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YEAR II - NUMBER 3 - JULY-SEPTEMBER 2016

NATIONAL CHILDREN'S SCIENCE CONGRESS

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ONE
Only Natural Energy

Year II - Number 3
JULY-SEPTEMBER 2016

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Formula E in Paris.
Photo: Michelinmotorsport.com
Publisher:
Sotacarbo Ltd
CO2 Technology Centre Sulcis
Grande Miniera di Serbariu 09013
Carbonia (Italy)

Reg. Nr: 2/2014 Cagliari Ordinary Court

Only Natural Energy [ONE] is a digital magazine published every three months.
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Speeding on the innovation highway

Electric cars were – and still are - being hailed as a new dawn. Next up are driverless cars. Going towards self-charging driverless cars will not be an easy ride

By JEZ ABBOTT

ONE

It was never meant to happen like this, and by and large it doesn't. Electric cars were hailed as a new dawn of clean, environment-friendly, safe driving.

And then someone lost their life behind the wheel of such a car. Joshua Brown, aged 40, died in the first known fatal crash involving a car in self-driving mode. Joshua's Tesla Model S struck the trailer of a lorry on a road in May. According to the highway patrol in Florida the car's windscreen hit the bottom of the trailer. His car's autopilot mode failed to recognise the oncoming truck. National highways chiefs are investigating that autopilot system – one used in 25,000 Model S cars. A Tesla statement on the sensors, which help steer the car by identifying obstructions, said they failed to recognise the oncoming vehicle: "Neither autopilot nor the driver noticed the white side of the tractor trailer against a brightly lit sky, so the brake was not applied."

Tragedy apart, electric cars have a track record that is good, argue not only their makers but a growing section of environment and road-safety lobbies. One blogpost on the Tesla tragedy in the UK's Independent newspaper read: "That's pretty good going, statistic wise. How many people have died in manually driven cars since the Tesla first drove on the road? A few more than one!"
Electric cars were – and still are - being hailed as a new dawn. President Barack Obama predicted one million electric cars in the US by 2015 while Virgin boss Richard Branson forecast last summer no new road cars would be petrol driven within 20 years. Combustion engines, insisted the British tycoon, were "complicated and antiquated".

Any doubts electric cars are the future evaporate as soon as you set eyes on the sleek lines of the newest models and then hit the on-switch. Today's high-end electric car is little short of a supercar, and everyone is in on the act, trialling, prototyping or bringing to market their own versions. BMW, Mercedes and Audi have all unveiled visions of the automotive future at car shows or in glossy aspirational magazines. Most of them boast – or promise - rapid acceleration thanks to a smooth, seamless supply of power from their electric motors.

What sets that motor apart from dirty gas guzzlers is the instant, massive twisting force it produces, called torque. This does away with the need for a gearbox and is more efficient at turning stored energy into motion. It saves weight and clears space for all those boys' toys like touch-screen controls. But the environmental savings are as alluring as the savings in running costs, not just to drivers but governments, municipal authorities and the medical profession. By switching to electric vehicles, average household greenhouse-gas emissions are cut by over a whopping 40%, according to some experts. And as transport is

Electric Car Charging Point at TUV Rheinland Headquarters in Cologne. Photo: © CEphoto, Uwe Aranas

said to contribute 23% of global greenhouse gas emissions, much hinges on the future development of the electric car in tackling climate change.

No wonder all the giant carmakers in America, China and Japan have spent billions of dollars to bring electric vehicles to the market. Yet it was General Motors that rolled out the first mass-produced, purpose-designed electric vehicle of the modern era, the EV1, from 1996 to 1999. And then they tried to kill it.

A 2006 documentary, *Who Killed the Electric Car?*, explored the creation, limited commercialisation and attempts to destroy the electric car phenomenon by traditional car makers, the oil industry, US government and others by trying to stymie development and adoption of this revolutionary but hugely controversial technology. It was a gutsy Silicon Valley start-up, Tesla, founded by the PayPal tycoon Elon Musk that pioneered a market-leading car of the same name using improved versions of industry-standard lithium-ion batteries.

Pros and cons include faster acceleration but a shorter distance range than conventional engines. There is no exhaust but there are long charging times. And the

The first all-electric school bus in the state of California pausing outside the State capitol building in Sacramento. Photo: Theurv

technology roars on. Formula E, the electric equivalent of Formula 1, is gaining traction with sports fans, and next up are driverless cars.

The Google self-driving car forms part of a new breed of 'autonomous cars', from the so-called Google X project to develop technology for mainly electric cars. The implication is huge. Near-perfect robotic drivers using ultra-precise digitised map technology could cut traffic accidents - maybe even the kind that killed Joshua Brown – and trim travel times as well as save on carbon emissions.

Driving an electric car is seen as a high-tech, pacey green badge of honour. Or is it? Electric cars have higher manufacturing emissions than normal cars, argue some. Electric cars also use electricity that has its own footprint, insist others. Put them together and they wipe out any climate benefit of electric cars. Academics from University of Minnesota meanwhile claimed in report published in 2014 that a battery-powered car recharged with electricity generated by coal-fired power stations was likely to cause more than three times as many deaths from pollution as a conventional petrol-driven vehicle. And sales, though promising, have hardly taken off: President Obama's prediction of one million electric cars in the US by 2015 fell somewhat short: 280,000.

The Renault-Nissan alliance, meanwhile, is cagey on sales targets. A 2011 prediction of 1.5m electric vehicles by 2016 turned out to be wildly optimistic. The group passed the 250,000 mark only last July. And yet the electric car is enjoying seemingly unstoppable, if not super-fast, momentum, thanks in part to the magical blend of offering motorists the chance to save money and reduce toxic exhaust emissions. Sales of cars such as the Nissan Leaf, Ford Focus Electric, the Tesla Model S and Chevrolet Volt may not be breaking records but they are indisputably on the up. As of the start of this year there were more than 30 models of all-electric cars and utility vans on sale in Western Europe, the United States, China and Japan. Popularity is also due in part to subsidies. Germany announced in April it would to give a €1bn subsidy to boost electric car sales: buyers receive €4,000 when they choose a purely electric vehicle and €3,000 for a plug-in hybrid. And a 'plug-in vehicle grant' from the UK government provides a subsidy of up to 35% of the cost of a car or van, up to a maximum of €5.360 (£4,500). All this gives an insight into the technological, corporate and political forces coming together to deliver vehicles that one day really will change the world, be it electric or driverless cars. Better batteries will give electric and hybrid cars even stronger performance and increased range, which will further improve their appeal, promise manufacturers. But the batteries also need to be cheaper for the mass market.

This throws up another intriguing twist involving the fall in oil prices. Lower fuel costs combined with the unprecedented efficiency of today's petrol engines, suddenly makes old technology a worthy rival to electric cars and batteries. What the latter have is is a tantalising, ever-evolving technology.

Back in March at the Geneva Motor Show 2016, architecture firm Foster + Partners and Nissan unveiled a vision for self-charging driverless cars that could power the home. Technologies included wireless charging, autonomous driving and battery storage to present a compelling proposal for the future of vehicles and cities.
Carlos Ghosn, the head of the Renault-Nissan alliance that sells more than half the electric cars in the world, has no doubt he's on to a winner: "Ten years ago people thought electric cars would never make it, they thought they were like a golf cart, something slow, bulky, not very attractive," he told the Guardian newspaper recently.

"Now they see the Renault Zoe, the Nissan Leaf, the Teslas and they think electric cars can be fun. They see Formula E and see the cars can be very powerful and go very fast. The idea that electric cars are normal cars, which is a big revolution from 10 years ago, has taken place." That's pretty good going, statistic wise. How many people have died in manually driven cars since the Tesla first drove on the road? A few more than one. ONE

The number one thing we can do to protect Earth's Oceans

By LIZA GROSS
ENSIA.COM

When New England fishers complained of working harder and harder to catch fewer and fewer fish, Spencer Baird assembled a scientific team to investigate. Though a fishery failure would once have seemed inconceivable, Baird wrote in his report, "an alarming decrease of the shore-fisheries has been thoroughly established by my own investigations, as well as by evidence of those whose testimony was taken."

The report was Baird's first as head of the U.S. Commission of Fish and Fisheries. The year was 1872. Baird recognized the ocean's limits. A decade later, however, his British counterpart, Thomas Huxley, took a decidedly different view. Calling the sea fisheries "inexhaustible," Huxley deemed regulations useless, since "nothing we do seriously affects the number of fish."

Over the next century, as fishing became increasingly mechanized, Huxley's notion that oceans are infinitely bountiful persisted even as evidence mounted that they are not. Today, 80 percent of global fish stocks have been fished to the limit or beyond, and our failure to protect the ocean — not just the fish in it — as a finite resource now threatens its ability to recover, argued an international commission of government and business leaders in a 2014 report.

"Habitat destruction, biodiversity loss, overfishing, pollution, climate change and ocean acidification are pushing the ocean system to the point of collapse," the Global Ocean Commission co-chairs warned. Scientists know how to cure many of the ills plaguing the high seas — that is, ocean waters farther than 200 nautical miles from shore, beyond the jurisdiction of nations. Restricting industrial activities like fishing, shipping and deep seabed mining in biodiversity hot spots would go a long way toward restoring ocean health, they say. But there is no room for such measures in a regulatory structure created to manage consumption and commerce, not conservation.

It's a system that's stubbornly clung to Huxley's tunnel vision, even in the face of evidence so alarming Baird could scarcely have imagined.

Toothless Conservation

The primary international framework for regulating the ocean's bounty is the United Nations Convention on the Law of the Sea. UNCLOS, which went into effect in 1994, was set into place to fill in gaps left by earlier U.N. agreements, which regulated shipping (through the International Maritime Organization) and fisheries (through the Food and Agriculture Organization).The treaty was soon supplemented by the 1994 Implementation of Part XI of UNCLOS, which governs deep seabed mining of nonliving resources (through the International Seabed Authority), and the 1995 U.N. fish stocks agreement, which depends on 10 regional fisheries management organizations, known as RFMOs, to implement its sustainability guidelines.

UNCLOS depends on 166 countries to ensure their own citizens and vessels comply with the treaty in areas beyond national jurisdiction — two-thirds of ocean waters. Countries tend to sign on to intergovernmental agreements – called "sectoral" agreements because they govern different business sectors — that reflect their national interests. These sectoral agreements create authoritative bodies to ensure the equitable use and exploitation of marine resources among

nations. Although the sectoral bodies represent the interests of the fishing, mining, shipping and other industries they govern, they can pass conservation measures if they want to. And some have: One sectoral body, the International Whaling Commission, for example, introduced a moratorium on whaling in the 1980s under pressure from non-whaling member countries. In contrast, the RFMOs, sectoral bodies that mostly include only fishing nations as parties to the agreements, have generally resisted conservation measures.

UNCLOS also protects the economic interests of nations with provisions that give coastal countries exclusive rights to marine resources within 200 nautical miles offshore. Most offshore oil and gas exploration, for example, is overseen by countries within these exclusive zones. But inadequate national regulations can lead to disaster, as the 2010 Deepwater Horizon oil spill — which left 11 dead and dumped nearly 5 million barrels of oil into U.S. waters in the Gulf of Mexico — made painfully clear. The only way to prevent similar disasters, the Global Ocean Commission panel argues, is through a binding international agreement on safety and environmental standards that holds corporations liable for environmental damage.

One of the biggest problems for ocean conservation, many scientists say, is that the sectoral agreements rely on binding measures for compliance, while conservation pacts, such as the Convention on the Conservation of Migratory Species of Wild Animals and the Convention on Biological Diversity, depend almost exclusively on voluntary measures.

There's no overarching or even regional conservation agreement that can protect the high seas, says Jeff Ardron, adviser on marine governance at the Commonwealth Secretariat, an international public policy coalition in London.

