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Only Natural Energy

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The Korean war memorial covered in snow, Washington, DC (USA). (Photo: Pxhere)

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Green has had no luck in F1 in recent years. Caterham Team competed in the Formula One World Championship only from 2012 to 2014. Photo credit: Caterham

Formula ONE

By GIANNI SERRA
ONE

From now on it will be a two-horse race. Last December FIA (International Federation of the Automobile) decided to give world championship status to Formula E from 2020-21. An unprecedented move that means that there are now two single-seater racing series recognized as a world championship. And F1, which has always been synonymous with cutting-edge technology, cannot tolerate being associated with the past, with the fossil fuels industry, to the advantage of the new greener competitors.

A few weeks earlier F1 had announced the commitment to reduce their carbon footprint immediately and to have a net-zero carbon footprint by 2030. In 2018 F1's carbon footprint was equal to 256.5 tonnes, not including fans' transport to races: over 70% of this came from personnel and equipment transport and only 0.7% from the overall F1 car emissions. The pledge is ambitious: "We will move to ultra-efficient logistics and travel and 100% renewably powered offices, facilities and factories and offset emissions that cannot be cut. All events will be sustainable by 2025 - no more single-use plastics; reused, recycled or composted wastes will be the rule, not the exception. And in 2021, regulations will demand that the petrol used in an F1 car has a biofuel content of at least 10%."

Chase Carey, CEO of Formula 1 said: "Few people know that the current F1 hybrid power unit is the most efficient in the world, delivering more power using less fuel, and hence CO2, than any other car. We believe F1 can continue to be a leader for the auto industry and work with the energy and automotive sector to deliver the world's first net-zero carbon hybrid internal combustion engine that hugely reduces carbon emissions around the world."

The electric vehicle sector is the one with the highest expansion potential in the car market. And the F1 mission statement, as well as the FIA's decision to recognize Formula E as a world championship, reveal an acknowledgement of these new commercial prospects for the automobile industry. But too many championship and too many champions can only diminish each other's value. Boxing was killed by the proliferation of titles and weight classes. Despite FIA's willingness to enlarge its family and to raise its members' profile and ambition, Formula One and Formula E are not there to cooperate. Apparently.

To grab more attention they are presented as conscious fighters who know that in racing there is no room for ex aequo. However, there would be no interest in a traditional technical comparison - F1's car is nearly 200kg lighter, has triple power and can reach 100KM in nearly half time and has a maximum speed of nearly 380km/h opposed to 225km/h. What has changed in 2019 is that going faster is not sufficient anymore to justify F1's status as the pinnacle of Motorsport. They need to show adaptability to please a public more conscious of climate and energy issues.

That's why FIA launched the race for the title of champion of the modern environmentalism, where fastest cars are also the most eco-friendly. A race with only one possible winner and it's called Liberty. Liberty Media owns Formula One, Liberty Global owns Formula E. Different companies, sure, but Liberty Media owner John Malone is also Liberty Global chairman. The merger of 1 and E into a greener Formula or the transformation of Formula E into an F1's more sustainable spin-off will be both viable options to avoid environmentally-conscious sponsors' ending their financial support to Motorsport's biggest show. ONE

Winterproofing the grid

How extreme cold weather is making a case for coal in the US.

By TOBY LOCKWOOD

ONE

Winter came early for many Americans this year, as parts of the United States have already seen record-breaking cold weather in November. A dramatic new lexicon of polar vortices, bomb cyclones, and Arctic blasts is testament to the glacial cold snaps endured almost annually by midwestern and north-eastern states at this time of year. Its increased frequency is thought to be linked to climate change and the warming Arctic.

Since the Polar Vortex of early 2014, these extreme weather events have continued to fuel a politically charged debate within the energy sector over how the electricity grid should best withstand such challenging conditions.

Power generation in most of the US is increasingly reliant on gas-fired power plants, driven by the shale gas boom, with gas replacing coal as the largest source of power in 2016 and many coal and nuclear plants struggling to remain financially viable. However, during cold weather, the combined demand for gas from both power and heating can lead to soaring gas prices, or even emergency prioritisation of residential customers, meaning power plants can have their supplies cut off.

In 2014, this was made worse by gas production and pipeline equipment freezing up, as well as fuel gelling at the plants, leading to nearly 20 GW of gas power plant going down across the country. In the Mid-Atlantic grid region known as PJM, record power plant outage rates were experienced, and daily average wholesale power prices reached almost $700/MWh. Although coal and other types of plant also struggled with the cold, the Trump administration has been quick to suggest that an over-reliance on gas, with its particular vulnerability to supply disruption, could harm the resilience of the electricity grid to extreme weather events of all kinds. The fact that both coal and nuclear plant tend to store much longer-lasting supplies of fuel on-site – sometimes termed 'fuel assurance' – therefore emerged as a new weapon which might reverse the fortunes of these energy sources in their losing battle against gas.

