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Poor unfortunate soils

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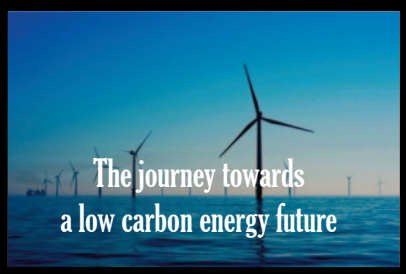

The journey towards a low carbon energy future

Concept of net zero is a dangerous trap

YEAR VII - NUMBER 3 - JULY-SEPTEMBER 2021

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ONE
Only Natural Energy

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Dead tree in Tsauchab River, Sossusvlei.
Photo credit: Dave Curtis

Poor unfortunate soils

GIANNI SERRA
ONE

We know everything about CO2. We know so much it looks almost tangible. Carbon dioxide is so often paired with global warming and climate change that it has become an automatic association. The sight of smoke from a factory or a car and the mind goes there.
CO2 is everywhere. This is why the whole climate transition debate revolves around lowering carbon emissions.

Fine. The only problem is that CO2 cannibalizes all the attention and the sense of danger. The most vivid example is the lack of urgency that surrounds soil pollution. Ground contamination can be natural or artificial. More often it is a combination of both.

A vital part of the mitigation strategy, trees are treated as they are rootless – very little thought is given to the nutrients they need. In contrast, a growing technology market builds upon trees' ability to work as natural carbon capture tools.

In 2019 the Ethiopian government announced the planting of 350 million trees, breaking the 50 million tree world record held by India for the most trees planted in one day. Now a Canadian startup announces modified aerial drones to plant trees ten times quicker than traditional methods, intending to plant one billion trees by 2028. A Californian company discovered that tweaking an enzyme in tobacco plants could make them grow up to 40 per cent bigger. They claim that the same genetic change will make trees taller and more prominent, allowing them to absorb more CO2. But trees and soil should not necessarily be CO2-related to be appreciated and treated as crucial.

Preserving the health of soils and forests is the first step to safeguarding the health of the people, improving the quality of life and economy of the area, and increasing biodiversity. And also, why not, absorb carbon emissions – but just as a consequence, not the only goal.
A recent joint report from the Food and Agriculture Organisation of the United Nations (FAO) and the United Nations Environment Programme (UNEP) describes the magnitude of soil pollution on global health, environment and food security. And the conclusion is "soil pollution has no borders: it spreads throughout ecosystems and redistributed through the global food and production chains."

Protecting the land from deforestation and contaminants should be a priority. The ecosystem and biodiversity are combinations too complex and intricate to be fully replicated. You can not delete or forget one element and expect the same result. Swapping one forest for another - the same size, but somewhere else - only works in Legoland. ONE

A hero for zero

How does carbon capture feature in the IEA's recent visions of net zero?

TOBY LOCKWOOD
ONE

In May, the International Energy Agency (IEA) released a report which made an unusually seismic impact across the energy sector and was even widely reported in the general media. *Net Zero by 2050 – a roadmap for the global energy sector* lays out a demanding course of action for the world to achieve an extraordinarily rapid shift to 'net zero' CO2 emissions, and was seen by some commentators as signifying a welcome change in outlook for the IEA.

Although the IEA's origins lie in the 1970s oil crises and the pursuit of energy security, the organisation has long regarded a transition to cleaner energy as one of its central aims, so is no stranger to this kind of analysis. Its widely used *World Energy Outlook* (WEO) publication has included decarbonisation scenarios since its first release in 2006, with recent editions setting out a 'Sustainable Development Scenario' (SDS) which reaches net zero by 2070. This target is chosen to give the world a reasonable chance of meeting the Paris Agreement goal of keeping global warming 'well below 2°C', and already requires a major acceleration in the energy transition. Last year's 'WEO 2020' even included a chapter dedicated to an additional 'Net Zero by 2050' scenario, so the attention drawn by the recent report is perhaps less related to sensational content and more to do with a conscious shift in how it has been targeted and publicised.

The interest in bringing net zero forward to 2050 is also linked to the Paris Agreement, which includes a less binding call on signatories to 'pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels'. This lower target has received greater emphasis since a 2018 International Panel on Climate Change (IPCC) report warned that even this much warming would have a severe environmental impact. The IPCC consider that achieving net zero globally by 2050 would give us a 50% chance of meeting 1.5°C. By comparison, the 20-year delay built into the IEA's Sustainable Development Scenario carries the same chance of limiting warming to 1.65°C.

Fatih Birol, Executive Director of the International Energy Agency.
Photo credit: Friends of Europe-Gleamlight/Ph.Molitor

As a growing number of – mostly high-income – countries have responded by proposing or legislating commitments to achieve either net-zero carbon or greenhouse gas emissions by 2050, it is no surprise that the IEA has put the goal increasingly under the spotlight. However, completely decarbonising society in just 30 years will require an unprecedented level of investment and political will even from these prosperous nations. For emerging economies, many of them still heavily reliant on fossil fuels and undergoing rapid economic growth, net zero is an even taller order.

Carbon capture, utilisation and storage (CCUS) is a technology which frequently features heavily in ambitious decarbonisation scenarios, despite its relatively limited use to date. This seemingly indispensable role is often attributed to the wide range of options the technology brings to the table, including its ability to cut emissions from industries with few alternative solutions, such as cement; its role in producing low-carbon

Climeworks direct air carbon capture plant in Iceland.
Photo credit: Arni Saeberg

hydrogen; and, perhaps most importantly, its ability to permanently remove CO2 from the atmosphere – thus offsetting any of remaining emissions.

From a starting point of only around 50 million tonnes of CO2 captured annually in 2020, the IEA's latest Sustainable Development Scenario calls for this rate to grow to over 10 billion tonnes in a net-zero 2070, passing through 5.6 billion tonnes of CO2 per year in 2050. Most of this CO2 is stored in deep rock formations, although a small amount is used to make synthetic fuels and other carbon-based products.
So, how does this climate mitigation technology fare in the more urgent scenario released last month? The total amount of CO2 captured in 2050 is increased to 7.6 billion tonnes, making for a much more rapid roll-out, but ultimately reaching net zero with significantly less CCUS. Interestingly, the IEA's earlier and less-heralded 'net zero by 2050' scenario, included in last year's World Energy Outlook, still called for over 10 billion tonnes of CO2 to be captured in 2050, so the recent report does seem to represent a somewhat reduced role for the technology, at least over this time period.

On the other hand, carbon capture is applied in largely the same pattern as in previous IEA scenarios, across a diverse range of applications. The technology mops up around 3.5 billion tonnes of CO2 emissions still produced by fossil fuels in 2050, which are associated with heavy industry (cement, steel, and chemical production), hydrogen production, and some remaining coal and gas power plants. Although the total capacity of capture-equipped power plants is similar to the level reached when the Sustainable Development Scenario hits net zero, the amount of energy they generate is significantly reduced, so much less CO2 is produced.

Hydrogen tends to be widely used as a low-carbon fuel for heating and transport in net-zero scenarios, as well fuelling power plants which act as clean back-up to intermittent renewables. Low-carbon hydrogen can be made either from fossil fuels while capturing the CO2 produced, or by splitting water using renewable electricity (electrolysis); IEA scenarios typically call on these technologies in roughly equal proportions. The total of 520 million tonnes of low-carbon hydrogen required in the 'net zero by 2050' scenario (including over 200 million tonnes using CO2 capture) is similar to the amount used by 2070 in the Sustainable Development Scenario, and accounts for a much bigger proportion of the total fossil CO2 captured in 2050. In other words, the accelerated decarbonisation has clearly not dented the need for this future fuel, but the pace of expansion is nearly doubled as a result.

The biggest winning variety of CO2 capture technology in the recent report is probably direct air capture – a technology which processes ordinary air to remove the low ambient concentrations of CO2. While last year's Sustainable Development Scenario sees only 100 million tonnes of CO2 captured in this way by 2050 (most of which is converted to synthetic fuels), the new scenario includes over six times this total. Given that this technology is only set to be demonstrated at large-scale for the first time in around 2025, this equates to an enormous scale-up in less than 30 years. However, it is still less than the final level of 800 million tonnes reached by the delayed net zero scenario in 2070.

The other main method of removing CO2 from the atmosphere is bio-energy with CCS (BECCS), in which sustainably grown plants are used to produce energy and the resulting CO2 captured. This approach sees roughly similar levels of expansion by 2050 in the two scenarios, but it is again much less relied upon in their final visions of net zero, as the Sustainable Development Scenario then ramps up its deployment three-fold to reach 300 million tonnes in 2070.

In short, a major difference between the two reports is the extent to which they rely on both types of 'negative emissions' to balance the books; net zero in 2050 has close to two billion tonnes compared to nearly three in the Sustainable Development Scenario.

This likely reflects the constraints of a more rushed transition: carbon removal technologies are already ramped up as fast as possible, so any remaining emissions have to be cut faster in order to match the removals in time for the earlier deadline. Regardless of exactly how the numbers break down, there is no doubt that CO2 capture technologies have a hugely significant part to play in reaching net zero in the timescales required by the Paris Agreement.

In fact, the IEA's own comparison of its latest '2050' scenario with the IPCC's '1.5°C scenarios' indicates that the level of CO2 capture is actually relatively low, along with – as we have seen – comparatively high reliance on hydrogen and lower use of bio-energy.

It is also worth noting that net zero is not the end of the story. If the global transition is then able to continue into net negative emissions – removing more CO2 from the atmosphere than we emit – even a 2070 target may not be too late to bring warming down to 1.5°C. For this 'clean-up job', carbon capture will again be at the fore. ONE

Climate scientists: concept of net zero is a dangerous trap

Why has it taken us so long to speak out about the obvious dangers of the concept of net zero? Because the premise of net zero is deceptively simple.

JAMES DYKE, ROBERT WATSON and WOLFGANG KNORR
The Conversation

Sometimes realisation comes in a blinding flash. Blurred outlines snap into shape and suddenly it all makes sense. Underneath such revelations is typically a much slower-dawning process. Doubts at the back of the mind grow. The sense of confusion that things cannot be made to fit together increases until something clicks. Or perhaps snaps.

Collectively we three authors of this article must have spent more than 80 years thinking about climate change. Why has it taken us so long to speak out about the obvious dangers of the concept of net zero? In our defence, the premise of net zero is deceptively simple – and we admit that it deceived us.

The threats of climate change are the direct result of there being too much carbon dioxide in the atmosphere. So it follows that we must stop emitting more and even remove some of it.

This idea is central to the world's current plan to avoid catastrophe. In fact, there are many suggestions as to how to actually do this, from mass tree planting, to high tech direct air capture devices that suck out carbon dioxide from the air.

The current consensus is that if we deploy these and other so-called "carbon dioxide removal" techniques at the same time as reducing our burning of fossil fuels, we can more rapidly halt global warming. Hopefully around the middle of this century we will achieve "net zero". This is the point at which any residual emissions of greenhouse gases are balanced by technologies removing them from the atmosphere.

This is a great idea, in principle. Unfortunately, in practice it helps perpetuate a belief in technological salvation and diminishes the sense of urgency surrounding the need to curb emissions now.

We have arrived at the painful realisation that the idea of net zero has licensed a recklessly cavalier "burn now, pay later" approach which has seen carbon emissions continue to soar.

It has also hastened the destruction of the natural world by increasing deforestation today, and greatly increases the risk of further devastation in the future.

To understand how this has happened, how humanity has gambled its civilisation on no more than promises of future solutions, we must return to the late 1980s, when climate change broke out onto the international stage.

