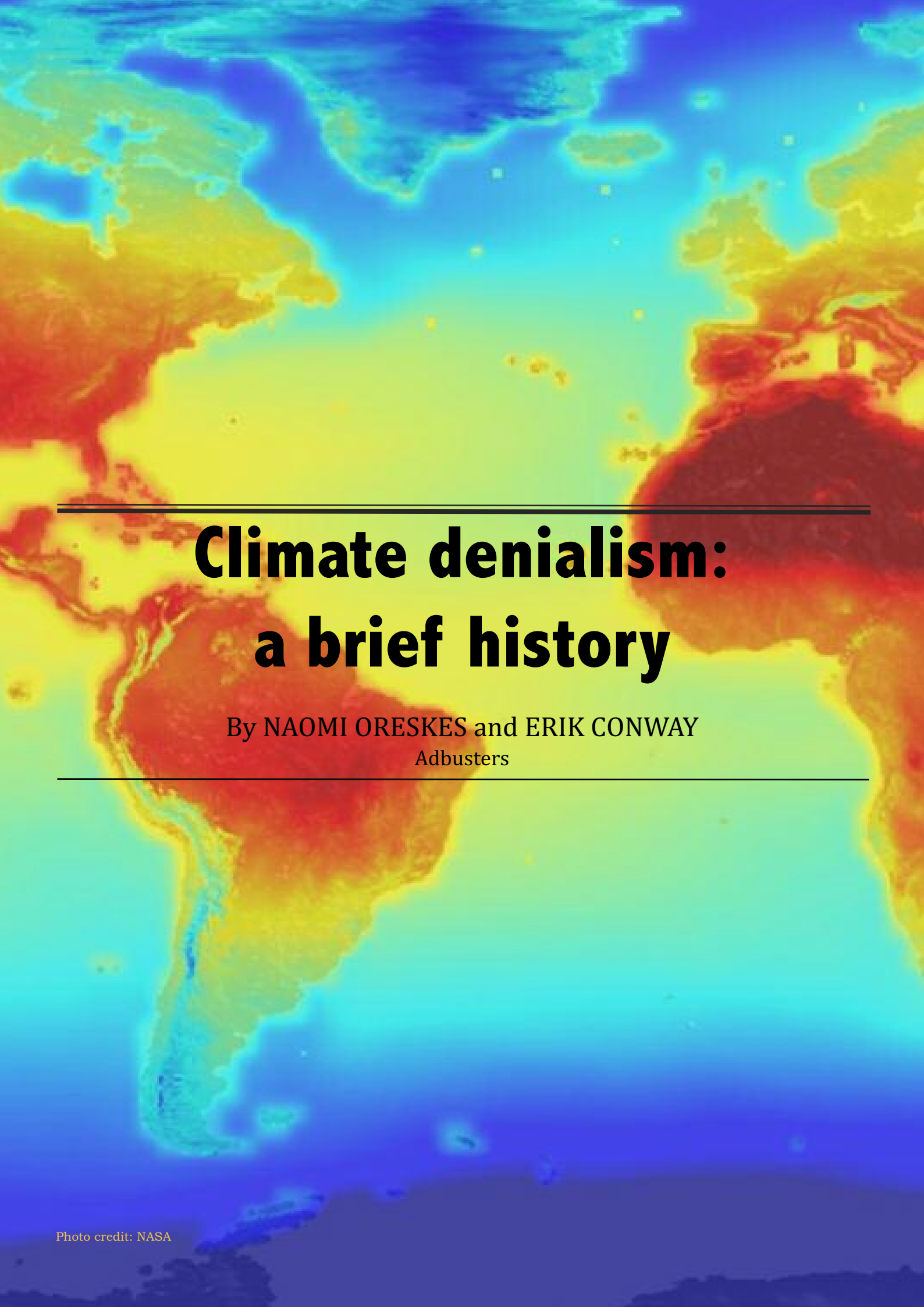
Were the Atlantic Meridional Overturning Circulation to fail, for example, there would be nothing we could do to turn it back on, nor would we be able to recreate coral reefs or resurrect the Amazon.

Add in one other factor: when natural systems of this magnitude fail, should we not expect human systems to fail as well? No one can answer this question with certainty, but we do know that earlier human societies collapsed when faced with other kinds of profound changes in climate.

All of this should be on the minds of delegates to the upcoming climate summit in Paris, a meeting focused on adopting an international set of restrictions on greenhouse gas emissions.

Each participating nation is obliged to submit a set of measures it is ready to take, known as "intended nationally determined contributions," or INDCs, aimed at achieving the overall goal of preventing planetary warming from exceeding 2 degrees Celsius. However, the INDCs submitted to date, including those from the United States and China, suggest a distinctly incremental approach to the problem. Unfortunately, if planetary tipping points are in our future, this mindset will not measure up. It's time to start thinking instead in terms of civilizational survival.

Originally published by Tomdispatch.com October 8, 2015



Climate denialism: a brief history

By NAOMI ORESKES and ERIK CONWAY
Adbusters

Photo credit: NASA

In the late 1970s, scientists first came to a consensus that global warming was likely to result from increasing greenhouse gases released by the burning of fossil fuels. This idea had been around since the turn of the century, but the development of computer models made it possible to make quantitative predictions.

Almost immediately, a small group of politically connected and conservative scientists began to question this consensus. As empirical scientific data mounted up, their attacks became more unprincipled.

These conservative scientists used data selectively and often misrepresented the conclusions of many studies undertaken by the scientific community. In 1992, world leaders gathered in Rio de Janeiro to sign the United Nations Framework on Climate Change. President George W Bush promised to translate the written document into "concrete action". Three years later, the Intergovernmental Panel on Climate Change (IPCC) declared that the human impact on the earth's climate was no longer a prediction but an observable fact. In the early 1990s, a group of skeptics claimed that Roger Revelle, one of the first climate scientists, had changed his mind about global warming and no longer believed it was a serious problem. The claim was repeated through several news outlets, including the Washington Post. When a graduate student named Justin Lancaster - who had worked closely with Revelle before his death in 1991 - tried to insist that Revelle had not changed his view, he was sued for libel. Lancaster was obliged to settle out of court. The claim was repeated again and again, and even today, exists on the Internet.