So scientists have to go through sectoral bodies one by one to protect a vulnerable ecosystem with mixed results, says Ardron. "It's inefficient and frustrating and slow," he says, "but they're all we have right now."

Sargasso Runaround

Take, for example, the case of the Sargasso Sea, a massive stretch of ocean in the North Atlantic named after the sargassum seaweed that supports a diverse community of turtles, fish, snails, crabs and other animals. The Sargasso provides spawning and nursery habitat for scores of species, including endangered American and European eels, which travel thousands of miles from rivers and streams to spawn in the itinerant mats of vegetation.

It's the only sea bounded by currents, not land, yet that has afforded little protection from human impacts. The currents concentrate pollution, plastic and other debris. Scientists at the Monterey Bay Aquarium Research Institute suspect these pressures may have contributed to significant declines in biodiversity since the 1970s, which they reported in a 2014 Marine Biology paper.

In 2010, Kristina Gjerde, high seas policy adviser for the International Union for Conservation of Nature's Global Marine and Polar Programme, helped set up the Sargasso Sea Alliance to protect this vulnerable ecosystem. Gjerde and her colleagues made the scientific case for recognizing the Sargasso as an important ecological area that warrants protection to the U.N.'s Convention on Biological Diversity. Delegates at the 2012 U.N. biodiversity talks agreed that the Sargasso meets the criteria for protection. But the authority to manage marine protected areas beyond national jurisdiction lies with the intergovernmental sectoral organizations that share a stake in the area.

So the Sargasso team had to appeal to each in turn.

First they approached the fishing body with jurisdiction over tuna fisheries in the Sargasso Sea, the International Convention for the Conservation of Atlantic Tuna. Representatives told the Sargasso team they didn't see the rationale for protecting a region that doesn't have much fishing. Next, the team approached the International Maritime Organization, which regulates shipping pollution. Officials wanted proof that sewage, ballast water discharge (which can carry

Outfall of Mandovi river into Indian ocean. Photo: Hajj0 ms

alien species as well as pollution) or ship transit was harming the sargassum.

"Proof is a very hard level to surmount in any issue," Gjerde says. That's why scientists have been trying to convince the bodies governing industrial ocean activities to embed precaution into their activities, she says. Finally, after years of negotiations, Gjerde and her allies won at least some protection for the Sargasso. Last year, the Northwest Atlantic Fisheries Organization agreed to outlaw mid-water trawling gear that could harm the seabed, report any vulnerable indicator species caught in the trawlers and declare all seamounts in its jurisdiction off limits to bottom trawling through 2020.

The Sargasso team has not yet reached similar agreements with the International Maritime Organization or the International Seabed Authority, which governs mining of the sea floor. And that illustrates one of the most frustrating flaws in existing regulatory structures. The lack of a comprehensive regulatory framework means that ocean advocates can protect a sensitive area from one type of exploitation only to find it at risk from another.

Synergistic Threats

The open oceans cover nearly half the Earth, harbor some of its most environmentally important regions, and provide employment and food security for tens of millions of people. Yet, with conservation bodies powerless to issue sanctions, it's possible to exploit the ocean's resources until there are no more resources to exploit.

Marine species at risk from overfishing must also contend with pervasive pollution from plastics, sewage, industrial chemicals, agricultural runoff and other contaminants. Ships release about 1.25 million metric tons (1.4 million tons) of oil each year, and cruise ships alone release as much as 30,000 gallons (100,000 liters) of sewage every day. Scientists estimate that plastic waste kills more than a million seabirds and 100,000 marine mammals a year.

Adding to these stresses, scientists have documented evidence of climate change's impacts on marine life. Cod and other deep-sea fish are moving toward the poles in search of colder waters. Coral reefs unable to tolerate warmer waters made 30 percent more acidic by excess carbon dioxide are experiencing widespread bleaching. And because warmer waters absorb less oxygen, species like tuna and marlin, already under intense pressure from fishing, are spending less time hunting in deep waters. As serious as these effects are, many scientists believe that controlling pollution and overfishing while protecting habitat can buy enough time to help species recover from climate change's impacts.

They say recent advances in satellite and remote sensor technology can now spot vessels that fish illegally, which could help keep millions of tons of fish off the black market. Interpol, the international police watchdog, recently established a fisheries crime unit to help countries apprehend pirate fishers when they come to port. But success depends on countries working together to hold illegal fishers accountable.

Convincing nations to collaborate on international conservation measures has proved a heavy lift, says Michael Orbach, professor emeritus of marine affairs

and policy in the Nicholas School of the Environment at Duke University. "Political will is at the heart of everything," he says. Countries need resources for monitoring and enforcement, but they also need the will to use those resources for conservation. "That's a big requirement," Orbach says.

Hope on the Horizon

If it were up to Orbach, all human activities on the high seas would need a permit from a regulatory body with the authority to monitor and sanction violators. That would solve the problem of relying on fisheries, shipping and mining organizations to police themselves. But getting such a system up and running would require a mass outpouring of public support, Orbach says. And that's not likely. "It's very difficult to get the public behind ocean conservation," he says. "It's just not something most people know about."

That's why ocean advocates have been working behind the scenes for years to build biodiversity protections into the law of the sea. Finally, their efforts are paying off.

Last year, the U.N. General Assembly adopted a resolution to expand UNCLOS to protect marine biodiversity and genetic resources in areas beyond national jurisdiction. The resolution, which calls for developing marine protected areas and environmental impact assessments, lays the groundwork for creating stronger high seas conservation measures. The first of four "preparatory committee" sessions to hash out what those measures should look like took place this past spring. Gjerde, who participated in the meetings, says the agreement shows that countries finally recognize that it will take an international legally binding agreement to ensure meaningful protections.

The agreement aims to create a regulatory body with the authority and infrastructure to enforce conservation rules and sanction misconduct. It also provides a process for designating marine reserves that restrict any activities that could harm habitat from the deep seabed to the top of the water column. With just 2 percent of the ocean protected — and some scientists recommending 30 percent to safeguard biodiversity — creating marine reserves is a top priority. The committee expects to deliver recommendations to the General Assembly at the end of 2017. Then the hard work of building international consensus on the new biodiversity agreement begins, a process that could take years. But a lot could happen before then. There's nothing stopping sectoral organizations from setting up protected areas right now, says the Commonwealth Secretariat's Ardron. "They just have to be convinced that there's a need to do it."

And that's where the public can play a role. Consumers can influence the fisheries, for example, through the power of the pocketbook, or pressure their governments to enact emission controls on ships, a source of largely unregulated greenhouse gas emissions. Social media can also be useful, says Gjerde. While scientists and conservation groups were urging the International Seabed Authority to open its mining decisions to public scrutiny, a Twitter campaign helped get nearly 800,000 signatures on a petition calling for the same thing. If enough people voice concern about the oceans, scientists can use the outpouring of support as leverage at the preparatory committee's next UNCLOS marine biodiversity meeting in August, says Gjerde.

Ultimately, good ocean governance lies beyond what individuals can accomplish. And Gjerde believes the new U.N. biodiversity agreement will finally give scientists the framework they need to set oceans on the path to recovery. She found reason to be optimistic at the first round of talks in April. Rejecting Huxley's insistence 130 years ago that humans could never harm our planet's expansive oceans, delegations came prepared to grapple with what they had to do to ensure sustainable management of the seas.

And that, says Gjerde, "is a huge step forward."

Originally published by Ensia.com May 23, 2016

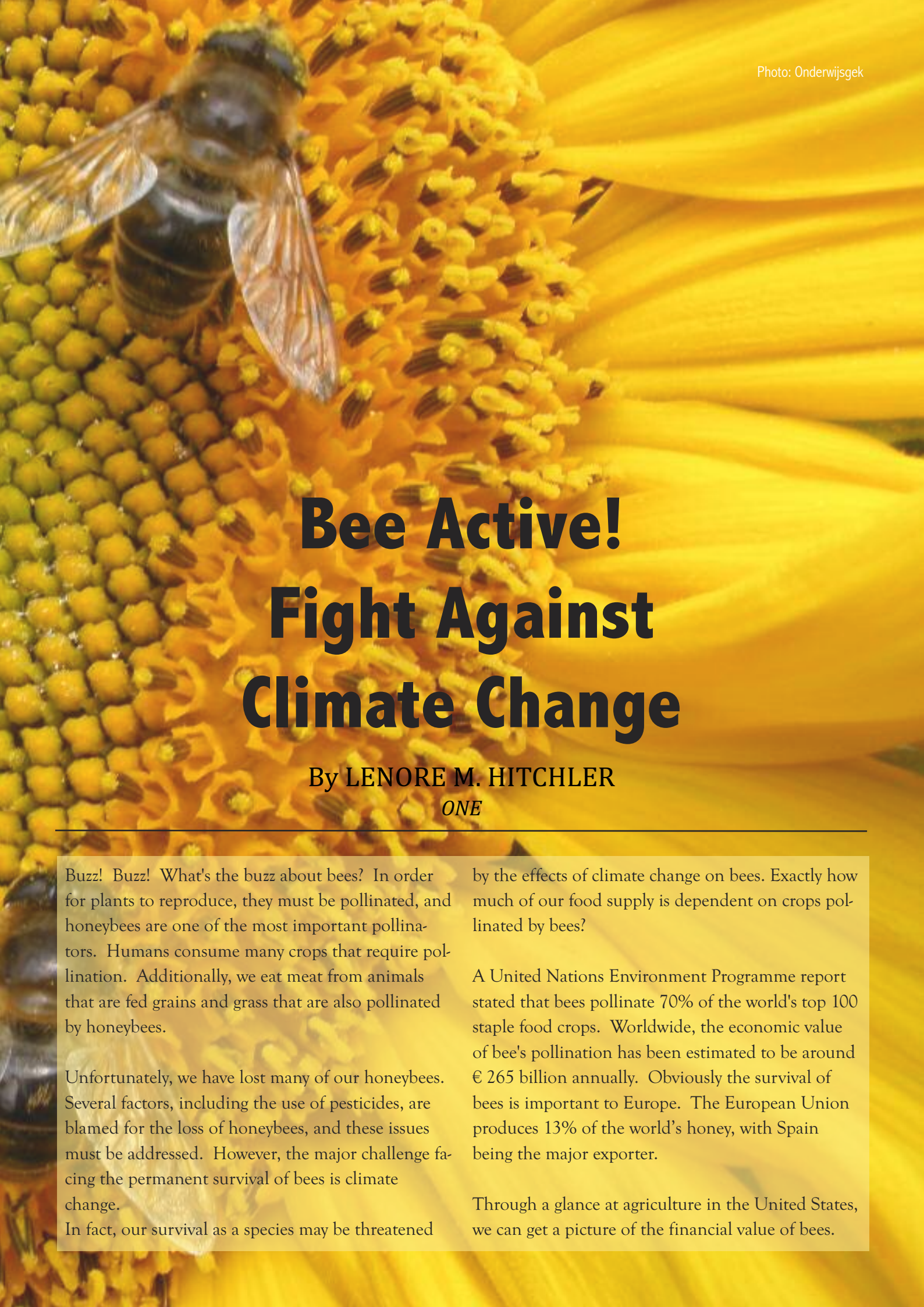


Photo: Onderwijsgek

Bee Active! Fight Against Climate Change

By LENORE M. HITCHLER

ONE

Buzz! Buzz! What's the buzz about bees? In order for plants to reproduce, they must be pollinated, and honeybees are one of the most important pollinators. Humans consume many crops that require pollination. Additionally, we eat meat from animals that are fed grains and grass that are also pollinated by honeybees.