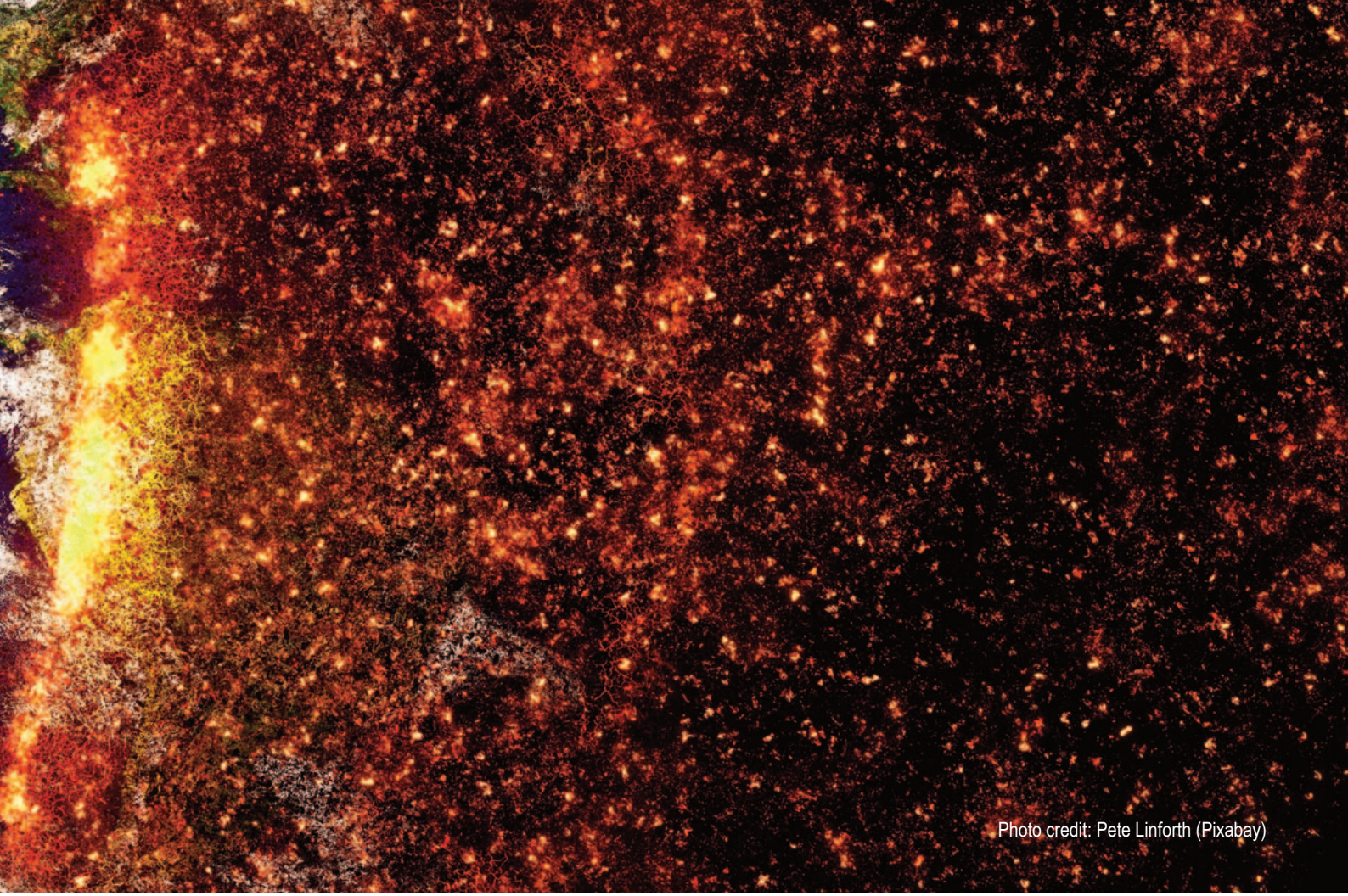


Photo credit: Pete Linforth (Pixabay)

Steps towards net zero

On June 22 1988, James Hansen was the administrator of Nasa's Goddard Institute for Space Studies, a prestigious appointment but someone largely unknown outside of academia.

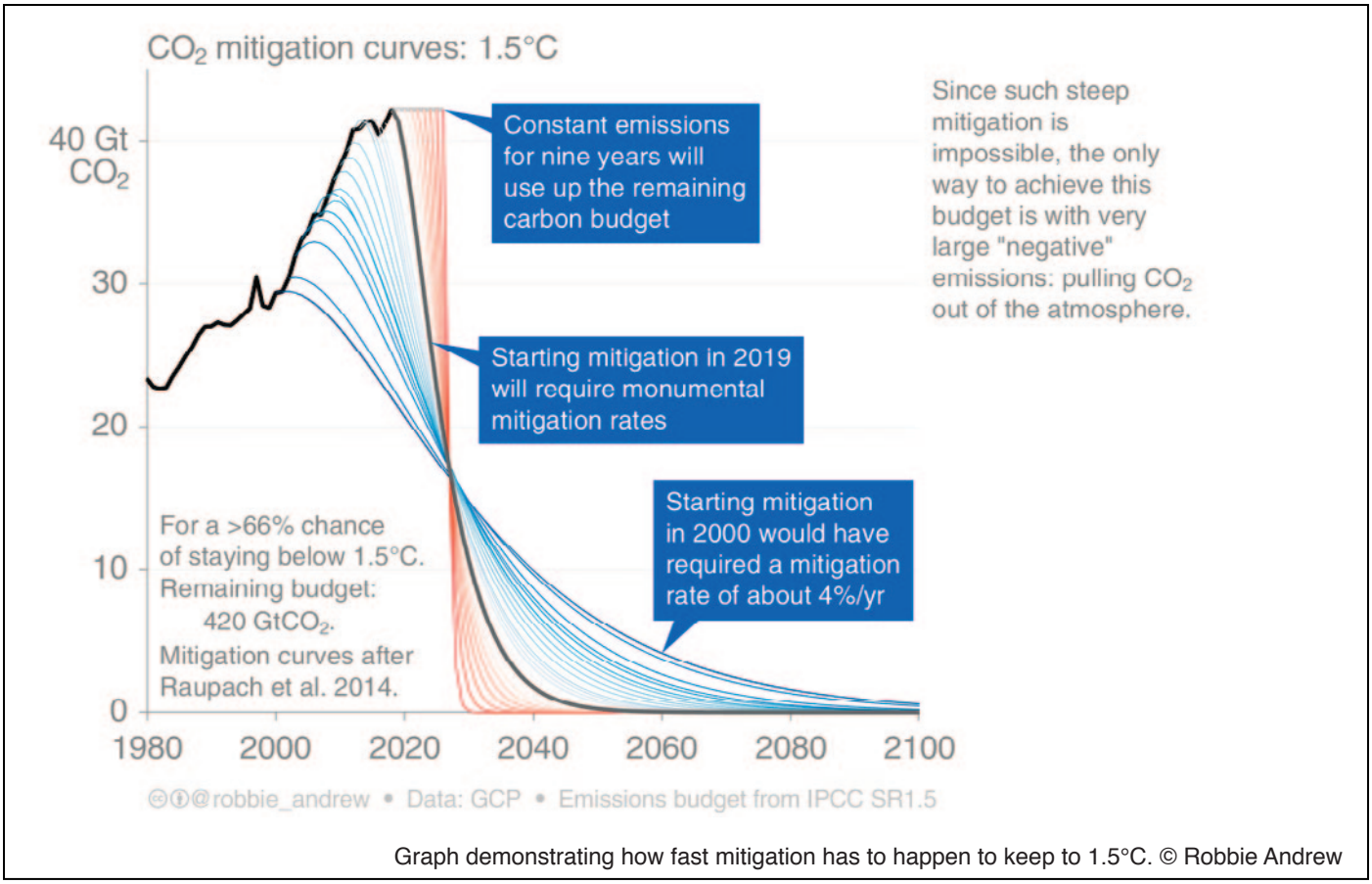
By the afternoon of the 23rd he was well on the way to becoming the world's most famous climate scientist. This was as a direct result of his testimony to the US congress, when he forensically presented the evidence that the Earth's climate was warming and that humans were the primary cause: "The greenhouse effect has been detected, and it is changing our climate now."

If we had acted on Hansen's testimony at the time, we would have been able to decarbonise our societies at a rate of around 2% a year in order to give us about a two-in-three chance of limiting warming to no more than 1.5°C. It would have been a huge challenge, but the main task at that time would have been to simply stop the accelerating use of fossil fuels while fairly sharing out future emissions.

Four years later, there were glimmers of hope that this would be possible. During the 1992 Earth Summit in Rio, all nations agreed to stabilise concentrations of greenhouse gases to ensure that they did not produce dangerous interference with the climate. The 1997 Kyoto Summit attempted to start to put that goal into practice. But as the years passed, the initial task of keeping us safe became increasingly harder given the continual increase in fossil fuel use.

It was around that time that the first computer models linking greenhouse gas emissions to impacts on different sectors of the economy were developed. These hybrid climate-economic models are known as Integrated Assessment Models. They allowed modellers to link economic activity to the climate by, for example, exploring how changes in investments and technology could lead to changes in greenhouse gas emissions.

They seemed like a miracle: you could try out policies on a computer screen before implementing them, saving humanity costly experimentation. They rapidly emerged to become key guidance for climate policy. A



Graph demonstrating how fast mitigation has to happen to keep to 1.5°C. © Robbie Andrew

primacy they maintain to this day.

Unfortunately, they also removed the need for deep critical thinking. Such models represent society as a web of idealised, emotionless buyers and sellers and thus ignore complex social and political realities, or even the impacts of climate change itself. Their implicit promise is that market-based approaches will always work. This meant that discussions about policies were limited to those most convenient to politicians: incremental changes to legislation and taxes.

Around the time they were first developed, efforts were being made to secure US action on the climate by allowing it to count carbon sinks of the country's forests. The US argued that if it managed its forests well, it would be able to store a large amount of carbon in trees and soil which should be subtracted from its obligations to limit the burning of coal, oil and gas. In the end, the US largely got its way. Ironically, the concessions were all in vain, since the US senate never ratified the agreement.

Postulating a future with more trees could in effect offset the burning of coal, oil and gas now. As models could easily churn out numbers that saw atmospheric carbon dioxide go as low as one wanted, ever more sophisticated scenarios could be explored which reduced the perceived urgency to reduce fossil fuel use.

By including carbon sinks in climate-economic models, a Pandora's box had been opened.

It's here we find the genesis of today's net zero policies.

That said, most attention in the mid-1990s was focused on increasing energy efficiency and energy switching (such as the UK's move from coal to gas) and the potential of nuclear energy to deliver large amounts of carbon-free electricity. The hope was that such innovations would quickly reverse increases in fossil fuel emissions.

But by around the turn of the new millennium it was clear that such hopes were unfounded. Given their core assumption of incremental change, it was becoming more and more difficult for economic-climate models to find viable pathways to avoid dangerous climate change. In response, the models began to include more and more examples of carbon capture and storage, a technology that could remove the carbon dioxide from coal-fired power stations and then store the captured carbon deep underground indefinitely.

This had been shown to be possible in principle: compressed carbon dioxide had been separated from fossil gas and then injected underground in a number of

projects since the 1970s. These Enhanced Oil Recovery schemes were designed to force gases into oil wells in order to push oil towards drilling rigs and so allow more to be recovered – oil that would later be burnt, releasing even more carbon dioxide into the atmosphere.

Carbon capture and storage offered the twist that instead of using the carbon dioxide to extract more oil, the gas would instead be left underground and removed from the atmosphere. This promised breakthrough technology would allow climate friendly coal and so the continued use of this fossil fuel. But long before the world would witness any such schemes, the hypothetical process had been included in climate-economic models. In the end, the mere prospect of carbon capture and storage gave policy makers a way out of making the much needed cuts to greenhouse gas emissions.

The rise of net zero

When the international climate change community convened in Copenhagen in 2009 it was clear that carbon capture and storage was not going to be sufficient for two reasons.

First, it still did not exist. There were no carbon capture and storage facilities in operation on any coal fired power station and no prospect the technology was going to have any impact on rising emissions from increased coal use in the foreseeable future.

The biggest barrier to implementation was essentially cost. The motivation to burn vast amounts of coal is to generate relatively cheap electricity. Retrofitting carbon scrubbers on existing power stations, building the infrastructure to pipe captured carbon, and developing suitable geological storage sites required huge sums of money. Consequently the only application of carbon capture in actual operation then – and now – is to use the trapped gas in enhanced oil recovery schemes. Beyond a single demonstrator, there has never been any capture of carbon dioxide from a coal fired power station chimney with that captured carbon then being stored underground.

Just as important, by 2009 it was becoming increasingly clear that it would not be possible to make even the gradual reductions that policy makers demanded. That was the case even if carbon capture and storage was up and running. The amount of carbon dioxide that was being pumped into the air each year meant humanity was rapidly running out of time.

With hopes for a solution to the climate crisis fading again, another magic bullet was required. A technology was needed not only to slow down the increasing concentrations of carbon dioxide in the atmosphere, but actually reverse it. In response, the climate-economic modelling community – already able to include plant-based carbon sinks and geological carbon storage in their models – increasingly adopted the "solution" of combining the two.

So it was that Bioenergy Carbon Capture and Storage, or BECCS, rapidly emerged as the new saviour technology. By burning "replaceable" biomass such as wood, crops, and agricultural waste instead of coal in power stations, and then capturing the carbon dioxide from the power station chimney and storing it underground, BECCS could produce electricity at the same time as removing carbon dioxide from the atmosphere. That's because as biomass such as trees grow, they suck in carbon dioxide from the atmosphere. By planting trees and other bioenergy crops and storing carbon dioxide released when they are burnt, more carbon could be removed from the atmosphere.

With this new solution in hand the international community regrouped from repeated failures to mount another attempt at reining in our dangerous interference with the climate. The scene was set for the crucial 2015 climate conference in Paris.

A Parisian false dawn

As its general secretary brought the 21st United Nations conference on climate change to an end, a great roar issued from the crowd. People leaped to their feet, strangers embraced, tears welled up in eyes bloodshot from lack of sleep.