In 1996, when the IPCC released its second assessment report, stating that the human impact on climate was "discernible", a fossil-fuel-industry-funded group called the Global Climate Coalition accused the IPCC author Benjamin Santer of making unauthorized changes to the document, with the intent of creating a sense that global warming was more certain than it was. The following year, Frederick Seitz, chairman of the George C Marshall Institute, repeated the charges in the Wall Street Journal in an op-ed piece headlined "A Major Deception on Global Warming".

Massive Attack

Had Santer made unauthorized changes to the IPCC report? No: his changes were made in response to peer review. He was doing what every scientist is expected to do - and what IPCC rules required him to do - accepting criticism and using it so that the conclusions of the study were rigorous and clear. Frederick Seitz was a former president of the National Academy of Sciences, so it was not plausible that he did not know about the peer-review process.

In 2007, the claims were repeated in Unstoppable Global Warming: Every 1,500 Years, a book whose premise is that "human-emitted CO2 has played only a minor role" in contributing to global warming. The authors are Dennis Avery and Fred Singer. Singer is a physicist with a track record of challenging scientific evidence. He had taken part in the previous attack on Santer. Both the IPCC and Santer's co-authors took considerable pains to set the record straight, denying that Santer had done anything wrong.

Yet, in their book, Avery and Singer reassert that "scientific reviewers discovered that major changes had been made 'in the back room' after they had signed off on the science chapter's contents" and that "Santer single-handedly reversed the 'climate science' of the whole IPCC report". The idea that any one individual could reverse the entire IPCC process is absurd, and yet, like the "Revelle changed his mind" claim, it remains on the Internet today.

Climate scientists have been subjected to repeated attacks of this kind. In 2005, Congressman Joe Barton of Texas demanded that Professor Michael Mann, director of the Earth System Science Centre at Pennsylvania State University, produce a huge volume of paperwork relating to his research.

Lake Hume. Photo: © Tim J. Keegan

In February, Senator James Inhofe of Oklahoma accused a dozen climate scientists of criminal violations of Federal Law, based on alleged evidence contained in the UEA emails. Recently, Virginia's attorney general, Ken Cuccinelli, went after Mann again, asking that the University of Virginia produce thousands of pages of documents relating to Mann's research.

We, too, have been objects of attack. When one of us (Naomi Oreskes) published a review on the book The Republican War on Science in the journal Science, in which we noted some connections not pursued in that book, Science was threatened with a lawsuit unless it published a rebuttal. (We supplied documents, Science held firm, and the threat went away.)

Blaming scientists for speaking truth to power is an old story. Scientists have long recognized that both the government and public can be reluctant to accept scientific evidence that results in discomfiting conclusions. In 1949, when the USSR detonated its first atomic bomb, the US had to face the reality that it had lost its monopoly on nuclear weapons. Scientists had been warning of this since 1945, but the success of their predictions did not increase their standing.

When they then said that any attempt to stay ahead of the Soviets by building the H-bomb would only speed up the arms race, they were accused of being disloyal. As Harold Urey, who won the Nobel Prize in Chemistry in 1934, wrote: "Because we [scientists] told disagreeable truths, we have even been accused of wishing to give up our progress because we are impractical dreamers or plain traitors."

What is most disagreeable to many "resistors" of global warming is the fear of climate change being used as a warrant for heavy-handed government intervention. There is a parallel with 1949: fear of the Soviet Union then was not fear of a potential invasion, but that the Soviets would export communism to Europe, from where it might spread to the US. Today, US conservatives and right-wing commentators are red-baiting once again. The columnist Charles Krauthammer alleges that "with socialism dead . . . the left was adrift until it struck upon a brilliant gambit: metamorphosis from red to green". Patrick J Michaels, director of the Center for the Study of Science at the Cato Institute, labeled plans for a cap-and-trade system to control greenhouse gases as "Obamunism". The irony is that in 1990, Bush installed a cap-and-trade regime to reduce acid rain because it was an acceptable market-based mechanism. Yet, when Congress finally took the model seriously, conservatives called it communism by other means.

Market Failure

Attacks on climate science, including the 2009 "Climategate" campaign, had nothing to do with the science itself and neither did the entire earlier history of global-warming denial we have studied. Scientists are an easy target. The real issue is the politics of defending the free market.

Since the mid-1990s, the fossil-fuel industry has made common cause with old cold warriors, maverick scientists and conservative think tanks to undermine climate science. The obvious reason is that climate change is what Nicholas Stern calls "the greatest and widest-ranging market failure ever seen." If the free market has failed, then governments will need to act. And that is precisely what various constituencies, from Inhofe to Cuccinelli and a host of think tanks, do not want. It was also what Seitz and his colleagues didn't want. These scientists were passionately anti-communist and viewed any form of government regulation as a step towards socialism.

No wonder we see the rise of McCarthyite tactics today: the stakes, at least in some people's eyes, are the same. But what these people seem to have forgotten from the 1950s is that McCarthyism didn't just destroy the careers of many innocent people: in the end, it destroyed Joe McCarthy.

Originally published by Adbusters.org October 2015

Energy Storage: the key to renewables success

By ALICE MASILI

ONE

Kilroot Power Station, Carrickfergus, Northern Ireland. Photo: © Ardfern

For some years now, scientists have been proposing the exhaustion of fossil fuels. The idea of finding a way to make renewables as primary and not aleatory energy source is becoming increasingly popular. Energy storage is one way to go.

As defined by the European Association for Energy Storage (EASE), "Energy Storage is a facility used for the intake and stocking of electricity in different suitable energy forms. The release of this energy, at a controlled time, can be in forms that include electricity, gas, thermal energy and other energy carriers".

The energy system is always evolving and growing in complexity; it means new challenges for a future energy system more interlinked and efficient. Energy storage is one of the important elements contributing to the development of a low-carbon electricity system also providing a backup for intermittent renewable energy.
Storage exists on all levels of the energy chain, from local to strategic, and its full potential in the new energy system seems to be unexploited. In a longer term scenario, energy storage technologies can contribute to increasing the penetration of renewables - in particular, intermittent renewables.