Unfortunately, we have lost many of our honeybees. Several factors, including the use of pesticides, are blamed for the loss of honeybees, and these issues must be addressed. However, the major challenge facing the permanent survival of bees is climate change.
In fact, our survival as a species may be threatened by the effects of climate change on bees. Exactly how much of our food supply is dependent on crops pollinated by bees?

A United Nations Environment Programme report stated that bees pollinate 70% of the world's top 100 staple food crops. Worldwide, the economic value of bee's pollination has been estimated to be around € 265 billion annually. Obviously the survival of bees is important to Europe. The European Union produces 13% of the world's honey, with Spain being the major exporter.

Through a glance at agriculture in the United States, we can get a picture of the financial value of bees.

According to the Xerces Society for Invertebrate Conservation, honey bees contribute $20 billion annually to the economy of the United States through the pollination of vegetables, fruit trees, flowers, and agricultural row crops. Some of these crops are tomatoes, melons, oranges, apples, strawberries, blueberries, onions, carrots, beans, broccoli, cucumbers, sweet potatoes and pumpkins.

Almonds and alfalfa are extremely important crops and are pollinated by bees. California, with 100,000 acres of almond trees, produces almonds worth $3 billion per year. Alfalfa is worth more than $8 billion each year, not including its value as feed for dairy and beef cattle. In 2012, the value of Wisconsin alfalfa hay production was $382 million dollars.

How does climate change affect the relationship between bees and plants? Climate change affects pollination by disrupting the synchronized timing of flower blooming and the timing of when bees are available to pollinate. Tim Levett, director of Public Affairs at the British Beekeeper's Association, stated that "The wrong weather at the wrong time can be very bad for bees.

One of the major causes of loss among honeybees in the spring is starvation. There are suddenly thousands of new mouths to feed. If they wake early and the plants are still asleep, then there is trouble. Likewise, if the plants awake early and the bees are still asleep and miss the first flush, then there can also be trouble."

Simon Potts, Professor of Biodiversity and Ecosystem Services at Reading University in the United Kingdom, stated that "Under climate change you would expect habitats that bees and pollinators use will shift—but the bees may or may not be able to move; there may be no connection between the habitat they have now and the new area. Both the bees and flowering plants are shifting because of climate, but, on average, the UK flowers are [blooming] earlier by 4 or 5 days each decade whereas the bees we have looked at are [emerging] earlier by 7-10 days per decade."
The environmental group Friends of the Earth has calculated that if all bees were wiped out in the United Kingdom, it would cost $2.81 billion to hand-pollinate food crops in their place.

Honeybees are not the only species of bees affected by climate change. Wild bees are also important for crop pollination, and they improve the flavor and quality of fruits such as apples. Wild bees may actually be more susceptible to climate change than honey bees, with bumblebees being even more vulnerable.

According to Jeremy Kerr, a biodiversity researcher at the University of Ottawa in Canada, climate change is "crushing bumblebees in a kind of climate vice." Kerr also warns that bumblebees "just aren't colonizing new areas and establishing new populations fast enough to track rapid human-caused climate change. Impacts are large and they are underway. They are not just something to worry about at some vague, future time."

Aside from causing disruptions in the plant-pollination relationship of bees and flowers, climate change could even make the parasites that infect honeybees more virulent.
For example, Robert Paxton, a biologist and co-author of a study published in the Proceedings of the Royal Society B, studied several types of organisms which prey on bees. Paxton stated that "Clearly, in Britain and the United States, if the temperature is warmer, it means that the exotic [species of] parasite, which has been suggested to be more virulent, will predominate or become more prevalent."

Since bees are so important to the food chain, it is important that their numbers be maintained. Over a long period of time, each species of bee has evolved to fit into their specific environmental niche. Climate change may not give them enough time to evolve to their rapidly changing habitat, and thus threatens their survival. ONE

Atmospheric Carbon Dioxide Concentration Has Passed the Point of No Return

By DAHR JAMAIL
Truthout

A recent trip up Washington State's Mount Rainier brought home to me how rapidly things are changing, even in the high country.

I first climbed the mountain in 1994, when the main route was a picturesque climb up smooth glaciers. Most of the time crevasses weren't even visible, and snow cover was abundant.

But anthropogenic climate disruption (ACD) has been speeding up with each passing year, and in the same area 22 years later, I found large portions of it nearly unrecognizable. We took a somewhat different route than the one I'd climbed in 1994, primarily because the lower portion of that route is now unusable, as the glacier it traversed is so broken up and crevassed as to make it impassable.

It being early season (most of the guide services had yet to begin taking clients up the mountain), I expected much heavier snow cover and the snow bridges over crevasses to be in decent shape. That wasn't the case. After gingerly stepping our way over several sketchy snow bridges, I was grateful we weren't on the 14,411-foot-high northwestern volcano any later in the season than we were. Thankfully, we were able to summit and get back down without incident.

Less than a year and a half earlier, in December 2014, Nature World News reported that ACD was melting Rainier's glaciers at "unprecedented" rates (six times the historic speed).

Climate Disruption Dispatches"Changes that normally occur over a matter of centuries are transpiring over decades," according to the report. "The Nisqually Glacier, for example, one of Rainier's 28 named glaciers, has been disappearing since 1983. It's currently at a historic minimum and still shrinking - more than 3 feet every 10 days."

Paul Kennard, a National Park Service geomorphologist, said of the rapidity of the decline of the glaciers, "If you look at it on a graph, it's like a Ping-Pong ball just fell off the edge of the table."

And things have only sped up since then, both in terms of hotter temperatures as well as loss of ice on the Pacific Northwest iconic mountain.

To give you an idea of how rapidly ACD is occurring, one of the most striking infographics I've ever seen on the rapidity with which the global temperature is increasing can be viewed here. Make sure you watch it; it only takes a moment.

NASA recently released data showing that the planet has just seen seven straight months of not just record-breaking, but record-shattering heat. It is clear, through the space agency's data, that this year we are already well on track to see what will likely be the largest increase in global temperature a single year has ever seen.

The NASA data also show that April was the hottest

"Changes that normally occur over a matter of centuries are transpiring over decades."

April ever recorded, as well as the fact that it crushed the previous April record by the largest margin of increase ever recorded.
That makes it three months in a row that the monthly record has been broken, and easily at that, by the largest margin ever. When record-smashing months started in February, it was then that scientists began talking about a "climate emergency," and since then our situation has only escalated.

In particular, the way this is playing out in the Arctic is horrifying. An Arctic without summer sea ice could happen as early as this September, a turn of events that would have serious implications for global climate patterns.

The decline in Arctic sea ice extent, area and volume is in the midst of a deep dive more severe than those that occurred in 2007 and 2012. The loss of sea ice is even outpacing the worst-case modeling predictions.

The decline in Arctic sea ice extent, area and volume is in the midst of a deep dive more severe than those that occurred in 2007 and 2012. The loss of sea ice is even outpacing the worst-case modeling predictions. It's worth noting that less than 10 years ago, scientists believed that an Arctic free of summer sea ice was not something that would happen until at least 2100.

But given that a recent four-day period saw a net loss of ice area the size of New Mexico, we will be lucky to see summer sea ice in the Arctic in September two to three years from now. Given the radically high temperature records and corresponding ice loss, scientists have been saying that the Arctic is now in "uncharted territory."

When we look at the amount of human-generated carbon dioxide in the atmosphere, it too is only continuing to increase.

Global atmospheric carbon dioxide concentration first crossed over the 400 parts per million threshold in 2013, but now, scientists are speculating that we may have entered an era when the global concentration remains permanently over that mark – an event some scientists are seeing as a point of no return.

And with the amount of atmospheric carbon dioxide increasing, temperatures are increasing right alongside it, and with higher temperatures comes a lowering of the oxygen content of most of the global oceans before 2040.
Yes, that is as scary as it sounds. According to a recent press release from the National Center for Atmospheric Research, a reduction in the amount of dissolved oxygen in the oceans due to ACD is already happening, and will become widespread before 2040.

Matthew Long, the lead author of the study that this press release is based on, stated, bluntly:

Loss of oxygen in the ocean is one of the serious side effects of a warming atmosphere, and a major threat to marine life. Since oxygen concentrations in the ocean naturally vary depending on variations in winds and temperature at the surface, it's been challenging to attribute any deoxygenation to climate change. This new study tells us when we can expect the impact from climate change to overwhelm the natural variability. The press release added, *"Scientists know that a warming climate can be expected to gradually sap the ocean of oxygen."* This is literally making it harder for fish to breathe, as well as exacerbating the effects of ACD and ocean acidification.

Facts like these are why, according to a report recently published in the UK, a person may be five times as likely to die in an extinction event than in a car crash.

On multiple levels, this is extremely difficult information to take in: emotionally, intellectually, psychologically, spiritually. But this is the world we live in today, and we need an accurate understanding of what is happening in order to make informed, and better choices for how we are to live our lives.

It is in the spirit of providing the most updated, accurate information available that this dispatch is written. Read on, sit with the information and then use it as a mirror for your life.

Earth

A report by Lloyd's of London sees the single greatest threat to civilization over the next four decades as ACD-amplified extreme floods and droughts that impact multiple global grain-producing "breadbaskets" simultaneously. Hence, the "Food System Shock" report warns that when this occurs, mass rioting, civil war, terrorist attacks and mass starvation are likely to happen.

The impacts of ACD on various species continue to make themselves known.

A cascade effect of ACD impacting weather, insect availability and other food sources is taking a serious toll on birds like the red knot, which is seeing its populations decline as the birds' body mass shrinks, according to a recently published study.

The report shows how, in the case of the red knot, the consequences of ACD are only being seen at a distance, which is another important concept for us to get our minds around as the crisis unfolds on multiple levels.

In this case, the body size of the red knot has been decreasing as its breeding grounds in the Arctic continue to warm, but, as the report states: "The real toll of this change appears not in the rapidly changing northern part of their range but in the apparently more stable tropical wintering range.

The resulting smaller, short-billed birds have difficulty reaching their major food source, deeply buried mollusks, which decreases the survival of birds born during particularly warm years."

On that note, a recently released report by the North American Bird Conservation Initiative shows that one-third of all North American bird species are at risk of going extinct, and ACD is one of the drivers of the catastrophic bird loss.

Water

As usual, the majority of the most dramatically obvious impacts of ACD are in this sector of the dispatch.

The World Bank issued a new report warning that global water shortages will deal a "severe hit" to economies across the Middle East, North Africa, and Central and South Asia as ACD progresses. The report warned that by 2050 growing demand for water from both cities and agriculture will cause dramatic water shortages in regions where it is currently in abundance, in addition to worsening shortages that already exist. This will, according to the World Bank, generate broad amounts of conflict and human migration across the regions cited.

Another report from the World Bank shows that, conversely, by 2050 there will be 1.3 billion people, along with $158 trillion in assets, put at risk from flooding and sea level rise alone. The twin factors of ACD and urbanization are the culprits, and the report warns that increasingly intense extreme weather disasters will continue to make matters worse as well.

Meanwhile, in the Micronesian island nation of Palau, the famous UNESCO World Heritage site of Jellyfish Lake is losing its namesake. Severe drought and increasingly hot temperatures are causing the unique non-stinging jellyfish to vanish, and possibly not return.

Sea level rise is continuing at abrupt rates. A study in the journal Environmental Research Letters linked ACD-caused sea level rise, along with wave action, to the Pacific Ocean swallowing several villages and five of the Solomon Islands.

More and more studies are showing the likelihood of far higher sea level increases than previously projected, as the rapid pace of melting of both the Antarctic

and Greenland icecaps increases. The studies show that abrupt sea level rise is an increasingly realistic threat, with sea levels estimated to rise by six feet within this century, and far higher in the next – flooding out many of the world's heavily populated coastal areas and cities. As if to underscore that point, a study recently released by the UK-based charity Christian Aid projected over 1 billion people at risk from coastal flooding by 2060, with the populations of China, India and the United States being the most heavily impacted. Again, ACD and overpopulation are cited as the prime drivers of the crisis.