The emotions on display on December 13, 2015 were not just for the cameras. After weeks of gruelling high-level negotiations in Paris a breakthrough had finally been achieved. Against all expectations, after decades of false starts and failures, the international community had finally agreed to do what it took to limit global warming to well below 2°C, preferably to

It has been estimated that BECCS would demand between 0.4 and 1.2 billion hectares of land. That's 25% to 80% of all the land currently under cultivation. How will that be achieved at the same time as feeding 8-10 billion people around the middle of the century or without destroying native vegetation and biodiversity?

1.5°C, compared to pre-industrial levels. The Paris Agreement was a stunning victory for those most at risk from climate change.

Rich industrialised nations will be increasingly impacted as global temperatures rise. But it's the low lying island states such as the Maldives and the Marshall Islands that are at imminent existential risk. As a later UN special report made clear, if the Paris Agreement was unable to limit global warming to 1.5°C, the number of lives lost to more intense storms, fires, heatwaves, famines and floods would significantly increase.

But dig a little deeper and you could find another emotion lurking within delegates on December 13. Doubt.

We struggle to name any climate scientist who at that time thought the Paris Agreement was feasible. We have since been told by some scientists that the Paris Agreement was "of course important for climate justice but unworkable" and "a complete shock, no one thought limiting to 1.5°C was possible". Rather than being able to limit warming to 1.5°C, a senior academic involved in the IPCC concluded we were heading beyond 3°C by the end of this century.

Instead of confront our doubts, we scientists decided to construct ever more elaborate fantasy worlds in which we would be safe. The price to pay for our cowardice: having to keep our mouths shut about the ever growing absurdity of the required planetary-scale carbon dioxide removal.

Taking centre stage was BECCS because at the time this was the only way climate-economic models could find scenarios that would be consistent with the Paris Agreement. Rather than stabilise, global emissions of carbon dioxide had increased some 60% since 1992.

Alas, BECCS, just like all the previous solutions, was too good to be true.

Across the scenarios produced by the Intergovernmental Panel on Climate Change (IPCC) with a 66% or better chance of limiting temperature increase to 1.5°C, BECCS would need to remove 12 billion tonnes of carbon dioxide each year. BECCS at this scale would require massive planting schemes for trees and bioenergy crops.

The Earth certainly needs more trees. Humanity has cut down some three trillion since we first started farming some 13,000 years ago. But rather than allow ecosystems to recover from human impacts and forests to regrow, BECCS generally refers to dedicated industrial-scale plantations

Forests near Ogunquit, Maine (USA).
Photo credit: Carol M. Highsmith's America, Library of Congress collection.

regularly harvested for bioenergy rather than carbon stored away in forest trunks, roots and soils.

Currently, the two most efficient biofuels are sugarcane for bioethanol and palm oil for biodiesel – both grown in the tropics. Endless rows of such fast growing monoculture trees or other bioenergy crops harvested at frequent intervals devastate biodiversity.

It has been estimated that BECCS would demand between 0.4 and 1.2 billion hectares of land. That's 25% to 80% of all the land currently under cultivation. How will that be achieved at the same time as feeding 8-10 billion people around the middle of the century or without destroying native vegetation and biodiversity?

Growing billions of trees would consume vast amounts of water – in some places where people are already thirsty. Increasing forest cover in higher latitudes can have an overall warming effect because replacing grassland or fields with forests means the land surface becomes darker. This darker land absorbs more energy from the Sun and so temperatures rise. Focusing on developing vast plantations in poorer tropical nations comes with real risks of people being driven off their lands.

And it is often forgotten that trees and the land in general already soak up and store away vast amounts of carbon through what is called the natural terrestrial carbon sink. Interfering with it could both disrupt the sink and lead to double accounting.

As these impacts are becoming better understood, the sense of optimism around BECCS has diminished.

Pipe dreams

Given the dawning realisation of how difficult Paris would be in the light of ever rising emissions and limited potential of BECCS, a new buzzword emerged in policy circles: the "overshoot scenario". Temperatures would be allowed to go beyond 1.5°C in the near term, but then be brought down with a range of carbon dioxide removal by the end of the century. This means that net zero actually means carbon negative. Within a few decades, we will need to transform our civilisation from one that currently pumps out 40 billion tons of carbon dioxide into the atmosphere each year, to one that produces a net removal of tens of billions.

Mass tree planting, for bioenergy or as an attempt at offsetting, had been the latest attempt to stall cuts in fossil fuel use. But the ever-increasing need for carbon removal was calling for more. This is why the idea of direct air capture, now being touted by some as the most promising technology out there, has taken hold. It is generally more benign to ecosystems because it requires significantly less land to operate than BECCS, including the land needed to power them using wind or solar panels.

Unfortunately, it is widely believed that direct air capture, because of its exorbitant costs and energy demand, if it ever becomes feasible to be deployed at

scale, will not be able to compete with BECCS with its voracious appetite for prime agricultural land.

It should now be getting clear where the journey is heading. As the mirage of each magical technical solution disappears, another equally unworkable alternative pops up to take its place. The next is already on the horizon – and it's even more ghastly. Once we realise net zero will not happen in time or even at all, geoengineering – the deliberate and large scale intervention in the Earth's climate system – will probably be invoked as the solution to limit temperature increases.

One of the most researched geoengineering ideas is solar radiation management – the injection of millions of tons of sulphuric acid into the stratosphere that will reflect some of the Sun's energy away from the Earth. It is a wild idea, but some academics and politicians are deadly serious, despite significant risks.

The US National Academies of Sciences, for example, has recommended allocating up to US$200 million over the next five years to explore how geoengineering could be deployed and regulated. Funding and research in this area is sure to significantly increase.

Difficult truths

In principle there is nothing wrong or dangerous about carbon dioxide removal proposals. In fact developing ways of reducing concentrations of carbon dioxide can feel tremendously exciting.

You are using science and engineering to save humanity from disaster.

What you are doing is important. There is also the realisation that carbon removal will be needed to mop up some of the emissions from sectors such as aviation and cement production. So there will be some small role for a number of different carbon dioxide removal approaches.

The problems come when it is assumed that these can be deployed at vast scale. This effectively serves as a blank cheque for the continued burning of fossil fuels and the acceleration of habitat destruction.

Carbon reduction technologies and geoengineering should be seen as a sort of ejector seat that could propel humanity away from rapid and catastrophic environmental change. Just like an ejector seat in a jet aircraft, it should only be used as the very last resort. However, policymakers and businesses appear to be entirely serious about deploying highly speculative technologies as a way to land our civilisation at a sustainable destination. In fact, these are no more than fairy tales.

The only way to keep humanity safe is the immediate and sustained radical cuts to greenhouse gas emissions in a socially just way.

Academics typically see themselves as servants to society. Indeed, many are employed as civil servants. Those working at the climate science and policy interface desperately wrestle with an increasingly difficult problem. Similarly, those that champion net zero as a way of breaking through barriers holding back effective action on the climate also work with the very best of intentions.

The tragedy is that their collective efforts were never able to mount an effective challenge to a climate policy process that would only allow a narrow range of scenarios to be explored.

Most academics feel distinctly uncomfortable stepping over the invisible line that separates their day job from wider social and political concerns.

There are genuine fears that being seen as advocates for or against particular issues could threaten their perceived independence.

Carbon reduction technologies and geoengineering should be seen as a sort of ejector seat that could propel humanity away from rapid and catastrophic environmental change. Just like an ejector seat in a jet aircraft, it should only be used as the very last resort.

Protester with a sign that reads "There is no Planet B" at a rally against climate change. Photo credit: Ivan Radic

Scientists are one of the most trusted professions. Trust is very hard to build and easy to destroy.

But there is another invisible line, the one that separates maintaining academic integrity and self-censorship. As scientists, we are taught to be sceptical, to subject hypotheses to rigorous tests and interrogation. But when it comes to perhaps the greatest challenge humanity faces, we often show a dangerous lack of critical analysis.

In private, scientists express significant scepticism about the Paris Agreement, BECCS, offsetting, geoengineering and net zero. Apart from some notable exceptions, in public we quietly go about our work, apply for funding, publish papers and teach.

The path to disastrous climate change is paved with feasibility studies and impact assessments.

Rather than acknowledge the seriousness of our situation, we instead continue to participate in the fantasy of net zero. What will we do when reality bites? What will we say to our friends and loved ones about our failure to speak out now?

The time has come to voice our fears and be honest with wider society. Current net zero policies will not keep warming to within 1.5°C because they were never intended to.

They were and still are driven by a need to protect business as usual, not the climate. If we want to keep people safe then large and sustained cuts to carbon emissions need to happen now.

That is the very simple acid test that must be applied to all climate policies. The time for wishful thinking is over.

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Five things to know about briquettes and sustainable bioenergy in Africa

DEANNA RAMSAY and MARY NJENGA
Forest News

The majority of people in Africa depend on wood for cooking and heating energy due to its affordability, accessibility and versatility for meeting people's needs. But while it offers a low cost means for cooking, heating homes and powering industrial activities, a sizable proportion of it is obtained unsustainably, leading to deforestation and land degradation. Moreover, wood is often burned in inefficient appliances, causing emissions that have negative health and environmental impacts.

Fuel briquettes could help alleviate these challenges.

With wood-dependent populations growing in the region, while access to wood declines, briquettes offer a practical solution to supplement the use of wood as fuel. They are produced by compressing biomass residues like charcoal dust, sawdust, other wood remnants or agricultural byproducts into a solid unit that is used like charcoal or firewood.

If the base materials do not hold together well, a binding substance such as soil, clay or starch is added. For use in the home, briquettes made from carbonized biomass are preferred, while non-carbonized briquettes are mostly used for industrial purposes.

Briquettes are more sustainable and more energy-efficient and could reduce the pressure on forests and lower pollution levels in urban areas, that is, if more people start using them. For example, in Nairobi's informal settlement of Kibera, one of Africa's largest slums, research found that use of slow burning charcoal dust and soil briquettes reduced household cooking energy expenditure by 70 percent if families produced their own, and 30 percent if they purchased briquettes from other sources.

Following a recent webinar on briquettes organized by *The Charcoal Project*, here are five takeaways on this emerging fuel that could make a major impact.

1) Briquettes offer an opportunity for small enterprises

The production and sale of briquettes offers major income opportunities for entrepreneurs and participants in the supply chain. There is huge potential in the cooking and heating fuel market in Africa, and it is not difficult to establish a briquette production operation. In addition, the competition is fragmented and there are no major, branded briquette businesses that have cornered the market, said Sylvia Herzog, director of The Charcoal Project, a nonprofit focused on sustainable biomass solutions.

The small businesses in Kenya and Uganda that have ventured into the market are focusing on the various energy needs of chicken hatcheries, rural households, tourist camps and restaurants, and the lower and middle classes in urban areas. For example, Kenya's Eversave Briquettes produces 10 tonnes a month of charcoal briquettes made from charcoal dust collected from trading sites mixed with gum arabic. When charcoal dust is in short supply, they make it from carbonized macadamia nut shells. Selling for 25 to 30 KES (USD 0.25-0.30) per kg, the woman-led enterprise has a 20 to 30 percent profit margin. Nairobi-based company Chardust salvages charcoal dust from the city's charcoal traders, producing briquettes of various shapes and sizes for different purposes, selling roughly 200 tonnes a month to local markets. Many examples like this exist in sub-Saharan Africa. But there is room for many more opportunities.

2) Briquettes can help re-purpose waste

Briquettes fit nicely into circular bioeconomy approaches that aim to reduce waste and spur more sustainable bioresources and market-based practices, while sustaining rural-urban linkages.

The Circular Bioeconomy Transformative Partnership Platform of the Center for International Forestry Research (CIFOR) and World Agroforestry (ICRAF) is working on the subject in relation to forests and the wood use. A circular bioeconomy approach is also being implemented in the refugee context in Africa by ICRAF and partner, supported by the Federal Ministry for Economic Cooperation and Development (BMZ) and the CGIAR Water, Land and Ecosystems research program (WLE).

In Cameroon, CIFOR supports Kemit Ecology, a start-up enterprise that transforms household waste such as plantain peels and maize leaves into ecological briquettes, contributing to urban

Charcoal.
Photo credit: Moerschy

waste management in the city of Douala.

3) Briquettes offer multiple ecological benefits

The use of briquettes also has the potential to preserve forests. In long-term studies undertaken at Kenya's Kasigau Corridor, a conservation dryland landscape of about 200,000 ha, research led by Wildlife Works in collaboration with the National Museums of Kenya and ICRAF is showing that tree regeneration could occur alongside biodiversity protection and charcoal briquette production from tree prunings in the area, since using prunings eliminates the need to cut down trees. Communities along the corridor are developing similar briquette and conservation enterprises, including EcoCharcoal, which works with The Charcoal Project.