EU energy policies have understood these technologies importance and also the need to support this sector. Still a lot has to be done. For this purpose, in 2011, the European Commission created EASE, as a result of a shared vision of the roles, technologies and potential applications of energy storage within the framework of the EU Energy and Climate Policy.

EASE is a part of the Strategic Energy Technology-Plan (SET-Plan) designed to accelerate and develop a new research and innovation approach in the energy system transformation. The SET-Plan includes Wind, Solar Energy, Smart Grids, Green Cars, Smart Cities and Efficient Buildings initiatives, emphasizing the importance of future electricity mar-

kets and introducing a new concept of "Prosumer," producer/consumer. Despite being designed to open up and integrate the energy market, the Directive 2009/72/EC, which establishes common rules for the internal electricity market, for the generation, transmission and distribution of electricity, never mentions the concept of electricity storage.

The means how the European electricity market is regulated, and the nature of the electricity market are critical policy issues determining the scope for energy storage to contribute effectively to energy security and emissions reduction. Now, the European electricity market remains fragmented. The European Union has energy rules set at the European level, but in practice, it has 28 national regulatory frameworks. It cannot continue. National markets are characterised by the presence of strong incumbents and have tended to encourage regulators to prevent competition from abroad.

There cannot exist a real internal market until such interconnection is built or reinforced. The inconsistent operational and regulatory approaches, in particular, the small incentive for energy storage in many European electricity markets does not permit a full liberalisation and transparency - also true for the different forms of renewable energy support mechanism across the EU.

The need of equal chances for all the energy storage services ensuring non-discriminatory access to networks is evident. The current market design and national policies do not yet set the right incentives and provide insufficient predictability for potential investors.

Europe has to reset its energy policy in the direction of a European Energy Union. If it continues the present path, the inevitable challenge of shifting to a low-carbon economy will be made harder by the economic, social and environmental costs of too many fragmented national energy markets.

ENERGY STORAGE TECHNOLOGIES

The energy storage market is going through continued innovations. Several technologies for storing energy already exist, and they can be classified into five general groups: chemical, electrochemical, electrical, mechanical and thermal. Some of these are both in the research and development (R&D) or demonstration & deployment (D&D) stages, waiting to evolve further to become commercially viable on a larger scale. The growth of this market technology would make renewable energy more efficient and integrated into the electrical system.

There is a need to increase the capacity of batteries, capacitors, or other devices, which allow keeping a reserve of energy likely if required.

It is possible to store electricity in different ways, not only using batteries. By electrolyzing, water produced hydrogen, that can then be stored and eventually re-electrified (e.g. via fuel cells). Compressed air energy storage (CAES) is another way to store energy generated at one time to be used at another. Again, thermal energy storage technologies allow us temporarily to reserve energy produced in the form of heat or cold for use at a different time. Modern solar thermal power plants produce all of their energy when the sun is shining during the day. The excess

EU's 3rd ENERGY PACKAGE

The legal framework for governing storage is defined at a European level in the Third Package Electricity Directive and, at a national level, in other laws under development. Energy Policy strategy for developing a single energy market started back in 1996 with the Directive 96/92/EC1, which defined common rules for the creation of an internal market for electricity. Then in 2003 to deal with shortcoming and to improve the functioning of the market, Directive 2003/54/EC2 was adopted. Finally, in 2009, to further open and integrate the energy market, Directive 2009/72/EC3 was adopted. This last directive, better known as the 'Electricity Directive', is part of the "European Union's Third Energy Package".

A GROWING MARKET

Recently, Tesla Motors showed its lithium ion batteries for homes and utility-scale applications, called Powerpack and Powerwall respectively, which could increase the prestige for the wind and solar energy resources that have so far depended on storage devices to compensate for intermittent nature of their generation.

Daimler is entering business in the field of stationary energy storage plants with its one hundred percent subsidiary Deutsche ACCUmotive. The first industrial-scale lithium-ion unit is already on the grid and is being operated by the partner companies The Mobility House AG and GETEC Energie AG.

Daimler is also aiming to enter into cooperation with other sales and distribution partners both in Germany and at an international level. An example is the subsidiary corporation Li-Tec, that develop, produces and markets lithium-ion battery cells for automotive, industrial and stationary applications.

Mercedes-Benz energy storages confirm that lithium-ion batteries are the most promising solutions for future energy supply. Developed for demanding service on-board cars, the Mercedes-Benz energy storage units meet the very highest safety and quality standards.

Northern Power Systems, a company, working in the field of power electronics, is team teaching with FIAMM Energy Storage Solutions, a strategic provider of innovative storage batteries and sodium nickel chloride. The product line of power converters Northern Power Systems FlexPhase fully integrates FIAMM's SoNick accumulation technology, providing control key features.

energy is often stored in these facilities - in the form of a molten salt or other materials – and used until the evening to generate steam to drive a turbine to produce electricity.

Typical storage tools are batteries. The most commonly used are lead-based, lithium based, nickel-based and sodium-based batteries.

STORAGE IN EUROPE TODAY

In Europe, there are a large number of energy storage facilities operating or under construction.

In **Austria**, hydroelectric power provides approximately 55% of electricity with an installed capacity of 11,853 MW of which 3,500 MW is Pumped Hydro Storage (PHS). This huge capacity is due to its geographical characteristics with existing storage lakes reducing the building required. Obervermuntwerk II is an example of Pumped Storage Hydro Plant under construction. Once in operation in 2018, the Obervermuntwerk II pumped-storage power station will have an output of 360 MW and will be Illwerke's second-largest power station. In 2011, a new pumped storage plant in the area of the existing Limberg I pumped storage power plant went into operation doubling the output capacity of the Kaprun power plant group from 353 MW to 833 MW. A new Pumped Storage Plant is currently undergoing approval procedure, Limberg III, as an extension of the pumped storage power plant Kaprun-Oberstufe. Following Limberg II, the project strengthens the power plant group in Kaprun as the green battery of Europe.