Recent images of the unprecedented coral bleaching event that is signaling the demise of Australia's Great Barrier Reef reveal the complete destruction of coral colonies that are large enough to fill an area the size of Scotland. Recent findings by leading ACD researchers and coral reef scientists show that the exceedingly warm water temperatures that drove the bleaching event at the Great Barrier Reef were made 175 times more likely by ACD, and could well become the "normal" water temperature with permanent bleaching there within the next 18 years.

Meanwhile, India is experiencing dramatic coral bleaching events as well. Rohan Arthur, the scientist who heads the coral reef program at the Nature Conservation Foundation based in India, has been studying the coral reefs and documenting the bleaching. Arthur described India's widespread coral bleaching as "heart wrenching," and expects it to continue to worsen. In Florida, it's not warm waters that are destroying coral. Instead, acidification is causing that state's coral to disintegrate faster than had been predicted, and a recent report shows that this trend will only accelerate as ocean acidification progresses, with the world's oceans continuing to rapidly absorb carbon dioxide.

Positive feedback loops have been wreaking havoc in the Arctic as well. Arctic Ocean acidification is being sped up by erosion and river runoff in Siberia. As the permafrost is thawing there, coastlines across Russia are falling into the ocean, along with rivers dumping massive amounts of carbon into the ocean, which is all combining to ramp up the acidification, which is bad news for all things living in the once-pristine waters of the Arctic.

In Austria, the glaciers are melting so fast, they have retreated an average of 72 feet during last year alone, which is more than twice the rate of the previous year, according to a recent survey.

In the Antarctic, the news of more melting continues. In eastern Antarctica, where the vast majority of the ice volume resides – an area once believed to be largely free of the impacts of ACD – the Nansen Ice Shelf has produced an iceberg 20 kilometers long. A giant crack in the shelf that has existed since 1999 expanded dramatically in 2014, and that trend continued into this year, when melting on the surface and from the warming seas below the shelf caused an area larger than the area of Manhattan to release out into the ocean.

On the other side of that continent, the Antarctic Peninsula saw an incredible new record high temperature of 17 degrees Celsius last year. This, coupled with the ongoing ramping up of the melting of the ice shelves, is having global implications already, including sea level rise, and impacts on global weather patterns.

Extreme drought across the world continues. In California, Gov. Jerry Brown has deemed that state's water conservation efforts permanent, a sign of resignation to the fact that the state's drought is now being considered ongoing, without an end in sight. Ninety percent of California remains in drought, and summer is just beginning.

As if to underscore that point, Lake Mead, the largest US reservoir, broke a record in May by declining to its lowest level ever recorded. In Zimbabwe, the UN Development Programme announced recently that 4.5 million people, which is at least half of the country's total rural population, will need food and water aid by next March, as an extreme drought persists with no end in sight.

The wildfire burning near Fort McMurray on May 1, 2016. Photo: Jason Woodhead

Fire

Summer had barely found its stride when residents of Fort McMurray in Alberta, Canada, became part of the historical record: their town saw the single largest fire evacuation event in Alberta's history. More than 80,000 residents of the tar sands oil town fled massive wildfires, in what couldn't be a more obvious sign from the planet that engaging in the most environmentally destructive method of fossil fuel extraction might not be the best idea.

Things settled down a bit after the winds shifted and the fires subsided – until the winds shifted again and the fires returned, forcing yet more evacuations as people again did not get the earth's memo.

So far this year, 22 times more land has burned than burned in the same period last year, and that year was one of the worst fire seasons in Canada's history. Meanwhile, Canadian Prime Minister Justin Trudeau, along with the rest of the country's mainstream media, have opted not to mention ACD when discussing the wildfires that threaten their earth-destroying cash cow, the tar sands.

Meanwhile, a recently published study shows what we are already seeing – that warming temperatures in the northern latitudes are spurring more fires across Alaska, which in turn cause increasingly warming temperatures ... hence, yet another runaway feedback loop is unveiled. Out-of-control wildfires raged across the Russian-Chinese border, as well as nearby Lake Baikal, according to The Siberian Times, resulting in more ACD refugees.

Air

As mentioned in the introduction of this dispatch, heat records around the world continue to be set at a breakneck pace, including the overall record heat increases for the entire planet. More specifically, Southwest Asia and India recently saw historic heat waves that have brought more than 150 deaths. Cambodia and Laos each set record highs for any day of the year during April. Cambodia saw 108.7 degrees Fahrenheit on April 15, and on April 26, Thailand set a record for national energy consumption (air conditioning), according to The Associated Press.

India went on to break its heat record in May, when the city of Rajasthan saw 51 degrees Celsius (123.8 degrees Fahrenheit), as the heat wave besetting northern India persists, as temperatures have exceeded 40 degrees Celsius for several weeks in a row now.

Looking to the north, the Russian Hydrometeorological Center recently reported that since May 2015, every single month has been the warmest in Russia's history. By way of example, in March, the temperature deviation on islands in the Barents Sea was a staggering 12 degrees Celsius.

In Alaska, despite it being very early in the summer, heat records are breaking by the dozens. Recent statements from the National Weather Service reported that the towns of McGrath and Delta Junction in the interior of the state hit a high of 78 degrees and a low of 49 degrees, respectively, beating the previous re-

cords set in 2005 and 1988 for each. Fairbanks set a new high temperature record of 82, which shattered a century-old record of 80 degrees set in 1915.

The largest city in Alaska, Anchorage, set a record of 72 degrees, a stunning seven degrees above the previous high that was set in 2014, while Juneau and Bethel, set new heat records. Even Barrow, in the far north, saw 42 degrees recently, breaking the previous heat record by four degrees. Given that Anchorage has already seen the second-largest number of record high temperatures for any year and there is still 63 percent of the year left, 2016 will certainly break the previous record of high temperatures seen, which was set in 2003.

In Africa, the heat continues to be unrelenting, and that trend is expected to not only continue, but increase, according to a study recently published in the journal Environmental Research Letters. According to the study, by 2100, heat waves on that continent will be hotter, last longer and occur with much greater frequency. One of the research team's authors said that "unusual" heat events will become much more regular, "meaning it can occur every year, and not just once in 38 years – in climate change scenarios."

Denial and Reality

Never a dull moment on the ACD denial front, especially with Donald Trump dominating headlines in the United States, and the corporate media giving him all the coverage he could possibly hope for. Trump, who could very well become the next US president, recently named ACD "skeptic" Rep. Kevin Cramer (R-North Dakota) as his energy adviser. Cramer is one of the leading oil and gas drilling advocates in the US, and North Dakota has been one of the states on the front lines of the US shale oil and gas boom.

Over in the UK, a group of the most eminent scientists there recently criticized The Times of London newspaper for its "distorted coverage" of ACD, along with the "poor quality" of its journalism around human-caused climate disruption. Media misrepresentation has been a major culprit for much of the public unawareness and misunderstanding of ACD.

Back in the US, on the reality front, Kevin Faulconer, the Republican mayor of San Diego, is pushing forward with a plan to run the city completely on renewable energy by 2035. Another hopeful note: Recent polling shows that now half of all conservatives in the United States believe that ACD is real, which is an increase of 19 percent over the last two years.

Exxon, now targeted by a campaign aimed at making the oil giant pay for ACD, is working overtime to blunt the attack. Exxon is sending executives and lobbyists to meet with state representatives in an effort to mitigate what could be extreme economic losses for the company if the campaign continues to be as successful as it has been thus far. The campaign against Exxon is now deeply tied to the overall campaign to pressure universities and businesses to divest from fossil fuel companies, which has been incredibly successful and is becoming more so by the week.

Lastly, in a story that has not gotten anywhere near the coverage it deserves, the US government has been actively resettling its first official ACD "climate refugees." A large grant of federal money was given to Louisiana's community of Isle de Jean Charles, where the people have been struggling (and losing) against rising seas, coastal erosion and increasingly violent storms. It is important to note this development, since well before 2100, there will be millions of people along US coastlines who will have to be resettled further inland as sea level rise only continues to speed up.

Meanwhile, the National Oceanic and Atmospheric Administration's latest inventory of greenhouse gas emissions provided the warning that methane and carbon dioxide emissions are "going completely in the wrong direction," as the amounts being injected into the atmosphere continue to accelerate.

Originally published
by Truthout.org
May 23, 2016

Isogo: a minimalist shrine to clean coal

Policy makers in countries at the forefront of the renewables revolution are now being forced to rethink fundamentally the way in which these markets operate.

By TOBY LOCKWOOD

ONE

Modern cities are ever more hungry for power, but increasingly prefer to keep their power plants out of sight and out of mind. Whilst the smogs suffered by London in the 1950s or many Chinese cities today are extreme examples of the effects of old coal power plants placed close to city centres, even modern plants are rarely found in urban environments.

However, situated on Tokyo Bay close to the heart of Yokohama, Isogo is no ordinary coal plant. Combining high efficiency power generation with a pioneering technology that restricts key pollutants to almost negligible levels, the plant has come to be regarded as a showcase for cleaner coal power, and a potential blueprint for a more acceptable form of coal power generation for the 21st century.

The plant actually consists of two 600 MW generation units completed in 2002 and 2009, built by owners JPower to replace an existing pair dating from the 1960s. Such is the demand for power in this heavily populated part of Japan, a major challenge for the upgrading project was the need to keep the original plant intact and operational throughout construction of the first new unit. The Tokyo Bay area is also dotted with gas-fired power plants which naturally have minimal impact on air quality, so the decision to retain a coal-fired plant in the region is somewhat indicative of Japan's wider energy policy. With practically no fossil fuel resources of its own, Japan is obliged to import both coal and natural gas to meet its power demand, and has long regarded coal power as an essential means of avoiding an over-reliance on costly gas imports and keeping energy prices as low as possible.

This dependence on coal power and a desire to get the most 'bang for buck' from its coal imports has helped spur Japan to lead innovation in coal power since the early 1990s, and the country now boasts the highest efficiency fleet of coal plants in the world.

Much of this research has concentrated on developing new steels and other metals able to withstand hotter and higher pressure steam, known as 'ultra-supercritical' conditions, which allow more of the coal's energy to be converted to electric power. Now adopted in many other countries, the units at Isogo still represent two of the finer examples of this technology, with the newer unit achieving over 45% power generation efficiency. In comparison to the world average for coal power of 35%, this represents almost a 20% reduction in CO2 emissions, highlighting the enormous greenhouse gas reductions possible if the Japanese approach to coal were more widespread.

Isogo's elegantly curved, 200 metre tall smokestack may simply appear a fittingly futuristic tribute to cutting-edge technologies, but it was also built to the meet the brief of a city almost as concerned with the visual impact of the plant as with its emissions.

The Isogo Power Plant. Photo: ONE

The pros and cons of biomass

By DEBO ADAMS

ONE

When most people talk about renewable energy they are referring to wind and solar power, which tend to dominate the news and their deployment is growing rapidly. However, a problem of wind and solar power is their intermittency – that is, where is electricity to come from when the sun doesn't shine, and the wind doesn't blow?

INTERMITTENCY

Coal-fired power stations were designed to provide baseload power. This means they were meant to run fairly constantly, providing a reliable supply of electricity, whatever the weather. In these conditions they run at their most clean and efficient. However, due to the generation of increasing amounts of wind and solar power and the prioritising of these supplies to increase the share of renewables, the situation is shifting in a number of countries so that coal-fired power stations now have to provide the backup power. As a result, coal-fired stations have to be more responsive to fluctuations in demand than previously.