The techniques used in the natural regeneration of vegetation and improved carbonization processes are also being applied in many areas under CIFOR-ICRAF's Governing Multifunctional Landscapes project, which works in Kenya, Zambia, Cameroon and the Democratic Republic of Congo and is funded by the European Union. Kings Biofuels in Kenya produces over 200 tonnes of sawdust briquettes per month and has an agreement with the Kenya Tea Development Authority (KTDA). This innovation could save millions of trees, as firewood is used as heat to dry tea. The non-carbonized briquettes produced by Kings Biofuels are used in other industries such paint and carton production.

4) Briquette production can be profitable

Briquette making requires machinery, which is easy to obtain but is costly. But once the business is established, there is profit to be made. According to Matthew Owen of Chardust, using pre-carbonized waste helps save, as carbonizing is costly. He noted that there is great business promise with a focus on quality (by sieving and sorting for maximum purity) and targeted, niche marketing.

On the flip side, if people with little income are used to collecting free wood, there is little incentive to pay for briquettes. However, firewood resources are dwindling and becoming harder to access, and rural households are increasingly starting to pay for fuel. In a recent national survey in Kenya, 42 percent of rural households were found to use charcoal for fuel compared to 34 percent in 2002, indicating that a shift has occurred, which could signal potential for another shift to briquettes.

5) Public awareness of the advantages of briquettes is vital

A solution to many of the challenges facing briquettes entering the market and becoming mainstream is in education, for consumers, for those wanting to enter into business and for institutions or investors looking to finance cleaner energy work.

Dorothy Auwor Otieno of Kenya's Nyalore Impact noted that behavior change takes time, and that health or environmental arguments for replacing wood and charcoal with briquettes would not convince the communities she works with to switch. Multiple factors including personal preferences affect people's choices, so getting briquettes into household kitchens could take a bit more time. But growing urbanization leads to growing demand for biomass energy. With more businesses in the briquette marketplace that are supported with effective value chains, alongside education and effective communication, this cleaner energy option has the potential to improve human wellbeing and create more sustainable environments – where people need it the most.

It is important to note that a complete switch to briquettes in the near future may not be a feasible goal, as raw materials are limited. However a substantial reduction in the consumption of firewood, charcoal and kerosene for domestic use and furnace oil in industries, and the use of electricity and charcoal in keeping chicks warm in chicken hatcheries, which are a big buyer of charcoal, would go a long way to improving both human wellbeing and the environment.

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Particulate matters

Numerous studies link air pollution from motor vehicles with neurological dysfunctions such as cognitive deficits, autism, and Alzheimer's disease. This research is relatively new and has not yet reached a scientific consensus. But these studies are published in respected scientific journals, and each article contains specific insights into brain dysfunction linked with traffic.

LENORE HITCHLER
ONE

Who wants to be afflicted with persistent anxiety or depression? Or neurological dysfunctions such as cognitive deficits, autism, and Alzheimer's disease? Numerous studies link air pollution from motor vehicles with these disorders. This research is relatively new and has not yet reached a scientific consensus. These studies are published in respected scientific journals, and each article contains specific insights into brain dysfunction linked with traffic.

Motor vehicle-based pollution is quite pervasive. According to a 2014 publication from the US Environmental Protection Agency, 45 million Americans live, work, or attend school within 300 feet of a major road. "Examples of directly emitted pollutants include particulate matter (PM), carbon monoxide (CO), oxides of nitrogen, and benzene, though hundreds of chemicals are emitted by motor vehicles. Motor vehicles also emit compounds that lead to the formation of other pollutants in the atmosphere, such as nitrogen dioxide (NO2), which is found in elevated concentrations near major roads, and ozone (O3), which forms further downwind."

One of the most damaging consequences of motor vehicles is the generation of particulate matter such as PM2.5. These particles are exceedingly tiny and measure only 2.5 micrometers in size. Several thousand of them could fit on the period at the end of this sentence. These particles are too small to be filtered out in the nose. Therefore, they can either travel to the lungs and be circulated to the brain, or they can travel directly through the nose into the brain. Researchers have only studied neurological dysfunction from relatively close distances to roadways. However, damage from air pollution is most

Beijing traffic and pollution (China).
Photo credit: The Erica Chang

likely present in control groups as they are likely to also have been exposed to air pollutants. According to the United Nations Environment Programme, air pollutants can travel thousands of kilometers.

Particulate matter is correlated with **anxiety**. "The Relation Between Past Exposure to Fine Particulate Air Pollution and Prevalent Anxiety: Observational Cohort Study" was published in the *British Medical Journal*. It reported that "Anxiety disorders, characterized by disruptive fear, worry, and related behavioral disturbances such as avoidance or physical sensations of hyperarousal, are the most common type of psychiatric disorder in the general population. Globally approximately 16% of people will have an anxiety disorder in their lifetime. … In 2010, anxiety disorders accounted for approximately 26.8 million disability adjusted life years worldwide." This study found an association between exposure to PM2.5 and anxiety.

Besides particulate matter being linked with anxiety, abnormally high levels of carbon dioxide (CO2) are also air pollutants and are linked with anxiety. "Behavioral and Cardiovascular Effects of 7.5% CO2 in Human Volunteers" was published in *Depression and Anxiety.* Healthy participants who did not have anxiety disorders breathed in air containing 7.5% CO2, and they felt threatened, anxious, tense, and fearful.

Depression is another mental illness correlated with air pollution. "Association of Ambient Air Pollution with Depressive and Anxiety Symptoms in Older Adults: Results from the NSHAP Study" was published in *Environmental Health Perspectives*. The article stated "PM2.5 exposures may harm mental health through increased neuroinflammation, oxidative stress, cerebro-vascular damage and neurodegeneration. … PM2.5 may also harm mental health by increasing markers of glucocorticoid activity and levels of the stress hormone cortisol." In this study PM2.5 was associated with both anxiety and depression.

Increased emergency room visits because of depression are correlated with higher amounts of particulate matter as shown in "Air pollution: A Systematic Review of its Psychological, Economic, and Social Effects" published in *ScienceDirect.*

Particulate matter is also linked with **obsessive-compulsive disorders** as shown in "The Association Between Anxiety, Traumatic Stress, and Obsessive-Compulsive Disorders and Chronic Inflammation: A Systematic Review and Meta-Analysis" published in *Depression and Anxiety*. Exposure to air pollution is associated with brain inflammation and the article reported "Inflammation is increasingly implicated as a cofactor in the pathophysiological processes underlying psychiatric disorders." The analysis of 41 studies led to the conclusion that people with anxiety disorders, PTSD, or obsessive-compulsive disorders have a significantly higher level of pro-inflammatory markers. One study found that "individuals with agoraphobia also demonstrated significantly higher levels of CRP [c-reactive protein]."

Just as some cases of anxiety are linked with air pollution from fossil fuels, so is **autism**. "Particulate Matter Exposure, Prenatal and Postnatal Windows of Susceptibility, and Autism Spectrum Disorders" was published in *Epidemiology*. It stated "We found that exposure to PM10 during the third-trimester of pregnancy was associated with increased risk of autism. … Components of traffic pollution cause a systemic inflammatory response. … Evidence suggests that proper brain network development depends on close co-ordination with the immune system, so that disruption in the immune system could affect brain development."

Another study correlating autism and air pollution is "Traffic-Related Air Pollution, Particulate Matter, and Autism" published in *JAMA Psychiatry*. During the first year of life, "Children residing in homes with the highest levels of modeled traffic-related air pollution were three times as likely to have autism compared with children residing in homes with the lowest levels of exposure. … Data examining biomarkers suggest that oxidative stress and inflammation may also be involved in the pathogenesis of autism."

Further corroboration comes from "Autism Spectrum Disorder and Particulate Matter Air Pollution Before, During, and After Pregnancy: A Nested Case-Control Analysis Within the Nurse's Health Study II Cohort" published in *Environmental Health Perspectives*. The article reported that "It was estimated there were 50% higher odds of having a child with an ASD [Autism Spectrum Disorder] in women in the highest quartile of estimated PM2.5 exposure throughout pregnancy. … In one study, increased mitochondrial DNA damage, possibly caused by reactive oxygen species, was found to be more common in 67 children with ASD than in 36 typically developing children."

Besides air pollution being linked with autism, it is also connected with other neurological difficulties. *The George Mason University Center for Climate Change Communication* published "The Link Between Fossil Fuels and Neurological Harm." The authors reported "According to the US Department of Energy, over the past 20 years, three-fourths of human-caused emissions were produced from burning fossil fuels. … In 2016, Environmental Health Perspectives published a joint public statement issued by 14 scientific or medical associations and 50 scientists representing the disciplines of pediatrics, toxicology, public health, and neurobiology. The Project TENDR (Targeting Environmental Neurodevelopmental risks) Consensus Statement noted evidence of danger to children in the United States due to air pollution, listing fossil fuel-related air pollutants (including particulate matter, PAHS, [polycyclic aromatic hydrocarbons] and nitrogen dioxide) as prime examples of toxic chemicals that can contribute to learning, behavioral, or intellectual impairment, as well as specific neurodevelopmental disorders such as ADHD [attention deficit hyperactivity disorder] or autism."

This article referenced additional studies on air pollution and cognition. "A longitudinal study of mothers and children in New York City's North Harlem produced some of the earliest evidence linking PAH exposure in pregnant women to cognitive defects and behavioral disorders in their children at ages three and five. Three-year-olds exposed prenatally to high levels of PAHs exhibited lower mental development scores on standardized tests and a higher risk for cognitive delays. At age five, they per-

Ratchadamri Road traffic in Bangkok (Thailand).
Photo credit: Kallerna

formed lower on IQ tests than children with lower exposure rates. As these children grew older, they continued to exhibit adverse neurological impacts – including anxiety, depression and hyperactivity – compared to children less exposed before birth to PAHs. … A 2018 study published in *Biological Psychiatry* found that children exposed in utero exhibited a thinner outer layer of the brain (the cortex) at ages six to ten years. These abnormalities were associated with impaired impulse control."

This article provided still further evidence correlating air pollution and neurological dysfunction. "In a study of 262 children ages 8 to 12, higher exposure to urban traffic pollution was linked to slower brain maturation. … Four studies investigating prenatal exposure to PAHs found links to delayed verbal, psychomotor and/or general development in children. … A 2014 cross-sectional study in the U.S. found an association between postnatal exposure to PAHs and special education needs in boys."

Cognition is also impaired by excessive amounts of CO2. The article "Is CO2 an Indoor Pollutant? Direct Effects of Low-to-Moderate CO2 Concentrations on Human Decision-Making Performance" was published in *Environmental Health Perspectives*. It states "outdoor levels in urban areas as high as 500 ppm have been reported. Concentrations of CO2 inside buildings range from outdoor levels up to several thousand parts per million. … In surveys of elementary school classrooms in California and Texas, average CO2 concentrations were >1,000 ppm, a substantial proportion exceed 2,000 ppm, and in 21% of Texas classrooms peak CO2 concentrations exceed 3,000 ppm. … At 1,000 ppm CO2, compared with 600 ppm, performance was significantly diminished on six of nine metrics of decision-making performance." CO2 is the key regulator of "arousal of behavioral states" which suggests a way in which CO2 affects the brain.

The following two articles also correlate carbon dioxide and cognitive difficulties. "Fossil Fuel Combustion is Driving Indoor CO2 Toward Levels Harmful to Human Cognition" was published in

GeoHealth. The authors state that "Studies focusing on school environments have found impacts of CO2 on standardized test scores, and attendance, and significant deterioration of attention, vigilance, memory, and concentration when CO2 levels are elevated." *Environmental Health Perspectives* published "Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments." The study only lasted six days and not all days were high CO2 days, and nonetheless it found "For seven of the nine cognitive function domains, average cognitive scores decreased at each higher level of CO2."

Air pollution also damages cognition. "The Impact of Exposure to Air Pollution on Cognitive Performance" was published in *PNAS*. The authors stated that "long-term exposure to air pollution impeded cognitive performance in verbal and math tests." *Environmental Health Perspectives* published "Prenatal and Childhood Traffic-Related Pollution Exposure and Childhood Cognition in the Project Viva Cohort." In Krakow, Poland, exposure in late pregnancy to PAHs was linked with poorer nonverbal reasoning at 5 years. "In a recent meta-analysis of European birth cohorts, prenatal exposure to ambient air pollution was associated with lower psycho-motor development in children 1-6 years of age."

The study itself found **children** living <50 meters away from a major roadway had lower nonverbal IQs, and somewhat lower verbal IQs and visual motor abilities.