Denmark has salt caverns suitable for the development of Compressed Air Energy Storage, and it has been considered in energy planning models.

Germany has the largest number of Pumped Hydro Storage plants with 23 operational plants and is the second European country after Spain in installed capacity with 7 GW. Future solutions might be in artificial structures like remaining quarries of opencast mining structures or chalkstone quarries. Compressed air energy storage (CAES) could also be a future storage option. Currently, only one CAES with a power of 290 MW is installed in Germany, whose regulation facilitates energy storage installation with a new law (EnWG §118) that exempts new energy storage facilities (installed before 2019) of paying connection taxes for ten years.

Ireland has one of the best wind resources in Europe. Recently, AES UK & Ireland announced the completion of the Kilroot Advancion Energy Storage Array, located in Kilroot Power Station in Carrickfergus, Northern Ireland. The Array provides 10 megawatts (MW) of interconnected energy storage and is the largest and most advanced energy storage system in the area.

The EU needs to tackle energy issues by implementing a policy that encourages a competitive market. However, a regulatory framework is necessary to ensure a level playing field for all energy. To invest in new storage technologies to keep the advantages of the energy produced by renewable sources, getting over the problem of their discontinuity is the only way to exploit a source of infinite energy. ONE

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Hijacking the Anthropocene

How the anti-green 'Breakthrough Institute' misrepresents science to advance a technocratic agenda and undermine grassroots environmentalism

By IAN ANGUS
Climate and Capitalism

What can lobbyists do when science contradicts their political messages? Some simply deny the science, as many conservatives do with climate change. Others pretend to embrace the science, while ignoring or purging the disagreeable content. That's what the Breakthrough Institute (BTI) is doing with one of the most widely discussed issues in 21st century science, the proposal to define a new geological epoch, the Anthropocene.

BTI has been described as *"the leading big money, anti-green, pro-nuclear think tank in the United States, dedicated to propagandizing capitalist technological-investment 'solutions' to climate change."*

Founded in 2003 by lobbyist Michael Shellenberger and pollster Ted Nordhaus, its philosophy is based on what's known in academic circles as ecological modernization theory – described by Richard York and Eugene Rosa as the view that *"industrialization, technological development, economic growth, and capitalism are not only potentially compatible with ecological sustainability but also may be key drivers of environmental reform."*

In BTI's simplified pop version, to which they've assigned catchier label ecomodernism, there is no "may" about it – their literature consistently couples a professed concern for the environment with rejection of actual pro-environmental policies, on the grounds that new technology, growth and capitalism are the only solution to all environmental concerns.

Most notably, BTI opposes efforts to limit greenhouse gas emissions, claiming that investment in nuclear re-

Peterhead Power Station

actors and shale gas will produce all the energy we need, and global warming will wither away as a side-effect. *"The best way to move forward on climate policy,"* write Shellenberger and Nordhaus, *"is to not focus on climate at all."*

As Australian environmentalist Clive Hamilton comments, BTI's founders *"do not deny global warming; instead they skate over the top of it, insisting that whatever limits and tipping points the Earth system might throw up, human technology and ingenuity will transcend them."*

In 2004, Shellenberger and Nordhaus wrote a notorious pamphlet, The Death of Environmentalism. That title wasn't an announcement – it was a goal. They declared their conviction *"that modern environmentalism ... must die so that something new can live."* Their organization has worked to achieve that death ever since.

Bill Blackwater has exposed the *"self-contradictions, simplistic fantasy, and the sheer insubstantiality"* of BTI's thought, and John Bellamy Foster has shown that ecological modernization theory involves *"a dangerous and irresponsible case of technological hubris [and] a fateful concession to capitalism's almost unlimited destructive powers."* In this article I examine one specific feature of BTI's current activity: its attempt to hijack the Anthropo-

congenial to their views. In contrast to scientists they deem to be depressing, pessimistic, and catastrophist, they declared that the Anthropocene isn't a crisis, it's an opportunity to build a global technological utopia, in which humanity embraces nuclear power and shale gas, and we all enjoy US-style consumerism forever.

What they offer is a homeopathically diluted Anthropocene, in which the only remaining trace of Earth System science is the fact that the Earth is dominated by human activity – and even that, BTI insists, is neither a recent development or a matter for concern. Nordhaus and Shellenberger gave the game away in an article they wrote for Orion magazine and then reprinted in a BTI-published e-book. After agreeing that humans are *"rapidly transforming nonhuman nature at a pace not seen for many hundreds of millions of years,"* they wrote: *"But the difference between the new ecological crises and the ways in which humans and even prehumans have shaped nonhuman nature for tens of thousands of years is one of scope and scale, not kind."* Read that again. If it's true, then there is no case for declaring a new epoch. There has been no qualitative change, so we are still in the Holocene, still doing what humans have always done, since long before the ice sheets retreated.

Landscape ecologist Erle Ellis, a Breakthrough Institute Senior Fellow, has been arguing for the *"scope and scale, not kind"* view in the Anthropocene Working Group, the international committee that is evaluating the proposal for a new geological epoch. He supports an early Anthropocene – the view that the Anthropocene began not recently but thousands of years ago, when humans first made large-scale changes to landscapes and ecosystems.

Official endorsement of an early date would strengthen the Nordhaus/Shellenberger claim that there is no qualitative break between current and past human impacts on the Earth. As Clive Hamilton and Jacques Grinevald write, the early Anthropocene option justifies a business-as-usual understanding of the present. *"It 'gradualizes' the new epoch so that it is no longer a rupture due principally to the burning of fossil fuels but a creeping phenomenon due to the incremental spread of human influence over the landscape. This misconstrues the suddenness, severity, duration and irreversibility of the Anthropocene leading to a serious underestimation and mischaracterization of the kind of human response necessary to slow its onset and ameliorate its impacts."*

BTI's website describes Ellis as *"a leading theorist of what scientists increasingly describe as the Anthropocene,"* but doesn't mention that his early Anthropocene position, while compatible with BTI's philosophy, has little support among the other scientists involved.