In 2017, newly installed Energy Secretary Rick Perry tasked the Department of Energy with studying the effects of ongoing coal and nuclear plant retirements on grid stability and resilience.

The resulting detailed investigation takes a measured tone, recognising the need to improve the grid's resilience to unusual weather, but also noting that all energy sources have vulnerabilities and there will be an inevitable trade-off between cost and reliability. Nevertheless, in September 2017 Secretary Perry proposed a 'grid resiliency pricing rule' that would direct additional compensation to power plants with at least 90-days' worth of fuel on-site.

During cold weather, the combined demand for gas from both power and heating can lead to soaring gas prices, or even emergency prioritisation of residential customers, meaning power plants can have their supplies cut off.

The Federal Energy Regulatory Council unanimously rejected the proposal that winter, citing feedback from grid operators that were unconcerned about the impact of any upcoming power plant retirements. Ironically, this

A snow-covered Yellowstone on 8 June 2019.
Photo credit: James st. John

decision took place while a 13-day cold snap – known as the Bomb Cyclone – was sweeping the country, reigniting the issue just as soon as it might have been laid to rest.

In response to the Polar Vortex, several grid operators in the North-East had already introduced changes to their 'capacity markets', which are well-established mechanisms to pay certain power plants for simply being available, whether they generate or not.

Given that many plants failed to fulfil these obligations during the 2014 event, the action was taken to pay generators more when they could perform well and penalise them more harshly if they were unavailable when needed, with regular checks imposed. In PJM, plants were increasingly required to demonstrate the dependability of their fuel supply in the form of long-term gas contracts or the ability to switch to oil if necessary.

In New England, the grid operator introduced a temporary Winter Reliability Program, which paid generators for storing oil and gas, before making permanent changes to its capacity market in 2018. The Bomb Cyclone in the winter of 2017-2018 was the first real test of these new measures. Although neither the cold nor electricity demand quite reached the levels seen in 2014, the long duration of the cold snap put the grid under considerable strain. PJM declared its market changes a success, with a much lower proportion of power plants put out of action (8% of capacity), and nearly half as many gas plants suffering from supply issues. Although gas prices actually went much higher in 2018 than they had during the Polar Vortex, electricity prices did not reach the same dizzy heights.

Despite this confident outlook, a study of the grid's response to the Bomb Cyclone by the Department of Energy's National Energy Technology Laboratory (NETL) found that normally little-used coal plant had been vital to meeting the growth in power demand, providing over half of the additional generation required across the eastern grids compared to an average winter day. Their analysis concluded that ongoing coal plant retirements, combined with inadequate investment in new gas pipeline capacity in these regions put some grids at risk of blackouts in future.

A war of words developed, as PJM shot back with its own response, maintaining that plenty of spare gas power plants were available and their losing out to coal plant during the cold was simply a result of the energy

Snow in Fairmount, GA, December 2017.
Photo credit: Thomson200

market functioning as usual. The NETL was quick to point out that these claims seemed at odds with PJM's own president's statements on the event, which agreed that they could not have served customers without their coal-fired plant and that fuel security risks were a growing concern for the operator.

In a formal reply, the government lab held that the high gas prices actually underlaid a genuine gas shortage in parts of the grid, with pipelines hugely over-subscribed by the time they reach the East Coast. To all intents and purposes, they claimed, a far higher proportion of gas plants were unable to generate.

In January 2019, the Polar Vortex returned, this time bringing record cold temperatures to the Midwest in particular, and again resurrecting the grid resilience debate.

Thousands of customers in Wisconsin and Iowa went without power, as the region's electricity system operator (MISO) suffered the loss of generation from around 25% of its generators and prices spiked to $800/MWh. However, the response to the emergency was generally regarded as a success, avoiding widespread blackouts. In PJM, where the cold was less severe, some commentators have noted that similar numbers of coal and gas plant were put out of action, although a further 3 GW of gas plant once again ran short of gas. There appears to be little prospect of a return of the kind of direct support for coal and nuclear plants originally proposed by Secretary Perry (who has since left the administration).

Still, concerns remain over how to manage the ever-growing relationship between the gas and electricity grids. Advocates of renewable energy argue that these sources can strengthen the system, together with smarter grids which have greater flexibility for consumers to reduce their demand. However, wind power – the renewable of choice for most US states – has often shown poor performance during cold weather events like the Bomb Cyclone.