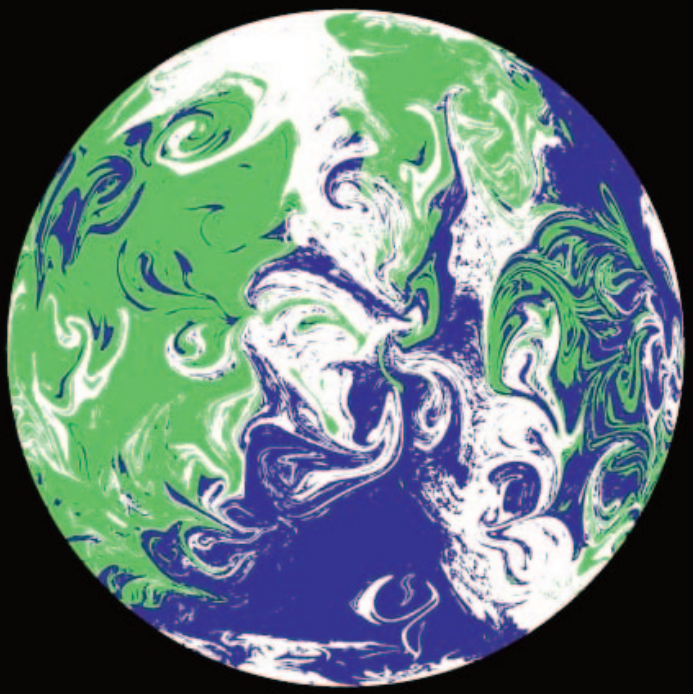
Particulate matter also appears damaging to **the elderly** brain as shown in "Fine Particulate Matter Air Pollution and Cognitive Function Among Older US Adults" published in the *American Journal of Epidemiology.* The authors reported that "Older adults living in areas with higher PM2.5 concentrations had worse cognitive function." *Translational Psychiatry* published "Particulate Air Pollutants, APOE Alleles and Their Contributions to Cognitive Impairment in Older Women and to Amyloidogenesis in Experimental Models." Living where the PM exceeded EPA standards increased the risk for global cognitive decline by 81% and 92% for all-cause dementia.

The following studies also show the connection of air pollution and **dementia**. The *Lancet* published "Living Near Major Roads and the Incidence of Dementia, Parkinson's Disease, and Multiple Sclerosis: A Population-Based Cohort Study," The report found "Living close to heavy traffic was associated with a higher incidence of dementia. Ultrafine particles have been found in the olfactory bulb and the frontal critical areas in the brains of highly exposed people to traffic." *The British Medical Journal* published "Are Noise and Air Pollution Related to the Incidence of Dementia? A Cohort Study in London, England." This study found that PM2.5 increased Alzheimer's rates.

Extreme air pollution is correlated with brain damage similar to **Alzheimer**'s. "Hallmarks of Alzheimer Disease Are Evolving Relentlessly in Metropolitan Mexico City Infants Children and Young Adults" published in *Environmental Research.* Autopsies of children showed the same type of damage as found in Alzheimer's.

Alzheimer's is one cause of dementia, and according to the Alzheimer's Association, more than six million Americans have Alzheimer's, one in three seniors die with Alzheimer's or another dementia, and in 2021, these diseases will cost $355 billion. Inflammation is a factor in Alzheimer's.

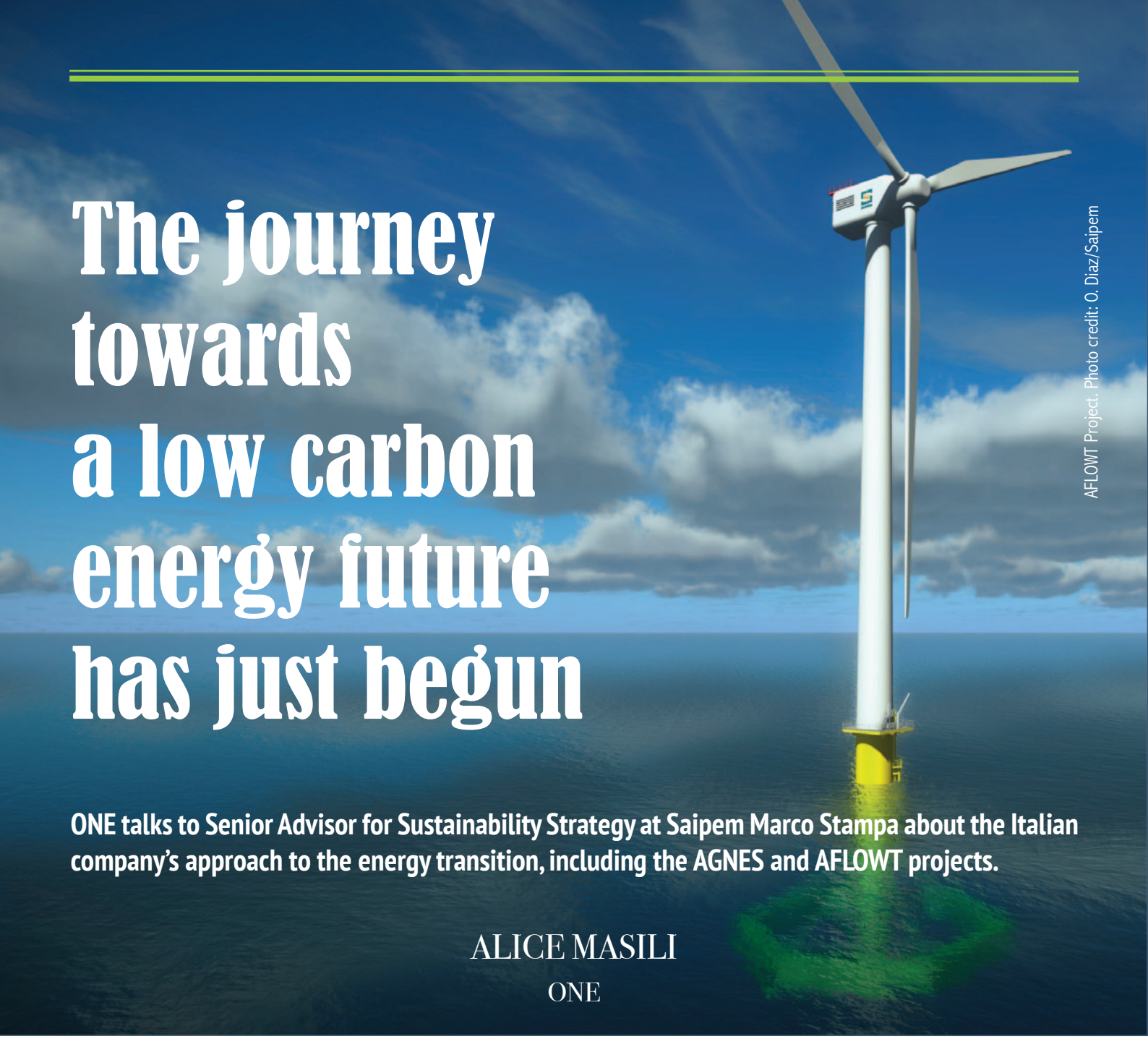
"Ozone, Particulate Matter, and Newly Diagnosed Alzheimer's Disease: A Population-Based Cohort Study in Taiwan" was published in the *Journal of Alzheimer's Disease.* Autopsy studies show "exposure to severe air pollution is associated with brain inflammation and depositions of amyloid-B 42 peptides—the key characteristic of AD [Alzheimer's Disease] in the frontal cortex and hippocampus. … Cytokines derived from systemic inflammation may also cross the blood-brain barrier and lead to active microglia. Microglial activation is an early event in the process of AD. … [particulates] "may directly enter the brain through the olfactory bulb and reach the cerebral cortex, hippocampus, cerebellum and brainstem." Exposure to ozone may lead to oxidative stress which can lead to memory loss. The researchers found a 211% risk of increase of AD per increase of 10.91 ppb of ozone and a 138% risk of increase of AD per increase of 4.4 u.g/m3 of PM2.5. Thus, air pollution from burning fossil fuels in motor vehicles is linked with many instances of brain dysfunction. Of course, not all air pollution is produced by burning fossil fuels. Nor is every case of anxiety, cognitive dysfunction, autism, or Alzheimer's caused by air pollution. However, also these disabilities will benefit from lowering air pollution. More than expected. ONE



UN CLIMATE CHANGE CONFERENCE UK 2021

IN PARTNERSHIP WITH ITALY

The journey towards a low carbon energy future has just begun



AFLOWT Project. Photo credit: O. Diaz/Saipem

ONE talks to Senior Advisor for Sustainability Strategy at Saipem Marco Stampa about the Italian company's approach to the energy transition, including the AGNES and AFLOWT projects.

ALICE MASILI
ONE

ONE: The energy transition faces challenges ranging from decarbonisation to digitalisation. How does Saipem see itself in this process?
Marco Stampa: Saipem's strategy is to embrace the opportunities created by the energy transition. We are proud to be playing a substantial role in this process, having decided to focus on our engineering and innovation strengths in renewable energies. We have decided to support the energy transition process by building on our competencies, innovative technologies, asset configuration, and the transparent way in which we communicate our role in tackling climate change to our stakeholders.

Carbon neutrality is a global goal. Which are your main projects related to it?
We want to be part of the development towards a low carbon world and be active players. In this respect, technological innovation, one of Saipem's strategic pillars, is key to driving the company towards fully decarbonised energies more quickly. We are co-developing the AGNES project in the north Adriatic Sea, off the coast of Ravenna, which will become a reality soon. We are installing a complex integrated system of wind turbines and solar panels, whose energy will be partially used to produce green hydrogen through electrolysis. Italy and many other countries have committed to become carbon neutral and use more renewable energy. We bring to the table this type of solution.

What are the proportions of oil-related and renewables-related projects in your current portfolio?
We have a long tradition as a contractor in the oil and gas services sector. But we aim to play a decisive role in the energy transition, including the development of natural gas projects and providing hi-tech solutions to

develop renewable energies. That's why we have pursued a non-oil strategy, and to date, more than 70% of the company's current backlog is non-oil related. We are focused on both blue and green hydrogen production technologies. We are also developing a specific floating offshore wind technology: Hexaflot. The testing of the first full-scale prototype is currently underway off the coast of Ireland for a project called "AFLOWT" (Accelerating market uptake of floating offshore wind technology), supervised by EMEC - The European Marine Energy Center. The project has a value of 31 million euros, partly funded by the European Union. Floating offshore wind is becoming an increasingly important new renewable energy sector. It gives us the possibility to increase the generation of renewable energy in mature markets, like Northern Europe, and in areas where the environmental conditions did not favour wind energy development. Due to the extended distance from the coast, such technology also has less impact on the landscape, fishing and tourism.

You purchased a new CO2 capture technology from the Canadian company CO2 Solutions Inc (CSI): can you tell us why it is so innovative and what are your expectations?
CSI is a leading innovator in enzyme-enabled carbon capture, and its technology lowers the cost barrier to post-combustion Carbon Capture enabling Sequestration and Utilisation (CCUS), making the industry able to derive profitable new products. The assets and technology purchased will help us expand our green products portfolio and underpin our journey towards a low carbon energy future. Also, the agreement we have signed with Snam is consistent with the decarbonisation process that we are both committed to pursuing in all our activities. This agreement aims to define and develop green hydrogen production and transport initiatives and carbon dioxide capture, transport and reuse or storage (CCS and CCU). We already started working together on new energy transition technologies, from green hydrogen to capturing and reusing CO2. We are focusing on developing the technology of water electrolysis. This process makes it possible to reduce CO2 emissions to zero in the production of green hydrogen, thus creating a powerful and effective tool in fighting climate change.

The energy efficiency concept is gaining traction. Is Saipem entering that area too?
Yes, absolutely. The concept of energy efficiency is crucial to us. Energy efficiency initiatives are embedded in Saipem's portfolio, both regarding the construction of new plants with state of the art and innovative solutions to optimize efficiency, and the retrofitting of existing plants to reduce waste and energy consumption. It is a must in every operation of the company.

Marco Stampa is Senior Advisor for Sustainability Strategy at Saipem.
He began to work at the Italian National Research Council and since 1992 in Eni with various roles in the Environment & Safety units.
After an experience in the Kashagan Project as Strategic Impact Assessment project manager, since 2002 he has been CSR/Stakeholder Relations manager to join Saipem in 2008 as Corporate Sustainability Manager.
Often teacher and speaker at many academy and training courses and webinars, he is also a member of CSR Manager Network Board of Directors and the Scientific Committee, Center for Sustainability at Fondazione Cà Foscari, University of Venice.

On the other side, we are continuing to improve our overall energy efficiency and to reduce emissions from our assets. In 2018, we established a 4-year Group Strategic Plan for greenhouse gas reduction, identifying three pillars to guide our decarbonisation efforts: greater energy efficiency in all internal operations, the CO2 value chain management and specific gas emissions reduction activities. This program has been recently re-defined launching a "Four-year Strategic Plan" to reduce greenhouse gas emissions from our own assets and operations. We estimate a comprehensive reduction of 26.7kt of CO2 in the 2020 timeframe. In addition, following Paris Agreement prescriptions, Saipem is targeting a 50% reduction for Scope 1 and Scope 2 emissions by 2035 and, in particular, to achieve Net Zero by 2025 for Scope 2.