The more frequent ramping up and down of coal-fired power stations increases the wear and tear on the plant, and so the maintenance burden goes up. In addition, the efficiency of the power plant falls. Thus an unfortunate and inadvertent result of increased use of wind and solar power can be increased emissions of CO2 from the supporting coal-fired power plant.

A way to avoid this situation, while still increasing the use of renewable energy sources, is to use more biomass. Biomass is biological material obtained from living or recently living plant matter that can be processed into electricity, fuel and heat. Biomass is a renewable resource as it takes up CO2 when growing, which is then released on combustion. If more biomass replaces that which has been used, then the cycle continues and there is no net release of CO2. Cofiring biomass with coal thus avoids the problem of intermittency, and this combination is a renewable resource that can also take advantage of the massive infrastructure that already exists to supply electricity from coal-fired power stations.

SUSTAINABLE?

There has been much discussion about the carbon neutrality and sustainability of biomass. Most biomass used for power generation is derived from forestry management and residues from timber processing. It includes tree thinnings and waste wood, which is the branches and bark left after the higher value material has been processed in a sawmill. Agricultural residues such as straw, husks and shells can also be used as biomass.

Many power stations that cofire biomass have introduced sustainability criteria to ensure that the biomass they used is produced to the required standard. The Sustainable Biomass Partnership (SBP) has developed a pan-European sustainability framework involving third party certification of the management systems of biomass producers, supplying biomass users. Currently, most biomass used in European power plants is produced in North American forests. Here the biomass for cofiring is mainly formed from the waste products of the forestry industry. As the demand for the

waste increases, it has a value which gives an incentive for more and better forest management, and in fact, the forest area in the USA is growing.

BIOMASS IS NOT COAL

Biomass is a very different fuel to coal, which means that in general coal-fired power plants can add biomass at up to 10% by mass before many operational problems arise. One of the main differences between biomass and coal is its much higher moisture content. So most biomass is dried and made into pellets for ease of handling and transport before being delivered to coal-fired power plants. Considerable research has gone into torrefaction which is a thermal process to make biomass more coal-like, with better fuel characteristics than the original biomass. However, as yet, biomass torrefaction is not happening at a scale sufficient to supply cofiring power plants.

ISSUES

Biomass combustion in a coal unit is likely to have various issues. Biomass combustion produces less ash than coal and also generally has lower emissions of nitrogen oxides (NOx) and sulphur oxides (SOx). Biomass also tends to have a higher chlorine content which can lead to problems with slagging and fouling if it is cofired at a high percentage. For example, waste solids can slag and foul the boiler and waste acids corrode boiler surfaces. As the fraction of biomass in the fuel increases, there is less ash to absorb sticky biomass deposits such as potassium chloride and so the sulphur/chlorine ratio becomes more important. So there are positive and negative impacts when adding biomass to coal for cofiring.

It follows then that fuel chemistry management is key to fouling, corrosion management and reliable operations when cofiring. Thus it is important to establish clear fuel specifications, to have the ability to blend delivered fuels, and to carry out continuous monitoring.

COAL IS NOT BIOMASS

So, moving from biomass to coal, whether entire units or to a cofiring situation is more than just a fuel switch. In fact, there are various technical challenges. Biomass is low density and must be kept dry, which means that transport and storage systems must be designed accordingly. There have been problems with handling biomass at coal-fired power plants, and bulk storage needs careful management and monitoring.

For example, air should be kept out of the storage facility. Drax power station in the UK, which uses eight Mt of biomass/y, has constructed four 75,000 t capacity domes for biomass storage.
There have been a number of serious fires, triggered by various dust problems at coal-fired units converted to biomass. As a speaker said at the 5th IEA CCC Cofiring biomass with coal workshop: “It is not a case of if there will be a fire, but when”.

TILBURY'S RISE AND FALL

A well-known example is Tilbury coal-fired station in the UK which was converted to biomass by RWE in 2011. The conversion was done incredibly quickly and included modifications to the feeders, mills, classifiers and burners to optimise combustion and improve flame stability when burning biomass. Two vacuum unloaders were installed for moving biomass from the ships to the plant to reduce problems with fugitive dust.

However, what the conversion of Tilbury power plant is best remembered for, unfortunately, is the fire of 27 February 2012. It started as a localised smouldering incident due to hot dust falling as smouldering embers from high level light fittings into the fuel bunkers below. It developed into a major fire but fortunately there were no serious injuries. After the fire, the station was closed, repaired and restarted but subsequently closed due to changes in RWE’s policies.

THE DRAX CASE

Many power plants are cofiring at 5-10%. Some are converting whole units. The largest power plant using biomass is Drax in Yorkshire, UK which provides 7-8% of the UK’s electricity demand. Drax power station uses more biomass than any other coal-fired

power plant. Drax Power Station was constructed and commissioned in two stages, three units were completed in 1974, and the final three in 1986. Each unit has a capacity of 660 MW when burning coal, giving a total capacity of just under 4,000MW, making Drax the largest power station in the UK.

In July 2012, Drax began converting three of its six generating units to burn biomass, having already trialled cofiring at rates up to 50%. The first of the three units was successfully converted in April 2013 and the second in October 2014.

The wood is pelletised in the USA before transport to the UK. A subsidiary company in the USA has built two 450,000 t/y pelletising plants in SE USA, and an associated port at Baton Rouge. Covered railway cars are used to transport the pellets from the port at Hull to avoid getting them wet and to help avoid self-combustion. The biomass pellets have a

The first all-electric school bus in the state of California pausing outside the State capitol building in Sacramento. Photo: Theurv

lower ignition point than coal and so are more liable to self-combust. Overall Drax has spent around £500 million on the biomass supply chain. Drax measure the full carbon life-cycle of generating electricity from biomass and conclude that the average carbon dioxide saving, over the full life cycle, resulting from burning biomass in place of coal is more than 80%.

This is a major saving, but has required serious investment, risk-taking, much learning by doing, and government support as biomass is not economically competitive with coal. So although the CO2 savings can be impressive, there are many issues to be considered when converting coal-fired units to cofire biomass or to fully convert to biomass.

Further, biomass is a more finite renewable resource than wind or solar that could contribute more to CO2 mitigation than it currently does. But its use will always depend on local factors and competing demands for the biomass resource, and its role will be limited.

The solar voyager

By ALICE MASILI

ONE

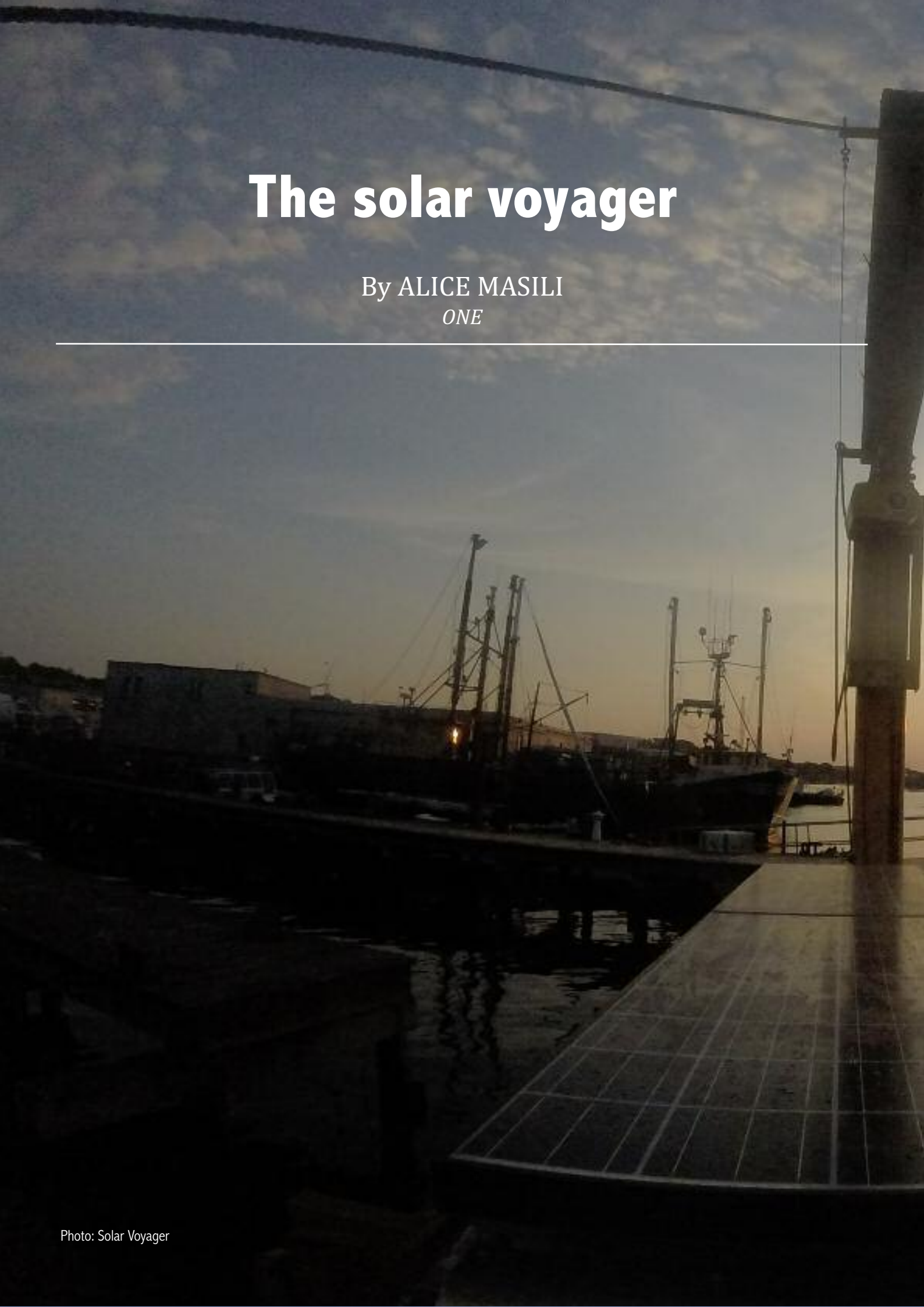
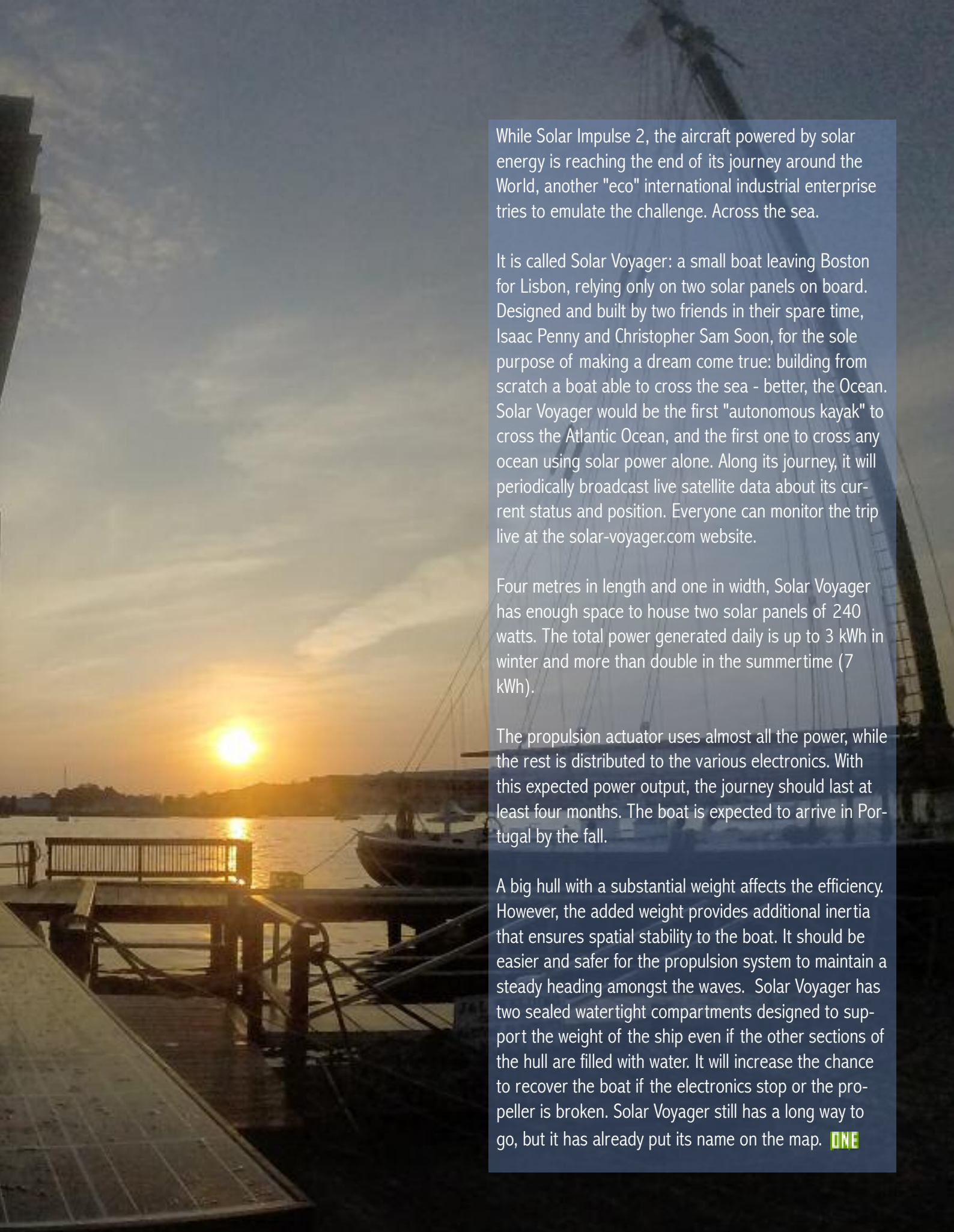