In January 2015, over two-thirds of the Anthropocene Working Group's 38 members endorsed 1945 as the beginning of the Anthropocene, both because the Great Acceleration is an historical turning point, and because it can be located in geological strata by the presence of radiation from nuclear fallout. The early Anthropocene argument, they write, unduly emphasizes just one aspect of the case for a new epoch: *"The significance of the Anthropocene lies not so much in seeing within it the 'first traces of our species' (i.e. an anthropocentric perspective upon geology), but in the scale, significance and longevity of change (that happens to be currently human-driven) to the Earth system."*

The AWG hasn't formally decided yet, but Ellis, who evidently believes he has lost the debate, recently told an editor of the journal Nature that he opposes making any official decision. *"We should set a time, perhaps 1,000 years from now, in which we would officially investigate this.... Making a decision before that would be premature."* That would allow BTI to continue misusing the word, but he seems to have little support: a recent article in Science, proposing to *"avoid the confinement imposed by a single formal designation"* has only four signatures, and of them, only Ellis is a member of the AWG.

Oxymoron alert

Breakthrough has invited influential environmental writers to a luxury California resort in June, all expenses paid, for a two-day seminar on "The Good

Anthropocene." So don't be surprised if articles using that oxymoron appear in the mainstream media this summer. Phrases like "unprecedented and unsustainable" will not be emphasized, if they appear at all.

The seminar's message was revealed in April, in An Ecomodernist Manifesto, signed by Nordhaus and Shellenberger and 16 others, all closely associated with BTI. Subtitled From the death of environmentalism to the birth of ecomodernism, it is self-described as *"an affirmative and optimistic vision for a future in which we can have universal human development, freedom, and more nature through continued technological and social modernization."*

The manifesto extends the oxymoron, promising "a good, or even great, Anthropocene" if only we will reject the *"long-standing environmental ideal ... that human societies must harmonize with nature to avoid economic and ecological collapse."*

Yes, you read that right. BTI's pseudo-Anthropocene requires deliberately expanding the metabolic rift between humanity and the rest of nature into a permanent chasm. After all, *"humans have remade the world for millennia,"* so more of the same must be good.

A striking feature of all BTI propaganda is the gulf between the concrete problems they admit exist and what Bill Blackwater calls *"the daydream quality of their positive solutions."* That is clearly on display in their Ecomodernist Manifesto, which proposes to solve the pressing problem of climate change with "next-generation solar, advanced nuclear fission and nuclear fusion" – technologies that don't exist and won't soon arrive. In the meantime, BTI proposes reliance on hydroelectric dams, which can cause major environmental problems, and on carbon capture and storage, which doesn't exist in any practical form.

Clearly, BTI's "Good Anthropocene" won't arrive before the climate and other essential elements of the Earth System reach tipping points. As Blackwater says, BTI's purported realism is actually "the very height of fantasy," a contemporary form of what C. Wright Mills used to call "crackpot realism."

It's time to defog

The pundits, politicians and CEOs whose interests are served by the Breakthrough Institute don't want to be identified with the science deniers of the far right, but neither do they want the radical measures that responding to the real Anthropocene requires. BTI's fantasy of a Good Anthropocene builds the illusion that both objectives are easily achieved. Don't worry, be happy – technological ingenuity will save capitalism from itself.

BTI could have avoided mentioning the Anthropocene, but that would have left a widely discussed concept unchallenged, posing the possibility that public understanding of the state of the Earth System will grow, strengthening the environmentalism that BTI wants to kill. It's far more effective to appropriate the word, to sow confusion by promoting a caricature that has nothing to do with the actual Anthropocene and everything to do with preserving the status quo.

There can be no question about which side the left is on in this conflict. We may not endorse every element of the Anthropocene project, but we must not allow Earth System science to be hijacked and misused by enemies of the environment.

As Dipesh Chakrabarty writes, the scientists whose work BTI is trying to undermine *"are not necessarily anticapitalist scholars, and yet clearly they are not for business-as-usual capitalism either."* Many are adopting more radical views as they study what's happening to the Earth System. It's our responsibility to help them blow away Breakthrough's fog of confusion, and work with them to stop capitalism's drive to ecological disaster.

Originally published by Climate and Capitalism May 19, 2015

9 reasons why the EU's bank is no climate leader

By ANNA ROGGENBUCK
EIB Campaign Coordinator

As declarations emerge from Paris about the billions and trillions of dollars needed to combat the affects of climate change, the world's largest public lender, the European Investment Bank (EIB), is positioning itself as one of the pioneers in this effort. Together with other multilateral development banks, the EIB is posing as the vehicle to distribute these vast sums of money, and as the EU's house bank, it has a guaranteed role to play in the bloc's contribution to the fight against climate change, both within Europe and beyond.

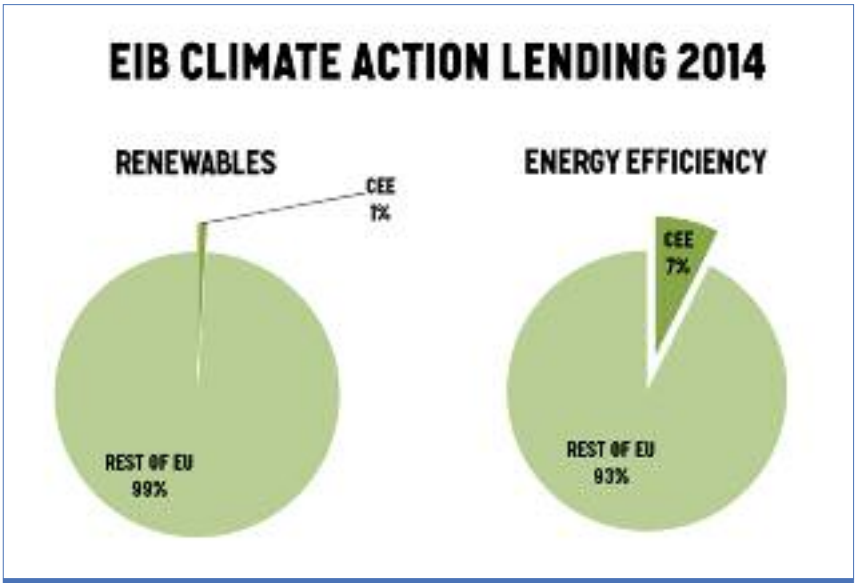
But is the bank really fit for purpose? Can the EIB make a break from its history of financing fossil fuels and polluting forms of transportation after decades of cosy relations with the biggest culprits?