The Sustainable Development Goals strongly recommend that creating pure economic value cannot be the only goal for a modern company. How will Saipem convince investors that tackling climate change should be part of their business?
Sustainability for Saipem is no longer just a commitment or a choice of social responsibility. It is the new frontier of competitive growth. The fight against climate change is universally recognised as paramount to sustainable development. The Covid-19 pandemic's local origin and global consequences remind us of this principle to be committed to environmental protection and fight to mitigate climate change. Saipem, in adhering to United Nations Global Compact, has made the Sustainable development goals a distinctive feature of its work - promoting best practices among its partners and investing in innovation to offer a technological platform for a sustainable business vision. ONE

6 ways to create jobs and solve climate change through nature-based infrastructure

RYAN RICHARDS and JENNY ROWLAND-SHEA

American Progress

President Joe Biden's American Jobs Plan outlines a strategy for economic recovery that pairs good jobs with a commitment to bold climate action. The proposal ensures that every dollar spent on rebuilding the nation's infrastructure will "prevent, reduce, and withstand the impacts of the climate crisis"—that each investment made contributes to a low-carbon future. But while this plan is bold for many sectors of the economy, it understates the value of investments in nature and agriculture as critical pieces of infrastructure, job creators, and climate solutions.

These nature-based solutions offer cost-effective, creative, and durable responses to climate change, while also providing opportunities for rural communities and landowners to benefit from climate investments. The American Jobs Plan proposes the creation of a Civilian Climate Corps, investments in cleaning up abandoned mines and orphaned wells, and restoration in key regions of the country—all of which are commendable. Yet the country cannot meet its commitment to cutting greenhouse gas emissions by at least 50 percent by 2030 without tapping the potential gains that come from protecting and stewarding U.S. natural and working lands.

Furthermore, the latest jobs report showed that while the new administration has seen more than half a million Americans, on average, get back to work each month, labor force participation is recovering even faster. People want to work, and Congress should be open to additional investments that allow them to do just that. The Center for American Progress has found that major investments in protection and restoration of natural resources have the ability to create more than 700,000 jobs—and the potential to grow the nation's natural carbon sink. Investments in climate-smart agriculture, meanwhile, can play a starring role in driving billions of dollars into rural communities. The administration's recently released America the Beautiful campaign and its goal to conserve 30 percent of U.S. lands, waters, and ocean by 2030 also call for job creation by investing in restoration and resilience.

As attention turns to Congress and legislators begin to assemble their next package, this column outlines six ways that the United States can go big on conservation and agriculture infrastructure to create jobs and solve climate change.

1. Boost spending to conserve and restore private lands

Growing the country's natural carbon sink—especially on private lands—is low-hanging fruit when it comes to climate action. U.S. Department of Agriculture (USDA) conservation programs already play a key role in supporting stewar-

Zion-Mount Carmel Tunnel, Zion National Park, Utah.
Photo credit: Ken Lund

dship. For instance, the Conservation Stewardship Program, Environmental Quality Incentives Program, and Regional Conservation Partnership Program all help landowners restore habitat for water and wildlife and manage land to better store carbon and reduce greenhouse gas emissions. Likewise, the Conservation Reserve Program, Forest Legacy Program, and Agricultural Conservation Easement Program protect vulnerable lands from development.

All of these programs are perennially oversubscribed, meaning there is significant unmet demand. And new research finds that, as a result, there are major climate benefits that are currently left on the table. For example, ecologically appropriate reforestation is possible on more than 100 million acres of private forest land, especially in the eastern United States. Investments in smart, environmentally sound reforestation on these lands could sequester hundreds of millions of tons of carbon.

USDA conservation programs deserve a major boost of funding, at the very least doubling to meet demand and turn the potential climate benefits of agricultural lands into reality. But Congress should also take this opportunity to create other avenues to support conservation and restoration on private lands, such as tax incentives for restoration and new easement options to keep private forests standing. Conservation and stewardship of private lands should be a high priority—for supporting rural communities, sequestering carbon, and safeguarding the nation's wildlife.

2. Invest in restoring U.S. public lands

Millions of acres of forests and other habitats on national public lands are in need of restoration. The footprint of past decisions to log, build roads, and stifle normal fire patterns have left the country with ecosystems that are out of sync with their historical condition. And for years, agencies such as the U.S. Forest Service have had to play catch up, shifting staff toward wildfire response ahead of other priorities.

While the 2018 wildfire funding fix helped manage the growing cost of fighting wildfire, agencies need support to complete work that has been put off for too long. Investments in restoration—through prescribed fire, stream restoration, and the removal of unneeded roads—would improve wildlife habitat, protect drinking water, and reduce the likelihood of catastrophic wildfire. These types of investments also help ecosystems store more carbon and stay resilient to a changing climate.

Press conference to support a bill to protect the Arctic Refuge in 2019. Washington, DC (USA).
Photo credit: Deb Haaland

The American Jobs Plan cites these types of investments as a clear opportunity to create good-paying jobs, calling out a model of grant funding laid out in Sen. Michael Bennet's (D-CO) Outdoor Restoration Force Act. But the scale of need on the ground calls for greater ambition. The Outdoor Restoration Partnership Act—a more recent version of Sen. Bennet's legislation that has received bipartisan support—does just that, making more than $60 billion in funding available for restoration projects that help states, tribes, and federal agencies create more than 2 million jobs.

3. Protect the Arctic Refuge

In December 2017, the Tax Cuts and Jobs Act opened the coastal plain of the Arctic National Wildlife Refuge to drilling despite the climate and conservation consequences. Then, in January 2021, the U.S. Bureau of Land Management held a lease sale in the area, which returned only $14 million in bids but leased more than 500,000 acres to the oil industry. In his first days in office, President Biden temporarily paused all oil and gas activity in the Arctic Refuge; but with leases already issued and another mandated lease sale on the horizon, Congress should take legislative action now to restore protections for the coastal plain.
The Arctic Refuge is a key piece of carbon-sink infrastructure, and the United States simply cannot achieve its carbon reduction goals if it is drilled for oil.

4. Fix county payment programs

Protected public lands will be central to meeting climate goals, as they anchor the country's natural carbon sink and sustain healthy rural economies. Unfortunately, existing fiscal relationships between public lands and local governments often run counter to the conservation, restoration, and recreation uses of public lands, even when there are clear long-term benefits. For example, several programs compensate counties for the nontaxable status of federal lands by sharing receipts from commercial activities, such as timber sales, directly with local governments or by making payments that must be appropriated annually.

These revenue-sharing payments are often used to support public services but tie local government budgets to extractive commercial activities on public land. By comparison, beneficial activities such as forest restoration, which reduces wildfire risk and creates jobs, fail to support local schools and public services. The fiscal relationship between public lands and local governments must be updated to reflect the current economic values of these lands, including growing restoration and recreation economies. And payments must be permanent and predictable for counties.

Proposals to realign payments with the changing economy include the Section 605 payments being defined by the

U.S. Department of the Treasury, as well as potential reforms to the Payments in Lieu of Taxes (PILT) program that would add a "bonus" for public lands dedicated to conservation and recreation uses. These reforms would allow communities to build economies around multiple values of public lands. Securing permanent and predictable funding will require a new framework for saving and investing receipts—as proposed by S. 1643, which would create a permanent endowment to fund the Secure Rural Schools and Community Self-Determination Act—as well as mandatory funding for PILT.

5. Enact federal oil and gas leasing and fiscal reforms

The federal oil and gas program is broken; it jeopardizes the health of U.S. public lands, does not account for climate change, is an impediment to necessary energy transitions, and is essentially a subsidy for the oil industry. Further, states and communities where leasing occurs have become specialized and overly dependent on continued drilling, leaving them exposed to acute fiscal and economic crises.

The administration's ongoing leasing pause and program review provides time to reform the leasing process so that it can address pressing climate, economic, and fiscal challenges. Congress is eying a number of reforms of its own to address low royalty rates, low rents and minimum bids, speculative leasing, and bonding and reclamation. Other potential reforms include policies to end noncompetitive leasing, account for the costs of carbon pollution associated with the extraction and burning of fossil fuels, and improve data collection and transparency, including by tracking the costs associated with administering a lease.

In addition, solutions are needed to resolve state and local revenue dependence through opportunities for energy-producing states to separate their budgets from oil and gas development on public lands, while also providing states with financial stability for schools, health care, and other essential services. Any investments in oil and gas reforms should take into account findings from the administration's assessment of the federal oil and gas program, as well as the ensuing report, which is expected this summer.

6. Expand on what is already in the American Jobs Plan

The American Jobs Plan starts to get at nature-based infrastructure in its proposals for plugging orphaned wells, reclaiming abandoned mine lands, and creating a Civilian Climate Corps. These types of programs are exactly what is needed, but Congress should be even more ambitious.

The plan directs $10 billion to the creation of a Civilian Climate Corps, which would mobilize a new generation of workers to advance conservation, resilience, and environmental justice. There are currently many civilian climate and conservation corps bills introduced in Congress that cover a wide array of landscapes, projects, and challenges.

Now is the time to be bold and scale up investments in a 21st century corps that creates jobs and tackles land and water conservation, climate resilience, fire preparedness, and more in both urban and rural areas across the nation.

Abandoned mines and orphaned wells have long damaged the surrounding environment and threatened the public health of communities nearby. The American Jobs Plan's $16 billion proposal to plug and remediate them is a great start and has the ability to create tens of thousands of jobs each year.

However, to ensure that future reclamation costs do not fall on taxpayers and that the fund is not simply an industry bailout, Congress should also assess a reclamation fee on ongoing hard-rock mining operations on federal lands and increase oil and gas bonding rates, as proposed in the Orphaned Wells Cleanup and Jobs Act from Rep. Teresa Leger Fernández (D-NM).

The country needs a rescue package, and the American Jobs Plan provides a valuable blueprint for creating jobs and addressing the climate crisis. Stronger investments in conservation and agriculture infrastructure will only boost those efforts to truly build back better.

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Leaders make bold climate pledges, but is it 'all just smoke and mirrors?': Critics

Forty nations – producers of 80% of annual carbon emissions – made pledges of heightened climate ambition at U.S. President Joe Biden's Leaders Summit on Climate. But as each head of state took to the podium, climate activists responded by pointing to the abysmal lack of action by those nations.

JUSTIN CATANOSO

Mongabay

World leaders took turns on Earth Day pledging increased ambition to battle climate change during President Joe Biden's virtual Leaders Summit on Climate. But environmentalists — weary of gaping policy loopholes, conservation lapses, and the utter failure of governments to meet Paris Climate Agreement carbon reduction targets — called loudly for the gap to close now between promises and real climate action.

Yes, eco-advocates are thrilled the U.S. is again engaged in climate leadership after four years in which the Trump Administration mocked and undermined climate efforts. But in a flood of statements, the impatience and frustration among activists were as evident as record warming, rising sea levels, and increasingly deadly storms, wildfires and drought.

"The Biden administration's new climate target to halve emissions by 2030 is more ambitious than any previous commitment by the U.S. government," said Brandon Wu,

The Leaders Summit on Climate held on April 23, 2021.

ActionAid USA's director of policy and campaigns. "Yet it is still deeply insufficient to meet the realities of the climate crisis."

Wu and others called on Biden to up U.S. emission reduction pledges to 70% by 2030 over a 2005 baseline, and to vastly increase its monetary support to help developing nations adapt to, and recover from, escalating climate impacts. The U.S., they noted, remains the historical leader in producing greenhouse gas emissions; it must do more.

Dave McGlinchey, chief of external affairs for the Woodwell Climate Research Center, added: "This summit could be a critical turning point in our fight against climate change, but we have seen ambitious goals before and we have seen them fall flat. Today's commitments must be followed with effective implementation, and with transparent reporting and accurate carbon accounting."

And while no president in U.S. history has prioritized climate action across the entire federal government as Biden has, plans remain vague on how the administration's many goals will be accomplished — especially with Senate Republicans vowing to block any meaningful legislation. With leaders from 40 countries, representing 80% of annual global carbon emissions, participating in Biden's summit, heads of state were eager to wax eloquent about the need to cut emissions, protect forests and biodiversity — even as they failed to explain their nations' failure to meet Paris Climate Agreement targets, while their peoples have been increasingly ravaged by climate change in the years since the 2015 signing of the accord.

China to phase out coal, or not?

With the U.S. and China still at odds on trade, technology and human rights, Biden claimed a small victory in getting the current world's leading greenhouse gas emitter to participate in the two-day summit. Yesterday, President Xi Jinping promised his country would "strictly limit increasing coal consumption" in the next five years with a goal of phasing out coal by 2031. But is that realistic, let alone possible?

China's demand for energy — 58% of which came from coal in 2019 — is rising. And even its historic investments in wind and solar energy are more than offset by its continued investments in new coal-fired power plants.