Photo: Solar Voyager



While Solar Impulse 2, the aircraft powered by solar energy is reaching the end of its journey around the World, another "eco" international industrial enterprise tries to emulate the challenge. Across the sea.

It is called Solar Voyager: a small boat leaving Boston for Lisbon, relying only on two solar panels on board. Designed and built by two friends in their spare time, Isaac Penny and Christopher Sam Soon, for the sole purpose of making a dream come true: building from scratch a boat able to cross the sea - better, the Ocean. Solar Voyager would be the first "autonomous kayak" to cross the Atlantic Ocean, and the first one to cross any ocean using solar power alone. Along its journey, it will periodically broadcast live satellite data about its current status and position. Everyone can monitor the trip live at the solar-voyager.com website.

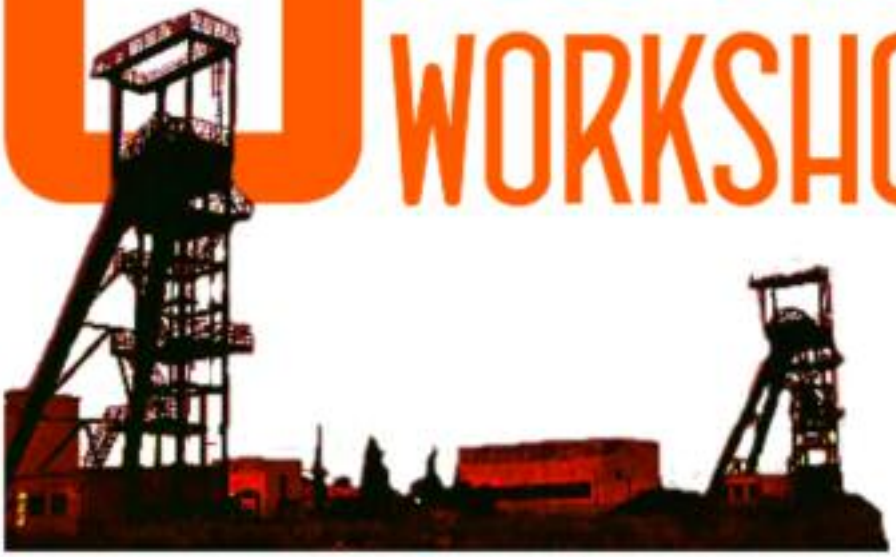
Four metres in length and one in width, Solar Voyager has enough space to house two solar panels of 240 watts. The total power generated daily is up to 3 kWh in winter and more than double in the summertime (7 kWh).

The propulsion actuator uses almost all the power, while the rest is distributed to the various electronics. With this expected power output, the journey should last at least four months. The boat is expected to arrive in Portugal by the fall.

A big hull with a substantial weight affects the efficiency. However, the added weight provides additional inertia that ensures spatial stability to the boat. It should be easier and safer for the propulsion system to maintain a steady heading amongst the waves. Solar Voyager has two sealed watertight compartments designed to support the weight of the ship even if the other sections of the hull are filled with water. It will increase the chance to recover the boat if the electronics stop or the propeller is broken. Solar Voyager still has a long way to go, but it has already put its name on the map. ONE

IEA CLEAN COAL CENTRE

6th COFIRING BIOMASS WITH COAL WORKSHOP



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‘Great Wall of Africa’ planned to hold back the Sahara

Policy makers in countries at the forefront of the renewables revolution are now being forced to rethink fundamentally the way in which these markets operate.

By CARLOS LAORDEN

El Pais / EurActiv

It’s a project to rival the Great Wall of China and Game of Thrones’ formidable barrier that protects the inhabitants of Westeros from the horrors to the north. The Great Green Wall is Africa’s solution to the rapidly expanding Sahara desert. It would eventually see a wall of greenery extending from Senegal on the Atlantic cost to Djibouti on the Gulf of Aden.

In 2007, the African Union officially launched the project, but it has been mooted for decades, since Richard St. Barbe Baker, a British environmental activist, suggested it back in the 1950s. The aim is to prevent the further degradation of soil and desertification of local communities in 14 countries. The wall, which would be 15 metres deep, forms part of a development programme in sub-Saharan countries which has already exported its ideas to other parts of the world such as Haiti and Fiji.

To assess the project’s progress and the challenges that lie ahead, the participating countries will be meeting this week in Dakar, Senegal, where a state-of-play about the “next wonder of the world” will be presented. The nations involved in building the Great Green Wall are under no illusion that the project is a magic bullet to stop desertification.

“Countries like Senegal have replanted a lot, but it gets to a point when that’s not enough,” said Nora Berrahmouni of the UN’s Food and Agriculture Organisation (FAO), one of the international bodies taking part along with the European Commission and the World Bank.

In Burkina Faso, Mali and Niger, they are working on using medicinal and edible plants, with an emphasis on water conservation. Projects such as those being pushed by the FAO have put a special emphasis on using local varieties that are adapted to the climate and conditions of the region.

Traditional planting and management techniques are also being used, so that local people will be able to take care of the wall once it is completed.

The main criticisms that have been levied against the idea revolve around the one-size-fits-all approach that has been taken to the problem. The huge variety of landscapes, environments and cultures to be found between Africa’s west and east coast has caused people to question whether such a project really is the best way forward.

However, the plan’s proponents have pointed out that the additional projects being run and the participation of local communities means that the people who need it most are being given a way in which to support themselves and their families. Reclaiming land

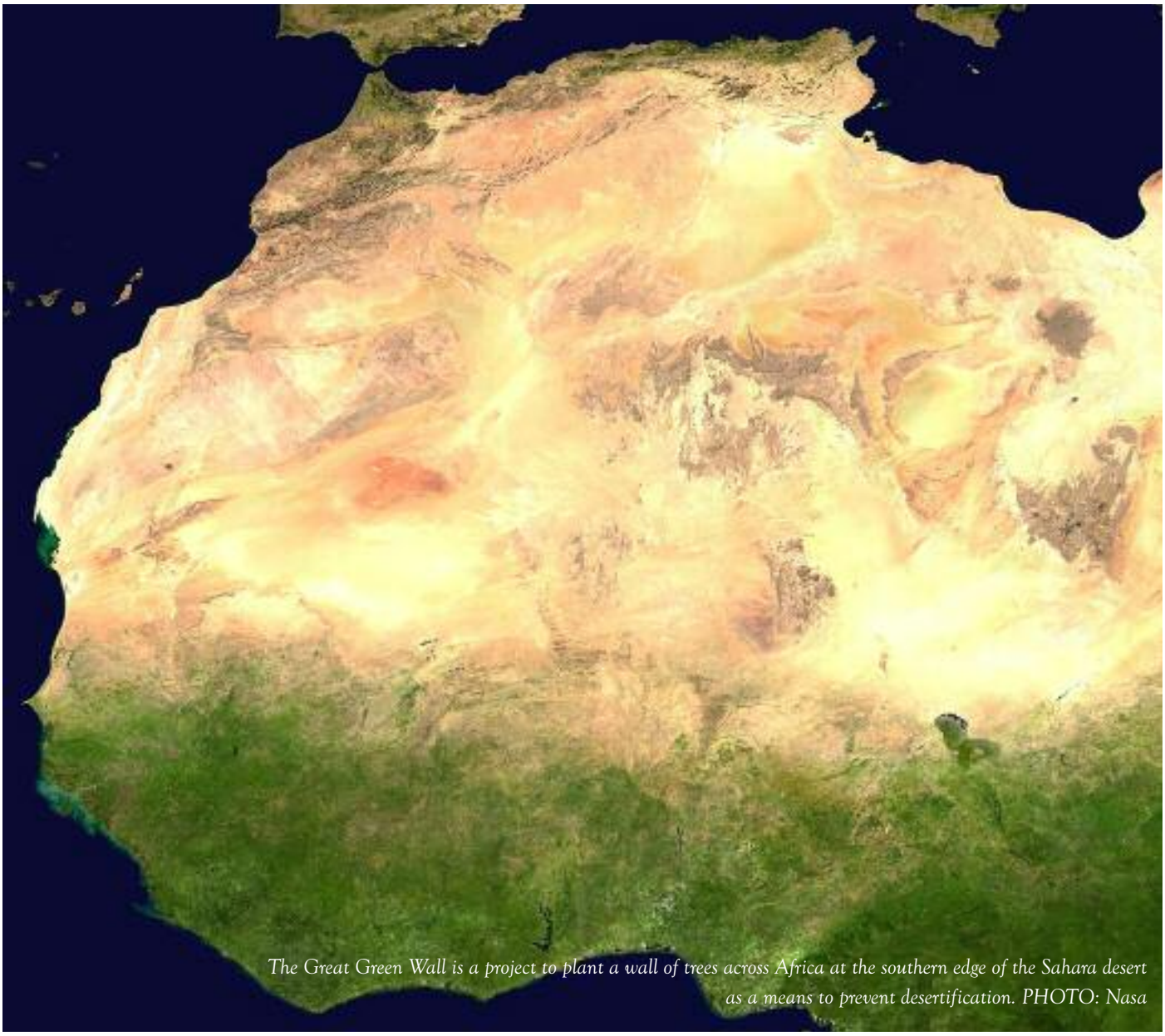
from the desert means that wildlife benefits and a surge in eco-tourism is expected to be another knock-on effect.

The paradox of the wall means that it will serve to unite countries, not divide them. At the border regions of Mali and Niger, many of the local communities have ignored national boundaries in order to collaborate with each other on plant propagation and water conservation schemes.

UN land governance expert Camilla Nordheim-Larsen highlighted that the opportunities being unearthed by the development projects means that the causes that lead people to migrate are being addressed.