We look behind the façade and at the numbers and find nine reasons why the EIB is not the climate's knight in shining armour.

1. Leader in climate finance ... in five countries

According to an EIB evaluation, 70 per cent of the bank's EUR 75 billion in climate finance between the years 2010 and 2014 was limited to just five countries: Germany, France, UK, Italy and Spain.

A closer look at the bank's projects from 2014 that are counted as climate action reveals an even more glaring imbalance. The 13 EU Member States in central and eastern Europe (CEE) collectively received less than one per cent (EUR 42 million) of the EUR 4.5 billion the EIB lent for renewable energy within the



Source: EIB climate action lending database 2013-2014


PHOTO. Palauenc05

EU in 2014. Of the EUR 2 billion for energy efficiency, only EUR 148 million (7.4 per cent) went to the CEE region.

Overall, CEE countries received only 10 per cent of the EIB's climate action lending in 2014 in spite of the energy intensities of their economies compared to the EU average.

2. Energy efficiency accounts for just two per cent of EIB lending

The European Commission has underlined the need to fundamentally rethink energy efficiency by introducing the Energy Efficiency First principle, i.e. to consider the potential for energy efficiency first in all energy related decisions. The EIB couldn't be farther away from making this a guiding principle for its lending.

As a cross-sectoral issue, energy efficiency measures constituted only 2.8 per cent of the EIB's total lending in 2014. (*Sources: EIB climate action lending database 2013-2014 for total energy efficiency lending; EIB 2014 Statistical Report for the volume of signed loans.*)

In spite of this, the Commission touts the bank as an important player for boosting energy efficiency investments in the EU. In its November Communication on the State of the Energy Union, the Commission proposed that the EIB-managed European Fund for Strategic Investments (EFSI) helps Member States and project promoters boost energy efficiency schemes. If the EIB's track record is anything to go by, energy efficiency is likely to be reduced to a footnote in the EFSI scheme.

3. Massive support for Europe's car industry

Despite repeated calls to transform the global transport system away from private road transport, car manufacturers received a significant 11 per cent of EIB climate finance between 2010 and 2014. As the EIB admits:

> *"Slightly over 40% of Climate Action RDI [Research, Development, Innovation] volume went to the German automobile sector. [...] RDI operations on new RE [renewables] technologies are virtually absent from the Climate Action portfolio".*

Throwing more money at one of the most polluting modes of transportation is not the most effective form of climate finance. Adding insult to injury, car producers have actively circumvented and undermined the promised emission reduction efforts, which brings us to point four.

PHOTO. Stillwellmike/Flickr.com/cc by-sa

4. Generous EIB climate finance for the Volkswagen group

Since 2009 the EIB lent the Volkswagen group EUR 1.5 billion from its climate action programme to improve fuel efficiency and reduce emissions from its engines. Without more detailed information from the EIB about Volkswagen's use of these loans, their contribution to emission reductions action is unknown

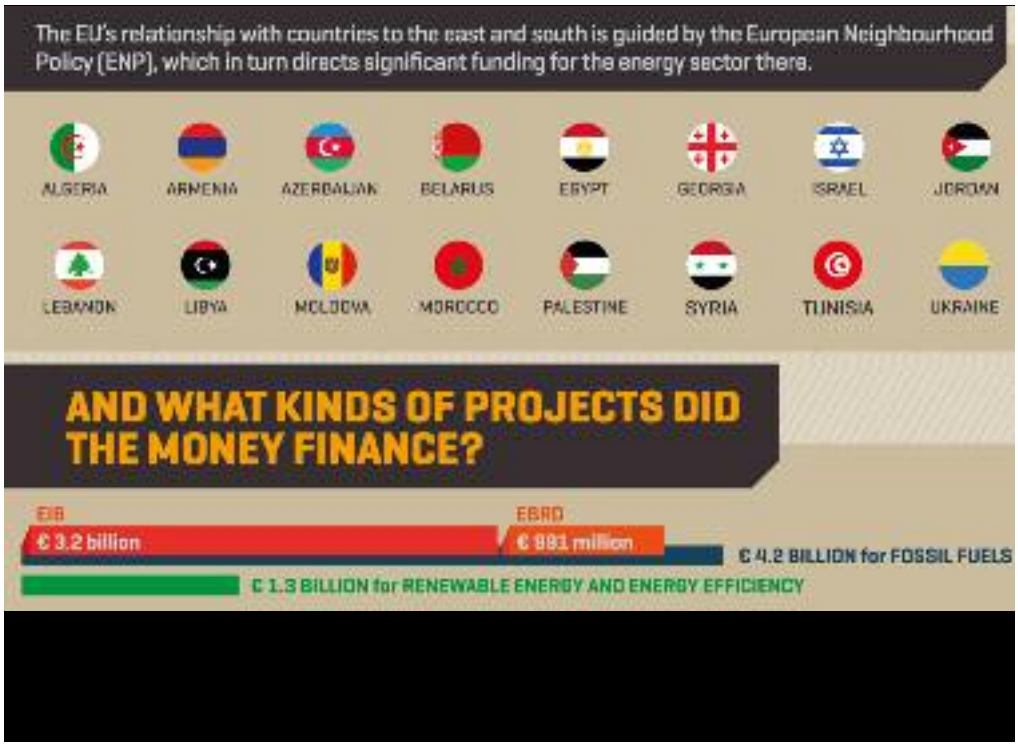
5. One hand doesn't know what the other is doing

While the EIB boasts about being a leader in climate finance, it still supports climate damaging projects with billions of euros. The EIB's sustainability report approximates that projects in 2014 resulted in 4.7 million tonnes of greenhouse gas emissions, the equivalent of putting 2.35 million new cars on the road.