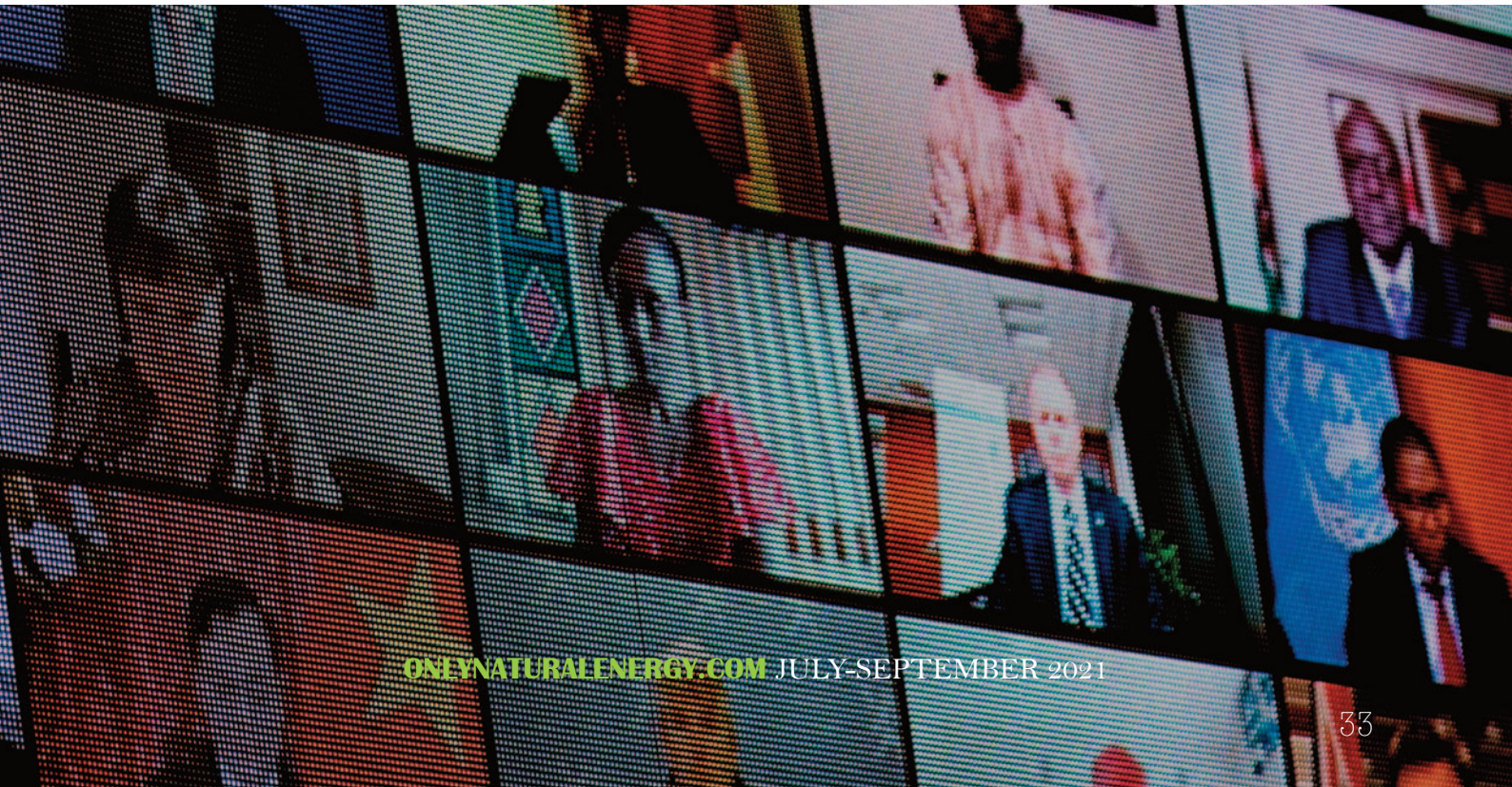
China brought 38.4 gigawatts of new coal-fired facilities into operation in 2020, more than three times what was brought online elsewhere in the world, according to Yale Environment 360.

Complicating Xi's pledge, a staggering 247 gigawatts of coal power is now in planning or development in China — nearly six times Germany's entire coal-fired capacity, a fact the Chinese president failed to note on Earth Day. How exactly, critics wonder, does China simultaneously shrink its unparalleled coal consumption in 10 years and still meet the energy demands of 1.4 billion people?

Asia, Europe and forest biomass

Japan, the world's third-largest economy, presents another conundrum. After the Fukishima disaster of 2011, the country closed most of its 54 zero-carbon nuclear power plants and replaced that energy generation mostly with fossil fuels, primarily coal.

Despite that, Prime Minister Yoshihide Suga told Biden that his country would cut emissions by 46% below 2013 levels by the end of the decade, without explicitly stating how it will get there.



South Korea had already pledged to get its emissions to net zero by 2050, but on Earth Day promised it would stop financing new overseas coal plants. British Prime Minister Boris Johnson pledged to reduce his country's greenhouse gas emissions by an astonishing 78% by 2035. And in a marathon-negotiating session earlier this week, the European Union pledged to reduce emissions among its member states by 55% by 2030.

These are impressive new goals, set by some of the planet's biggest carbon polluters. Impressive until one looks behind the pledges at the numbers game played to get there.

Each of these countries, along with the EU, is shifting a portion of its energy generation mix to burning wood instead of coal, thus putting intense pressure on forests and ecosystems in the southeastern U.S., western Canada, Eastern Europe and Southeast Asia as they meet their voracious demand for wood pellets to produce electricity.

These nations do actually stand a chance of meeting their emissions targets — but not in reality, and only on paper, due to a long-standing loophole in international carbon accounting. A never-corrected error in the Kyoto Protocol of 1997 defined wood, or biomass, as a renewable energy source on par with zero-carbon wind and solar. As such, the emissions from burning forest biomass for energy go legally uncounted at the smokestack.

In the U.K., for example, biomass now accounts for 12% of energy generation, leading to a significant undercounting of the country's actual emissions. That undercount is also occurring across the EU, and increasingly in Japan and South Korea. The trouble is, nature knows these nations are cheating, and so do environmentalists, even though much of the public still remains unaware of the harmful policy flaw.

In an April 20 letter to Biden and EU leaders, some 70 European climate advocates of the Forest Defenders Alliance urged the European Union to close the loophole, which they argue is driving global deforestation when we can least afford to lose forest carbon sinks: "As the European Commission's own Joint Research Centre has warned, burning forest biomass is not carbon neutral because burning emits carbon simultaneously, while forests need decades, if not centuries to regrow to offset emissions."

"We have to actually reduce emissions," said Woodwell's McGlinchey. "If Europe achieves so-called carbon neutrality by burning wood pellets from U.S. forests, and not accounting for the emissions from that deforestation, then it's all just smoke and mirrors. We are at a critical juncture in climate policy — we need real and effective solutions and we need them immediately."

Oh, Canada!

Among the G-20, perhaps no country came in for more intense criticism from climate activists this week for its climate ambition than Canada. No sooner had Prime Minister Justin Trudeau boldly announced that his country would up its previous target of 30% reduced emissions to 40-45% above 2005 levels by 2030, than critics began to howl.

"Canada not only needs to improve its climate targets, but also pass strong legislation to meet those targets," said Catherine Abreu, Climate Action Network Canada's executive director. "Canada's proposed Net-Zero Accountability Act, currently stalled in Parliament, must be strengthened as it contains more of a duty to report than a duty to act."

As Mongabay reported this week, Trudeau's emission-reduction goals are not being helped by British Columbia. BC Premier John Horgan and his majority party adopted aggressive recommendations last fall to preserve the province's shrinking stands of tall, old-growth forest, but has failed to enact those policies as logging continues and enormous stores of carbon are potentially lost forever. Canada is fast becoming a supplier of wood pellets to the world, helping send carbon skyward thru the accounting loophole.

"I know there is this perception of Canada and BC as progressive on climate and the environment, but we are not," said Sonia Furstenau, leader of BC's Green Party. "We are massively subsidizing the oil and gas industry at the federal and provincial level… We are racing in the wrong direction as a province. The last stands of old growth, which are our best chance to absorb and store [atmospheric] carbon, are being cut down under the government's watch."

Patricia Espinosa, executive secretary of the United Nations Framework Convention on Climate Change, is well aware of the politics of climate policy — the give-and-take, the sleight of hand, the often-empty rhetoric of global leaders. But, basking in the glow of yesterday's new national pledges, she remains optimistic about meeting the Paris Agreement goal of holding global temperature rise to 1.5 degrees Celsius above a 1900 baseline to avoid climate catastrophe.

"We congratulate the commitments shown by several nations at the [Biden] summit," she said, "and I urge all nations to carry forth this leadership and momentum to the crucial COP26 [UN Climate Summit] negotiations scheduled for this November in Glasgow."

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Greens: divided on 'clean' energy? Or closer than they appear?

Influential climate advocacy groups disagree on President Biden's ambitious clean electricity standard, but the potential for compromise remains.

DANA NUCCITELLI
Yale Climate Connections

Several media outlets over the past week or so have run stories about environmental groups setting up a "circular firing squad" because more than 600 such organizations sent a letter to Congress opposing the clean electricity standard that may become a centerpiece of Democrats' climate and infrastructure package. The standard would likely require that 80% of U.S. electricity be generated by "clean" sources (meaning those that do not release significant greenhouse gas emissions into the atmosphere) by 2030, and 100% by 2035.

The issue in contention: whether certain technologies like fossil fuels that capture their carbon emissions, nuclear, and biomass power should be considered sufficiently "clean," or whether they should be eliminated from the American power generation mix for the sake of environmental justice. This potential infighting has triggered flashbacks among many advocates to their last shot at passing serious climate legislation over a decade ago, when in 2009 a proposed carbon cap and trade system died a quiet death in the Senate after having been narrowly passed in the House.

But several key players believe the two sides are not so far apart and remain optimistic that the proposed climate policy this time around could garner sufficient support to become law.

The case against not-so-clean electricity

The coalition of groups opposing a clean electricity standard includes 350.org, Oil Change International, Greenpeace, the National Association for the Advancement of Colored People (NAACP), Climate Justice Alliance, Climate Hawks Vote, California Environmental Justice Alliance, and Friends of the Earth. These groups worry that burning biomass, often in the form of wood pellets, generates significant air pollution and that, as more than 500 scientists and economists wrote to President Biden this past February, "Trees are more valuable alive than dead both for climate and for biodiversity."

About nuclear power the organizations argued in a March 18 letter to congressional leaders that "the vast majority of uranium mines, mills, production facilities, reactors, and waste dumps are located in communities that are disproportionately Indigenous, Black, people of color, rural, and low-wealth." It's worth noting that the mining needed to produce the rare earth metals for numerous clean technologies like wind tur-

Photo credit: Creative Commons CC0

bines and electric cars poses similar environmental pollution and injustice problems.

The numerous coalition members also worry that outfitting fossil fuel power plants with carbon capture technologies will extend the lifespans of those fossil fuel facilities, whose other air pollutants have long harmed public health disproportionately in communities of color. It's also an expensive technology. Contacted via email, a spokesperson for 350.org posed the question, "Why add sequestration technology and the attendant costs when coal, oil, and gas are already becoming increasingly uncompetitive relative to wind?"

The case for keeping all options on the table

The Breakthrough Institute's Director of Climate and Energy, Zeke Hausfather, agreed with the latter point, noting via email, "more complex and expensive carbon capture and storage plants cannot as cost-effectively ramp up and down to fill in increasingly infrequent gaps as we decarbonize the power sector, and for this reason tend not to be used that much in decarbonization models."

But Hausfather pointed out also that, "if you believe renewables will be dirt cheap and everything else will be too expensive, there really seems no downside to technologically neutral policies like a clean electricity standard." In addition, developing carbon capture technologies could be useful for decarbonizing the industry sector, where fossil fuels are difficult to replace in certain applications that require generating lots of heat. There are also political constraints to consider. Most significant climate policies face overwhelming opposition from sitting congressional Republicans.

Given that reality, Democrats must walk a tightrope to succeed in ferrying them through Congress, in particular the Senate. Democrats' slim majorities require them to maintain support from nearly all party members and use the budget reconciliation process to have a chance of getting at least the 50 votes that would allow Vice President Kamala Harris, as president of the Senate, to cast the tie-breaking vote that would open the way for a presidential signature.

Democratic proponents appear to be optimistic that a clean electricity standard might be able to run this gauntlet, but excluding options like carbon capture, biomass, and nuclear power could risk fierce opposition from powerful industry lobbying groups and the support of key legislators like West Virginia Democratic Senator Joe Manchin.

Clean vs. renewable electricity standards

The coalition instead endorsed a renewable electricity standard that would require all U.S. electricity be supplied only by wind, solar, and geothermal power by 2030 – a goal most experts consider infeasible.