UN figures estimate that over 60 million Africans could be forced from their homes over the next five years because of desertification and climate change, and that by 2025, two thirds of the continent's cultivatable land could have been lost. "This is going to build up the resilience of local communities and give young people a reason to stay," Nordheim-Larsen added.

Originally published by El Pais - EurActiv
Translated by Samuel Morgan
May 9, 2016

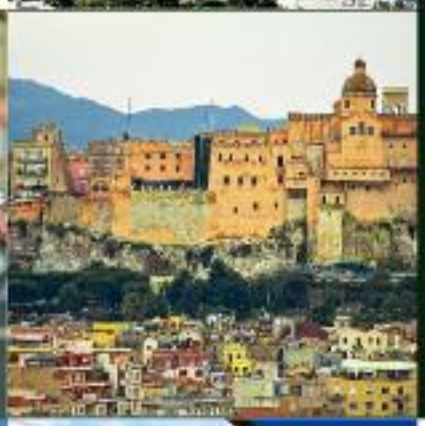


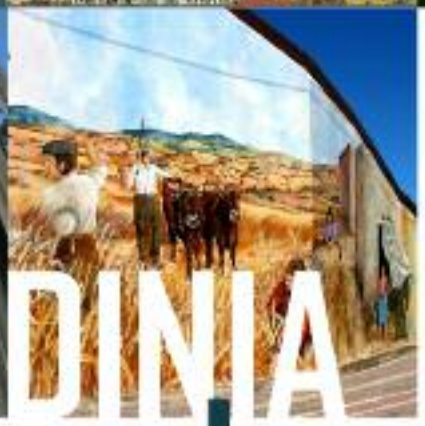
The Great Green Wall is a project to plant a wall of trees across Africa at the southern edge of the Sahara desert as a means to prevent desertification. PHOTO: Nasa







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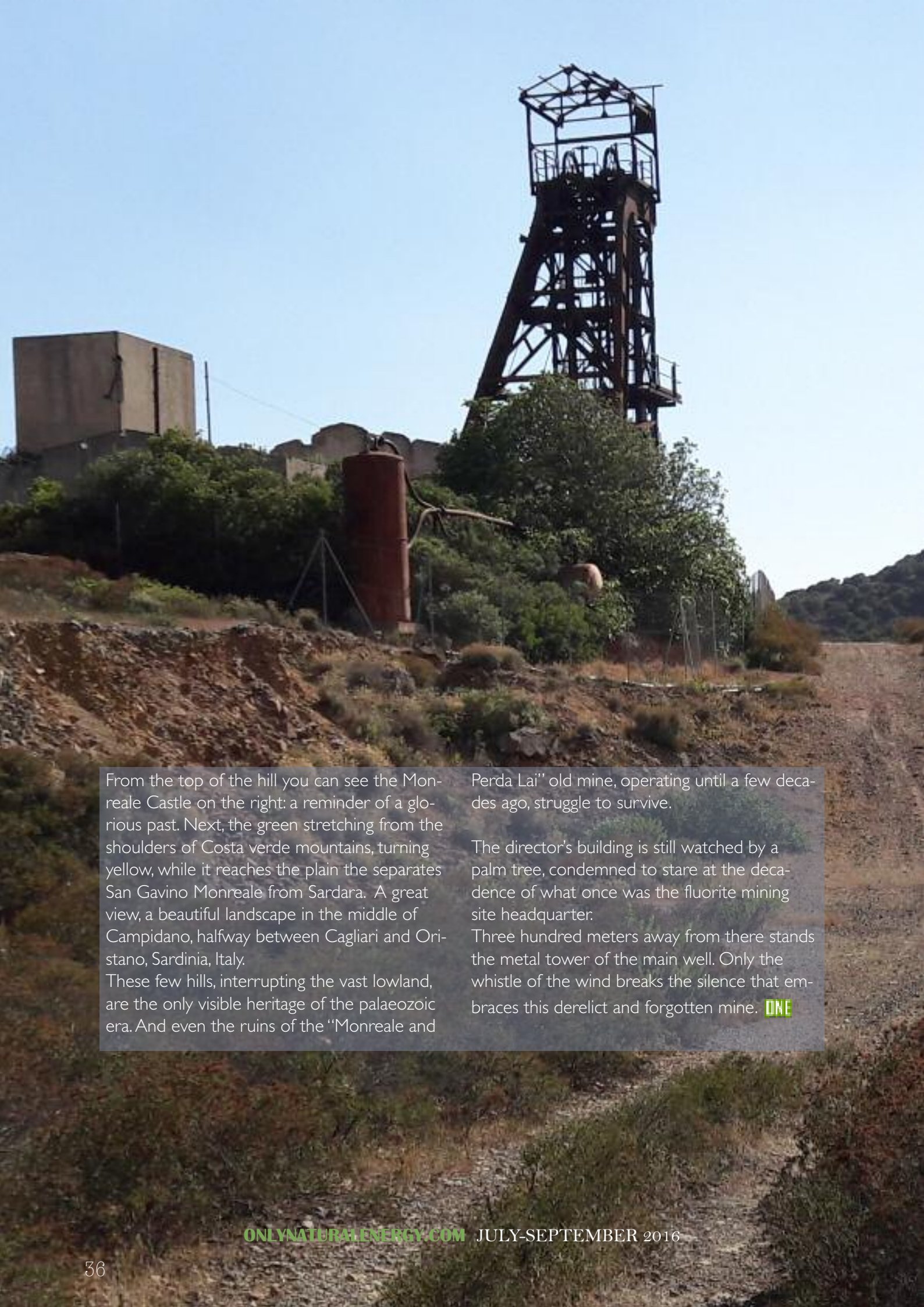
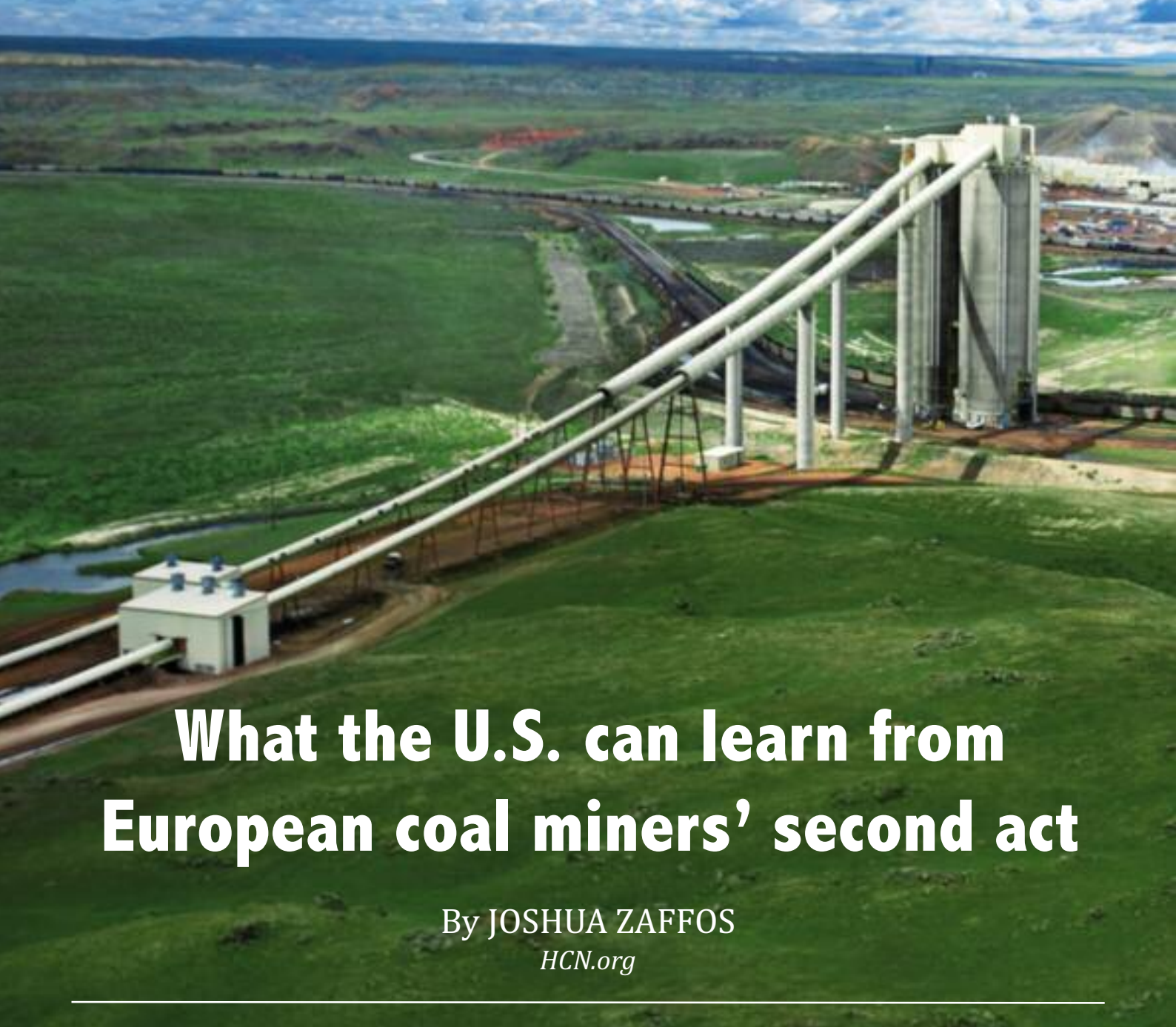
Monreale mine: a view from the past

Photo copyright: ONE



From the top of the hill you can see the Monreale Castle on the right: a reminder of a glorious past. Next, the green stretching from the shoulders of Costa verde mountains, turning yellow, while it reaches the plain the separates San Gavino Monreale from Sardara. A great view, a beautiful landscape in the middle of Campidano, halfway between Cagliari and Oristano, Sardinia, Italy.
These few hills, interrupting the vast lowland, are the only visible heritage of the palaeozoic era. And even the ruins of the "Monreale and Perda Lai" old mine, operating until a few decades ago, struggle to survive.

The director's building is still watched by a palm tree, condemned to stare at the decadence of what once was the fluorite mining site headquarter.
Three hundred meters away from there stands the metal tower of the main well. Only the whistle of the wind breaks the silence that embraces this derelict and forgotten mine. ONE



What the U.S. can learn from European coal miners' second act

By JOSHUA ZAFFOS
HCN.org

People linger at an outdoor café, children run around a park, and visitors tour a former coal mine, now a thriving museum. The one-time industrial site, which includes an events center, restaurants, and even a Ferris wheel, attracted 1.5 million visitors over the past five years. Zollverein, Germany, once home to one of Europe's largest coal mines, is now a retail and tourist destination.

The second act at Zollverein may provide inspiration — or aggravation — for down-and-out coal communities in Wyoming's Powder River Basin and elsewhere in the West. March 31 has become known as Black Thursday in Wyoming since Arch Coal and Peabody Energy announced 465 layoffs at two major mines, amid recent Chapter 11 bankruptcy filings by Arch, Alpha Natural Resources and Peabody.

Given the combination of crashing prices, bankruptcies, and a global push to phase out fossil fuels, the layoffs are likely just beginning.

In northeastern Wyoming, where coal provides one out of every 10 jobs and has generated billions of dollars for schools, roads and other public services, plans for a popular museum or conference center seem far-

"The safety net is much different in Europe," says Robert Godby, a University of Wyoming economist.

North Antelope Rochelle coal mine in Wyoming, United States. Photo: Courtesy of Peabody Energy

fetched. Good jobs are scarce outside the energy industry, and retirement benefits from faltering companies seem uncertain. Many locals wonder how their small towns will survive. Given all this, the official government response feels underwhelming.

While Zollverein is a long way from the Powder River Basin — the German mine is near a city of almost 600,000 people — U.S. economists and policy analysts are eyeing Europe, where governments, companies and unions are charting a different path toward life after coal.