For example, the construction of a 37 kilometre expressway adjacent to the Warsaw ring road in Poland is forecasted to contribute absolute emissions of 134 000 tonnes of CO2 equivalent per year. A gas extraction project in Tunisia will add another 1.5 million tonnes of CO2 equivalent per year.

6. EIB fossil fuel finance in European Neighbourhood countries

Between 2007 and 2014, the EIB provided EUR 3.2 billion for fossil fuel projects in sixteen countries of the European Neighbourhood Policy. Only EUR 780 million went to renewable and energy efficiency projects, the majority of which is located in just one country, Morocco. For more, see the full infographic and executive summary of a study on EU financing in the energy sector of European Neighbourhood Policy countries.



7. Turning its back on the EU's long term climate objectives?

In its new climate lending strategy approved in late September 2015, the EIB decided to drop a reference to the EU's 2050 low-carbon economy roadmap. Despite bank statements repeatedly naming climate action a top lending priority since 2010, the new climate strategy fails to commit to EU decarbonisation goals.

PHOTO. Tropical.Pete/Flickr.com/cc by-sa

8. EIB's emissions standard for energy production lags behind

The EIB Emission Performance Standard (EPS) for the energy sector is currently set at a level of 550 g CO2/kWh. An EPS is a limit on the amount of CO2 that can be emitted by a power station. Conventional hard coal combustion results in the emission of approximately 850g CO2/kWh, while the most efficient gas power plants emit about 300g CO2/kWh. During consultations on the EIB's new climate policy, civil society organisations (E3G, WWF) pointed out that this level is inconsistent with the EU 2050 climate target since it allows financing for infrastructure, like new oil-fired plants, with too high emissions to reach the 2050 target. Lying above the minimum level required (450 g CO2/kWh) to support the EU's climate target the EIB's EPS also lags behind similar standards introduced by the UK, the US and Canada. This means that the bank may still finance fossil fuel-fired power plants that are less efficient than they could be.

9. Climate impact swept under the rug for one third of the EIB's lending

Even though loans distributed through financial intermediaries, such as commercial banks and private equity funds, totalled 31 per cent of EIB lending in 2014, the bank still lacks a methodology to calculate the climate impact of this type of lending.

Originally published
by Bankwatch.org
December 8, 2015

Thorium — a holy grail?

By Nils Bøhmer
Bellona

According to the proponents of using thorium as nuclear fuel, it would have benefits such as producing much less radioactive waste than uranium fuel. It would make nuclear accidents like nuclear meltdowns all but impossible. And its lobby says thorium would be less likely to lead to nuclear proliferation. Are these claims true? If so, what kind of technical developments must occur to makes these predictions come true?

Thorium is a chemical element with the symbol Th and the atomic number of 90. All of the thorium isotopes are radioactive, and the only natural active isotope is Th-232. Thorium (Th-232) itself is not fissile[1], meaning it can't produce energy directly in a conventional reactor. But when Th-232 is irradiated with neutrons it transforms to a fissile isotope of uranium, U-233. To use thorium to produce energy, you first have to irradiate thorium in a reactor. The U-233 that's produced must then either be reprocessed in a chemical process to produce the new fuel, or it can be used in-situ within the same reactor, as in the concept molten salt reactors.

Compared to uranium, thorium is three to four times more abundant in the earth's crust, giving it the potential to replace uranium as nuclear fuel in the future. But the International Atomic Energy Agency (IAEA) has said there are sufficient uranium resources for the next 150 years based on current reactor requirements.

As there are sufficient uranium resources for the foreseeable future there has been little interest from the traditionally nuclear industry to develop thorium fuel. But some countries like Norway and India have looked into this option, and their interest is based largely based on their domestic thorium resources.

Norway

Norway has relatively large thorium resources in the Fen-area in the country's southeast. Even though the country has a strict non-nuclear policy, there have been discussions on whether Norway should do research on thorium's potential as a nuclear fuel. At the moment, a privately funded research program on the behavior of thorium fuel in a traditional reactors is taking place at the Norwegian Halden research reactor.

India

Because of India's nuclear weapons program, the country has not signed the Treaty on the Non-Proliferation of Nuclear Weapons, or NPT. It has therefor been difficult for the country to import uranium to fuel their nuclear reactors. India has a long-term goal to develop a heavy-water reactor fuel cycle for their domestic thorium resources.

The Indian heavy-water reactor fuel cycle consists of three stages. The first stage consists of conventional reactors using uranium fuel to produce plutonium. The plutonium will be used in the second stage, which uses fast neutrons reactors that produce more plutonium as well as fissile uranium (U-233) from thorium (Th-232). The plutonium and thorium will be used to produce the plutonium-thorium fuel for either the Advanced Heavy Water Reactors (AHWR) or molten salt breeder reactors (MSBR) in stage three.

But according to Bhabha Atomic Research Centre (BARC) it is important to build up a significant amount of fissile materiel before stage 3 is implemented. BARC announced in 2013 that the introduction of thorium-based reactor deployment in India is ex-

pected happen after 2070.

Thorium in nuclear reactors

With some modifications, thorium can be used in some conventional reactors in operation today, like heavy water reactors. It would be necessary to mix thorium (Th-232) with either U-235 or Pu-239 to produce fissile U-233. The U-233 would then be reprocessed so that the fuel in the reactor would gradually contain more and more fuel comprised of U-233.

The use of thorium in the present reactors would involve reprocessing of the spent thorium fuel in order to use the U-233 products in the fuel. Because spent thorium fuel contains a higher amount of short-lived radioactivity, this would make the reprocessing more challenging than current methods of reprocessing of traditional uranium fuel. Producing so-called Mixed Oxide (MOX) fuel with a mixture of thorium and plutonium has been proposed as solution to burn some of the huge amounts of plutonium that's been stockpiled around the world for military and civilian purposes. A thorium-based MOX process would burn plutonium more effectively, as no new plutonium would be produced, unlike the burning uranium and plutonium.