Solar, wind, and geothermal sources currently account for just 11% of U.S. electricity, with another 7% from hydroelectric dams, 20% from nuclear, 19% from coal, and 40% from gas. A host of energy modeling studies have concluded that renewable energy could be scaled up to supply 80-90% of U.S. electricity demand, but meeting the final 10-20% is exceedingly challenging. The 2035 report by the UC Berkeley Goldman School of Public Policy estimated that the U.S. could achieve 90% emissions-free electricity by 2035, including 70% from wind and solar with batteries, 20% from nuclear, and 10% from gas.

Authors of a January 2021 study published in the journal AGU Advances found that in the most cost-effective scenario to reach zero-emissions by 2050, wind and solar would supply 91% of U.S. electricity generation by mid-century, with 3% each coming from hydroelectricity, nuclear, and gas with carbon capture. The study found that a 100% renewable electricity scenario would cost more than twice as much because so much more wind and solar infrastructure would need to be built to address intermittency issues. Authors of a 2018 study in the journal Joule similarly found that to reach zero emissions, electricity costs would nearly double if technologies like nuclear, bioenergy, and gas with carbon capture were excluded from the energy system. And higher energy costs disproportionately impact low-income households.

UC Santa Barbara political scientist Leah Stokes – a key architect of the clean electricity standard – also noted via email that "The problem with a renewable electricity standard is that it is extremely unlikely to pass. Advocates have been trying to pass one federally since the 1990s." She says she agrees with Hausfather that even if included in a clean electricity standard, carbon capture technology is so expensive that it would rarely be used. Energy system modelers, environmental organizations, and climate policymakers agree that a rapid deployment of increasingly cheap wind, solar, and battery technologies can achieve most of the de-

The United States Capitol Building Washington DC (USA).
Photo credit: Mathieu Landretti

carbonization of the electricity sector. But it's that "most" that is the real rub: There are no easy choices when it comes down to reaching net zero emissions. Ruling out certain technologies for the sake of environmental justice risks exacerbating the racial wealth gap or even torpedoing advocates' best-yet shot at passing serious climate legislation.

The divide over carbon offsets

There are also some types of climate policies supported by congressional Republicans. For example, a bill called the Growing Climate Solutions Act has strong bipartisan support in the Senate with 25 Republican and 23 Democratic co-sponsors. (It has also been introduced in the House with co-sponsors from both parties.) The bill would direct the U.S. Department of Agriculture (USDA) to develop a program to reduce barriers for farmers, ranchers, and private forest landowners to access carbon credit markets.

Agriculture currently accounts for 10% of U.S. greenhouse gas emissions and 25% globally. But farming has the potential to become a significant climate solution, were farmers to transition to regenerative agricultural practices like no-till farming and rotating cover crops to sequester carbon in soils. Assisting farmers in selling credits representing carbon stored in soils would provide a financial incentive for the challenging transition they would face. Measuring and verifying soil carbon content is costly, and upon switching to regenerative agricultural practices, farmers face a one- to two-year

decline in crop yields before the process can lead to increased profitability. Because of the significant potential for agriculture and forests to naturally capture and sequester carbon, many environmental organizations have endorsed the Growing Climate Solutions Act. Among those supporting the effort are the Environmental Defense Fund, The Nature Conservancy, National Wildlife Federation, World Wildlife Fund, National Audubon Society, and Citizens' Climate Lobby.

On the other side of the ledger, however, Sunrise Movement, 350.org, Oil Change International, Climate Justice Alliance, Climate Hawks Vote, California Environmental Justice Alliance, and Friends of the Earth are among the larger environmental organizations opposing the Growing Climate Solutions Act.

Their primary critique of the bill is similar to their opposition to carbon capture: "[carbon] credits generated will be purchased by power plants, refineries, and other polluters, which will use them to offset their emissions instead of reducing and eliminating pollution." Carbon offsets are also notoriously difficult to quantify and verify.

For example, a recent analysis by the nonprofit group Carbon Plan estimated that by averaging tree types and densities over large forested areas, California has over-credited 30 million tons of carbon sequestration in forests. Polluters were able to purchase these offsets rather than reduce their own emissions, and approximately 30% of the offsets did not represent real carbon reductions, according to the Carbon Plan analysis. Agricultural offsets are easier to measure, although farming practices and soil carbon content would need to be monitored and verified.

The organizations opposing the Growing Climate Solutions Act argue that "ecologically regenerative farming should be incentivized in addition to, and not instead of, carbon reductions in the energy sector." But removing carbon offset markets from the equation would necessitate government funding, which in turn would likely eliminate most or perhaps all Republican support for the policy and its chances of becoming law.

The Growing Climate Solutions Act in essence enjoys bipartisan support precisely because it would simply help connect farmers to existing revenue streams from carbon offset markets. As with the clean electricity standard, the perfect is at risk of becoming the enemy of the good. One key point: carbon offset markets will continue to operate with or without the Growing Climate Solutions Act, which would at least establish a USDA certification process in an effort to increase confidence that the offsets represent real carbon reductions.

Some opponents are more flexible than others

The Center for Biological Diversity's energy justice director, Jean Su, told Politico, "There's this gross fallacy that we need to compromise on justice to get clean energy, and it's not true … We can come back and get something better." But it's possible – perhaps even likely – that the current narrow political window represents America's best hope for passing robust climate legislation that could put the country on track to meet its climate pledges.

Other environmental organizations appear more open to compromise. Climate Hawks Vote president and founder RL Miller views opposition to the clean electricity standard as a negotiation tactic – an effort to pressure those crafting the climate infrastructure package to take heed of the California model.

In its 2018 climate law, California set a 60% renewable portfolio standard by 2030, to be followed by a 100% clean electricity standard by 2045. This approach keeps the focus on deploying cheap renewable energy in the near-term while ultimately allowing other low-carbon sources to supply the challenging final 10-20% of electricity demand.

In the end, climate advocates may have to decide whether they're willing to risk losing their best chance at passing ambitious and consequential climate policy for the sake of chasing a more perfect solution that in the end may simply be beyond reach. But as Stokes noted, there is a lot of common ground between the groups, and once a final package is brought to a vote in Congress, most environmental organizations seem likely to support it.

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Cranberry farmers look to sweeten income by pairing crop with solar panels

Several projects are under development that would incorporate pole-mounted solar panels over active cranberry bogs as a way to boost revenue for farmers and create more space for solar development.

SARAH SHEMKUS
Energy News Network

The first solar panels installed over working cranberry bogs are set to come online in Massachusetts this year, putting to the test supporters' belief that these installations can help struggling farmers while offering new ground for renewable energy to grow. Two such installations planned for the town of Carver closed on financing last month and are expected to be operational by the end of the year. The $53 million project is owned by Pine Gate Renewables, a North Carolina-based solar developer, and will create 9 megawatts of solar capacity, while cranberry crops continue to be grown and harvested in the bogs beneath the elevated panels.

Other cranberry solar developments have been proposed for the towns of Rochester, Wareham, and Plymouth. "We see this as becoming very much the future of solar projects," said Pine Gate's director of market development Jeffrey Secrest, speaking of installations that combine solar and agricultural uses.

Massachusetts' 375 cranberry farms grow roughly a quarter of the country's cranberries each year. Yet, like farmers of all kinds, many Massachusetts cranberry growers are having trouble staying afloat. Over the past 20 years, increasing competition from growers in Quebec and Wisconsin — the top-producing state — and has kept prices relatively low, said Brian Wick, executive director of the Cape Cod Cranberry Growers Association, which represents the state's cranberry farmers. Unlike a dairy or vegetable farm, a cranberry bog is a wetland and can't be sold off to property developers. Some growers, therefore, find themselves unable to make enough farming, but without any options for cashing out.

In 2019, a promising new idea emerged as part of a larger state program. Massachusetts, long considered one of the most solar-friendly states, launched the Solar Massachusetts Renewable Target (SMART) incentive in November of that year. The program pays owners of solar panels a fixed rate per kilowatt-hour of power generated. The rate is higher for installations that include features the state wants to encourage, such as construction on previously polluted sites or location in a low-income neighborhood. Among these so-called "adders" is one aimed at encouraging projects built over active agricultural fields.

This approach, known as dual-use solar, was mostly envisioned as a solution for upland farmers who could grow crops or graze livestock under the photovoltaic panels. Some cranberry growers, however, wondered if the strategy would work on bogs as well. And for solar developers, the provision seemed to open up another option for finding land suitable for solar panels.
"Massachusetts has very aggressive renewable energy goals, but it is limited in the amount of land that's available," Secrest said. "This is a solution to meet the renewable energy future while using what's available and maximizing the use of the land."

Still, it was not immediately obvious the idea was viable. There were questions about how the pilings should be erected in the boggy land, how the shade created by the

A cranberry bog in Kingston, Massachusetts (USA).
Photo credit: Massachussetts Office of Energy & Environmental Affairs

panels would affect crop productivity, and how the finished structure would disturb the existing cranberry plants. To help address some of these concerns, the University of Massachusetts Cranberry Station, a research center devoted to maintaining the economic viability of cranberry farming, got involved early on. In 2019, researchers built plywood panels intended to emulate a solar installation on a section of active cranberry bog to see whether the shade would result in fewer or lower-quality berries. "We definitely had a yield reduction, but there weren't any big red flags that came up," station director Hilary Sandler said. "Cranberries are a really good candidate because they are typically an understory plant so they don't need a lot of sunlight to be successful."

As plans moved ahead, Pine Gate had to find ways to adapt to the unfamiliar bog environment. Instead of supporting the solar array with conventional steel racking, the company devised a plan to use wood utility poles, which they expect to be more durable in the wet bog conditions. The poles will be driven as deep as 30 feet into the ground to ensure the installation remains stable.

Even as bog solar installations come online, developers and researchers will continue to learn and adjust. The research station has plans to partner with five bogs to maintain an ongoing research project studying the impacts and results. For example, cranberry bog panels will be sited over a perennial crop, so some damage to existing plants is inevitable. Sandler and her team will track the extent of this damage and try out methods for mitigating it; adding extra sand to the bog, she theorized, could reinvigorate the plants to return them to full productivity more quickly. They will also be looking at whether panels can be spaced more closely together without lowering the cranberry yield significantly.

"There is a lot of thought going into how to do these things right," said Iain Ward, a veteran cranberry farmer and solar consultant who will be operating the parcels in Carver for Pine Gate. "In five to six years, we're going to have new best practices specifically tailored to growing crops under dual-use arrays."

Solar will never be a solution for every farm, developers and growers agree. Some bogs don't get enough sunlight to make solar a viable option, and others aren't located close enough to transmission infrastructure to easily hook a solar installation into the grid, Wick said.

There is, nonetheless, broad agreement that the strategy holds significant potential for growers and solar developers alike.

"It's absolutely something that everyone should evaluate," Ward said. "It's not the answer for cranberries, but it is an answer."

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Photo credit: Gurvinder Singh

SAHAGANJ

In 1936 the pneumatic tyres manufacturer Dunlop opened its first factory in India. Sahaganj was the chosen venue. It was the first tyre manufacturing plant in the Asian continent. Spread across 97 hectares, Sahaganj's plant employed over 12,000 workers to manufacture car and aeroplane tyres.

Dunlop was the world leader in the pneumatic tyres industry, and the Sahaganj plant was its Asian most prominent symbol. It was no surprise that in 1980, Prince Charles, a 32-year-old bachelor at the time, drove down there to visit the Dunlop plant. A stone plaque remembers his visit.

In September 1983, the Japanese company Sumitomo, a former subsidiary, bought Dunlop's European business. One year later, New Zealand and India branches were sold too. It turned out to be the beginning of the end for the Sahaganj's plant.

The ownership changed hands several times. The plants were closed for years and re-opened for short spells until 2014 – a 30-year list of false dawns and unfulfilled promises. Now the whole site and its buildings are mainly abandoned and in a dilapidated state. A sad remembrance of what remains in Sahaganj of the company founded in Dublin in 1889, which still bore the name of John Dunlop, who had redesigned the first pneumatic tyre for his child's tricycle and developed it for use in cycling, despite withdrawing three years earlier. Something was unfair before even starting. ONE

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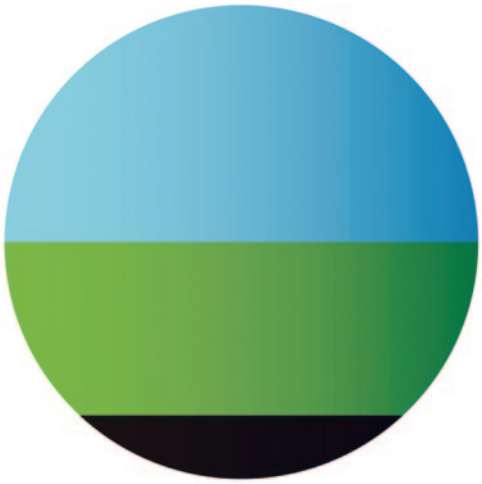

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