Overseas, coalfields are also facing job cuts, but unemployment benefits generally last longer, job training and economic-development programs are more extensive and retirement benefits better protected. "The safety net is much different in Europe," says Robert Godby, a University of Wyoming economist.

Mark Perkins, left, and Scott Pearce talk about recent layoffs from the nearby Black Thunder Coal Mine at Perkins' electrical shop in Wright, Wyoming. Perkins is closing his business after the mine laid off hundreds of workers, including Pearce, due to a dramatic decline in demand for coal. The town, with a population of less than 2,000, relies heavily on the energy industry to sustain itself. As concern over climate

change has grown, Europe and the U.S. have taken different paths. In the U.S., coal-producing states and Congress have balked at steps to shift from coal to other industries, while Europe has more willingly embraced the transition.

Germany, which relied heavily on coal for power and jobs following World War II through reunification, has the most productive lignite mines in the world. But the government is now scaling back soft-coal mining as part of a national effort to address climate change by reducing fossil fuel use and investing in renewables. Mining subsidies are being phased out by 2018, according to agreements negotiated by the German government and industry.

The arrangement has created a "soft landing" for workers and companies without unexpected mass layoffs or abrupt bankruptcies. Many older workers will ease into retirement, while younger miners can take advantage of Germany's strong vocational training and apprenticeship programs to pursue work in engineering, technology and other industries.

The Zollverein Coal Mine Industrial Complex is a large former industrial site in the city of Essen, North Rhine-Westphalia, Germany. Once home to one of Europe's largest coal mines, it is now a retail and tourist destination.

The U.S., however, lacks a comprehensive climate action or energy policy. Miners and officials in Wyoming and elsewhere tend to blame President Obama and the Clean Power Plan, rather than global price drops, export declines and environmental pressures, for coal's downfall. "First, it's fiction," says Adele Morris, a senior fellow with the Brookings Institution, who authored a recent report on the future of coal communities and workforces, "and, second, it's unconscionable for leaders to not serve the people. It behooves us to do right by these folks who kept the lights on."

Instead, while global forces buffet industry and workers, U.S. lawmakers have done little to ease their pain or adjust to new realities. Wyoming Gov. Matt Mead, R, opened temporary community resource centers in the coal towns of Casper, Gillette and Douglas to provide information on unemployment insurance, job opportunities and training, and counseling services. Following Black Thursday, more than 900 people showed up at the centers and workforce offices, including some unemployed oil and gas workers. But the state's latest energy strategy is focused on fossil fuels with scarcely any mention of renewables, and Mead recently said Wyoming is "doubling down on coal," aggressively backing unproven "clean coal" and carbon capture and storage technology, in hopes of somehow bucking the global downturn.

In Europe, stabilizing forces also include the unions. Germany's mining, energy and chemical industry trade union is one of the nation's strongest, and has helped maintain welfare and retirement benefits and pensions and supported the negotiated phase-outs of coal. In contrast, the once-mighty U.S. mining-labor movement is in steep decline. The United Mine Workers had 800,000 members in the 1930s, but now represents just 35,000 active and 40,000 retired miners. A mere 5 percent of mining, quarrying, and oil and gas workers were members in 2014.

"In the Powder River Basin, union mining is almost nonexistent," says Godby, partly since strip mines

there have small workforces compared to West Virginia and Kentucky's underground mines. The union has fought hard to prevent companies from trying to duck out of retirement benefits in Appalachia, but it has little stake or influence in the Powder River Basin. Arch Coal, at least, has said it will continue to make retiree benefit payments after filing for bankruptcy. But the company's executives also paid themselves exorbitant bonuses despite the bankruptcy announcements. For laid-off workers, Arch is offering between four and 26 weeks of severance pay.

Behind decisions over unions, retirement and support services, notes Godby, is a larger debate over what citizens expect from governments. In Europe, governments and citizens have mostly supported broader public resources and a greater safety net than the U.S., where limited government remains a mantra among conservatives and even some progressives. On top of that, Europe's politics are generally more left-leaning, with social-democratic influences that walk the line between capitalism and -socialism.

A stronger safety net, however, requires higher taxes, a trade-off most Americans resist. So while Wyoming miners average $83,000 a year, a laid-off worker collects perhaps $470 a week, and benefits can run out after half a year. In Germany, a lignite miner's salary was roughly $57,000, in 2011, and tax rates are about double U.S. rates, but unemployment benefits pay job seekers two-thirds of their former earnings for up to two years, and healthcare continues despite job loss.

In remote Svalbard, Norway, small coal-mining communities are surviving thanks to government help. Payments of about $66 million helped the state-owned mining company, Store Norske, concentrate operations in one expanded mineshaft while closing down others, giving the community time to develop alternative industries. The company and government also formed a local tourism enterprise and helped develop a university Arctic research program.

In the U.S., President Obama launched the POWER Initiative last year to provide about the same amount, $65.8 million, for job training, job creation and economic diversification for slumping coal communities. But it's mostly focused on Appalachia, and isn't big enough, considering the size of the country's energy industry. According to the recent Brookings report, protecting retiree benefits, reclaiming abandoned mines and providing substantive job training would require tens of billions of dollars.

To generate that sort of money, Morris suggests that a carbon tax — anathema to energy-dependent states and many politicians — could actually help by providing predictable coal-price changes for companies and collecting funds that could be set aside to help communities and workers.

"Regardless of regulation, the market and outlook for coal is grim, and it's unfair and unwise to rely on a rebound," Morris says. "It's going to take a lot of money, and our (national and state) budgets are wholly unsuited to the kind of ambition we need to help revitalize these areas. But it's much easier said than done."

Originally published by Hcn.org May 16, 2016

Photos: Courtesy of C.M. Chao Architect & Planners / interdesign associates & Javier Callejas Sevilla / Hallucinate Design Office

Silk Road revisited

By EUSEBIO LORIA
ONE

A city within the city. It is the new Midwest Commodity Exchange Center (MCEC), the core of the metal products trade park in Xi'an.

Positioned as one of the regional headquarters of China's New Silk Road, this area has recently witnessed a new urban development.

Modern buildings, artificial lakes, and green parks are apparently disconnected with Xi'an recent past, but it is Silk Road's rich historical and cultural background that inspired architects and designers projects.

There are seven main towers: four - called "bridge" - representing the connection between south-north and east-west transportations; one - called "gold seal" - representing fair international trades; and a pair of hexagonal columns - called "gate" - representing the constant change in urban life within the city environment.

At night, led light streams along the façade to keep moving - through a particular lighting program - to create a spectacular and active urban landscape.

ONE

Plastic Bags Might Kickstart the Carbon Capture Industry

By RICHARD S. MIDDLETON
Los Alamos National Laboratory

You just can't drink enough soda to create a market for bottling and storing all the excess carbon dioxide in the atmosphere. But as researchers look for ways to stave off global warming by reducing atmospheric CO2, many have turned to a related idea. Carbon capture, utilization and storage (CCUS) is one strategy--along with others such as solar energy, biofuels and energy efficiency--that can work together to rein in runaway greenhouse gases.

If CCUS were applied broadly across the U.S. manufacturing sector, it could save hundreds millions of tons of industrial greenhouse gas emissions from entering the atmosphere every year. The trick is demonstrating that it makes economic sense.
A team led by Los Alamos National Laboratory worked out a CCUS model that just might deliver the financial return investors need. It relies on a surprising source: the ethylene manufacturing plants that make plastic bags and packaging from natural gas.

The Los Alamos–led research team explored capturing CO2 from ethylene manufacturing plants. The ethylene plants, clustered in the U.S. Gulf Coast, can recover their carbon capture costs by selling the CO2 to nearby depleted oil fields and using the gas to extract up to 15 percent more oil. The team's study found that large, clustered sources of ethylene coupled with the high demand for CO2 in enhanced oil recovery could support an integrated pipeline network from New Mexico across the Gulf region to Mississippi. This kind of a large, commercially viable and fully integrated CO2 capture network could stimulate wide-ranging industry "buy-in."

Capturing CO2 emitted from ethylene manufacture and using that CO2 for enhanced oil recovery lowers the carbon footprint of gasoline use by approximately one third.

The implications are global. Even as nations increase their share of renewable energy, fossil fuels will remain an economic driver for decades. For instance, China and India are committed to coal-fired electric plants for decades and CCUS is the only technology capable of reducing those CO2 emissions. A large-scale carbon-capture network can go a long way to reducing the environmental impact of fossil fuel use.

Most researchers recognize that turning around climate change involves deploying multiple strategies, and CCUS has the advantage of reducing carbon emissions during a transition from fossil fuels to other energy sources. As such, it is poised to help transition the global energy economy to a cleaner, more diversified energy future.

Originally published by Energy.gov May 6, 2016

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Now is your chance to make a difference on this planet by presenting a project which governments from all over the globe can incorporate and reduce their energy consumption. Rather than demolish and recreate a building, your task is to achieve 25% reduction in energy consumption by retrofitting a public building. Step into the future and be the change you wish to see in the world!

THE CHALLENGE

Choose a building in your country of residence:

- It must have been constructed before the year 2000
- Either a government building or your university building

Criteria is divided into the following point system:

Energy enhancement comparison	30 points
Use of solar components	20 points
Innovation / Use of technologies	20 points
Overall methodology & presentation	20 points
Financial analysis / Feasibility study	10 points

NEW

Get bonus points!	Optional
Presenting a prototype	5 points
Video presentation	3 points
PowerPoint presentation	2 points

The team that gets the highest points will win!

PRIZES

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- Commendation certificate from MESIA and Intersolar
- Project will be showcased at the Intersolar Middle East event
- A trophy and a certificate by the Ministry of Energy, UAE
- 6 weeks Internship in a MESIA member company in the UAE
- US $900 in cash for the team

SILVER

- Bronze prize
- Plus US $600 in cash for the team (total US $ 1,500)

GOLD

- Bronze prize
- Plus US $1600 in cash for the team (total US $2,500)
- 6 week internship at MASDAR
- Chance to visit Intersolar Europe in Germany (22 -24 June, 2017)
- Flights and two night accommodation in Germany for the team of three
- Hosted one to one meetings with Solar Energy companies at Intersolar Europe - 2017

NEW Present the winning project in Germany

IMPORTANT DATES

Submission Deadline: **31 July 2016** Top 5 Announced: **20 August 2016** Top 3 Announced: **19 September 2016**

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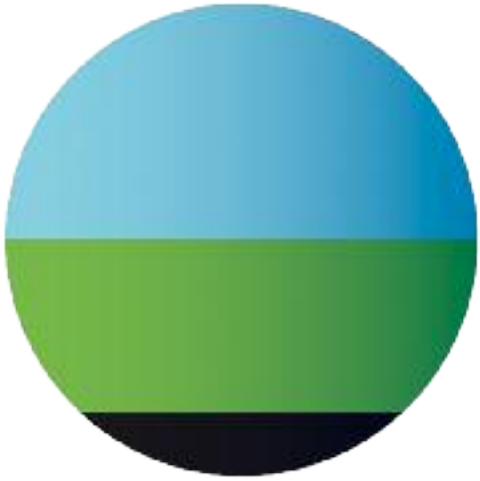
Photo: Staselnik

MIR

The Mir Mine is located in Mirny, Eastern Siberia, Russia, and is the second largest excavated hole in the world, after Bingham Canyon Mine (USA). Mir was an open pit diamond mine 525 meters deep with 1,200 meters of diameter.

The first diamonds were discovered in 1955, and it took only two years to start the mining activity, in spite of the Siberian severe climate freezing the ground and making it hard to dig. Mir was the first and the largest diamond mine in the Soviet Union. It lasted 44 years, stopped operations in June 2001 and closed for good in 2004. ONE

SOTACARBO



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