The use of thorium in reactors would produce radioactive waste and spent nuclear fuel that would have to be stored and or treated in the same order of magnitude as traditional uranium fuel. The spent thorium fuel would be more radioactive and more challenging to handle than spent uranium fuel because spent thorium fuel contains the alpha-emitter Th-228, which has a half-life of 2 years.

In a long perspective it's possible to develop a thorium fuel cycle based on so-called fourth generation nuclear reactors. With fourth generation nuclear reactors it has been envisaged that radioactive waste production will be much lower than with the present technology. These benefits are expected for both for uranium- and thorium fuel cycle if the technology is developed. It's expected that the fourth generation nuclear reactors would be commercially available around 2030-2040.

Of the fourth generation reactors, the most suitable for thorium would be the Molten Salt Reactor (MSR). In this reactor, thorium and uranium is dissolved in molten fluoride salt at a temperature of 400-700 C. This mixture is circulated through the core region and then through a chemical processing circuit that removes unwanted radioactivity produced in the core region. The MSRs are the fourth generation reactor still requiring considerable research and development, and the period of study is planned for completion by 2025.

Even though thorium is three to four times more abundant that uranium, the economic initiative is lacking to develop a thorium fuel cycle – which is a result of predictions by the IAEA and the Organization for Economic Cooperation and Development that uranium resources will last for another 150 years. There are very few safety benefits to be gained from using thorium in current reactors. Burning thorium in traditional reactors produces spent nuclear fuel that's more radioactive and more challenging to handle than spent uranium fuel. The use of thorium in a full scale fuel cycle in the next generation of nuclear reactors is far in the future. India's active development of a thorium fuel cycle won't, as noted above, come to fruition for another 55 years.

Thorium won't be part of the solution in dealing with climate change before 2050. The only tools that can rise to that challenge are renewable energy deployment, energy conservation and CO2 Capture and Storage.

[1] Fissile isotopes are isotopes that can sustain a nuclear chain reaction with slow neutrons.

Originally published by Bellona.org February 5, 2015

The many faces of water

By CHAO CHEN
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Water is an essential element for life. All species, fauna and flora, have evolved with water and have developed vital reactions to water in terms of survival. Nature always has a professional way to solve life's problem. In order to release and protect its seeds, a pine cone has the amazing ability to open and close through its surface reaction to water.

This natural phenomenon led me to a material study into pinecone of bio-mimicry science and has inspired me to create a laminate water-reacting material. Utilizing inherent properties, this bio-mimetic material detects humidity and changes its shape automatically without mechanical structures or electrical elements. While water is indispensible in our daily life, it sometimes causes problems.

In the context of different scenarios involving water (planting and architecture exterior), the water-reacting material has been applied to different products: a water indicator which detects the soil moist and informs users, the architectural surface which changes its colour in the rain and a shelter which automatically closes to prevent the rain.

Using a mechanism analogous to the water reaction from the pine cone, these products utilize a natural way to face the water and solve problems, illustrating nature`s engineering with functionalism and aesthetics.

THE WATER INDICATOR

The Water Indicator is designed for home gardeners to detect the soil moist in the plant pot and inform the users about the right time to water the plants. Inspired by the pinecone, the Water Indicator is made of the bi-layer water-reacting material. It has two sides with two colours, red and blue. Place it directly in the soil and face the red side outward. When the soil is dry, the material will keep straight and show users the red colour, indicating that the plant needs water. When the soil is wet, the material will bend automatically and show the blue colour to users, indicating that the plant has enough water.

THE WATER-REACTING SHELTER

The Water-Reacting shelter is made of laminated water-reacting tiles supported by a plywood structure.
On sunny days, the water-reacting tiles are dry and keep open, so the users can enjoy the sunshine through the opened tiles.
On rainy days, the tiles get wet and bend automatically. They will stack one by one and cover the whole area of the shelter to prevent the rain.
In this way the shelter is controlled by the weather and responds to different conditions.

THE WATER-REACTING SURFACE

The water-reacting surface is an architectural exterior material. Installed outside the building, it brings bright colour to residents in dim rainy days, especially in cities usually rains (London, Nanjing, Wuxi, etc.).

On sunny days, the tiles of the surface are dry and lie flat.
On rainy days, the tiles get wet and bend automatically, gently opening and showing the colour hidden beneath the surface to bring vitality to the space.

Photo: Albert Duce

DETROIT

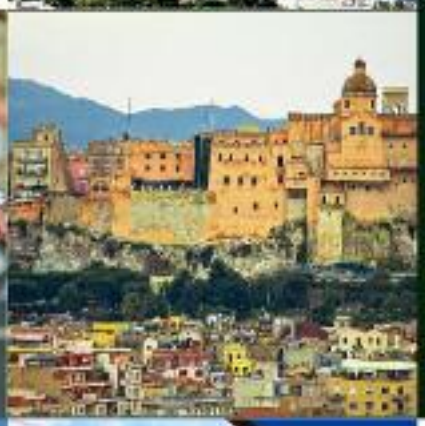
The grand Michigan Central Station was described by Dan Austin in his book 'Lost Detroit: Stories Behind the Motor City's Majestic Ruin' as the epitome of Detroit's economic rise and fall: "No other building exemplifies just how much the automobile gave to the city of Detroit - and how much it took away,"

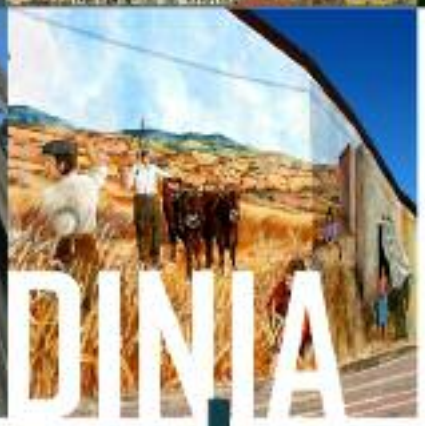
The building opened in 1913 (it was the tallest railway station in the world). Closed down in 1988. ONE







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