Expansion of the gas grid could prove to be the most realistic insurance policy, but that will take time. Meanwhile, it remains to be seen if and when the grid will begin to really feel the effects of the ongoing wave of coal plant retirements throughout the country. With colder temperatures forecast to return later this winter, another chapter in this saga may soon be written. ONE

UN report: Pollution from planned fossil fuel production would overshoot Paris climate goals

By DANA NUCCITELLI
Yale Climate Connections

In the 2015 international Paris Climate Agreement, nearly every country [see editor's note] agreed to try and limit global warming to no more than 2 degrees Celsius (3.6 degrees Fahrenheit) and preferably closer to 1.5 degrees Celsius (2.7 degrees Fahrenheit) above pre-industrial temperatures. Achieving these goals will require dramatic changes, as the world has already warmed 1 degree Celsius (1.8 degrees Fahrenheit), and temperatures, fossil fuel consumption, and carbon pollution all are continuing to rise.

To determine how far off track emissions are with respect to the Paris goals, groups like the International Energy Agency and Climate Action Tracker evaluate each country's climate policies. According to their analyses, were each country to follow through only with current policies, global temperatures would rise about 3 degrees Celsius (5.4 degrees Fahrenheit) above pre-industrial temperatures by the year 2100 – a level of warming that would result in severe and dangerous climate changes.

In addition, a new report produced by the United Nations Environment Programme, UNEP, and a coalition of research organizations takes a different approach: The report examines government plans for fossil fuel production and the amount of carbon pollution and global warming that would result if all these fuels were burned.

"Our collective failure to act early and hard on climate change means we now must deliver deep cuts to emissions", UNEP Executive Director Inger Andersen said in a statement releasing the report. So urgent is the need for action, he said, that "every city, region, business and individual need(s) to act now".

The resulting picture is indeed bleak – total carbon emissions between now and 2030 from global fossil fuel production plans are about 10% higher than those from the current climate policies that would put the world on track for 3 degrees Celsius warming by 2100. These fossil fuel plans present a difficult impediment to meeting the Paris climate goals.

The challenge, by the numbers

According to the newly released figures, to stay on track to meet the 2 degrees Celsius Paris target, the fossil fuel supply can release only about 350 billion more tons of carbon dioxide between now and 2030, and a total of 550 billion tons by 2040. For the 1.5 degrees Celsius target, the numbers are about 300 billion tons by 2030 and 450 billion tons by 2040.

Based on the analyses of current pledged climate policies, humans are currently on track to exceed the 2 degree path by 17% by 2030 and 36% by 2040. Those are policies that would instead send the world towards the 3 degrees Celsius warming scenario by 2100.

However, based on countries' fossil fuel production plans, carbon pollution will be about 10% higher yet. Those plans translate to about 450 billion tons of carbon dioxide released between now and 2030, and nearly 850 billion tons by 2040. For the latter date, it's an overshoot of the 2 degrees Paris carbon budgets by 50%, and 85% too much carbon to stay on the 1.5 degrees Celsius path.

In short, if countries follow through with their current fossil fuel production plans, the world will be on track to warm more than 3 degrees C (5.4 degrees F) by 2100, and meeting the Paris targets would become virtually impossible.

Achieving Paris goals means 'stranding' valuable assets

The Paris agreement includes "a global stocktake every five years" starting in 2023, at which point countries can ratchet up their climate goals and policies. Implementing such policies often is a political and economic challenge, and reducing planned fossil fuel production may be even more difficult.

According to a recent study published in the journal Energy Research & Social Science, for the world to meet the Paris 2 degrees Celsius target, more than 80% of all proven fossil fuel reserves must be left in the ground – by no means an easy choice in any capitalist system or democratic society. The reserves and some associated infrastructure would then become "stranded assets," meaning that they no longer hold any value.

These goals are difficult to reconcile with the reality that, as the data document, many large countries plan to expand rather than reduce their fossil fuel production over the coming decades. In the United States, oil and gas production is projected to increase 30% above current levels by 2030. Chinese coal production currently accounts for 43% of the global total, has expanded the past two years, and is forecast to decline slowly after 2020 as the country's natural gas production ramps up. India foresees more


Photo credit: Alfred T. Palmer

than a tripling of coal production by 2040. Australia, currently the world's leading exporter of coal and the second-largest producer and exporter of liquid natural gas, has proposed opening new coal mines and ports in one of the world's largest fossil fuel expansions. And in Canada, Prime Minister Justin Trudeau has described a Trans Mountain pipeline expansion transporting tar sands oil to coastal ports as being "of vital strategic interest to Canada." The country's oil and natural gas production are projected to increase 60% and 34%, respectively, between 2017 and 2040.

The new UNEP report calmly and briefly summarizes the challenges posed by these planned fossil fuel expansions:

Once built, this infrastructure is difficult to turn away from; it decreases fossil fuel prices, hooks consumers on fossil fuels, and deeply entangles many parts of society – including workers and communities – in a fossil fuel economy.
In other words, the more countries invest in expanding fossil fuel extraction infrastructure now, the costlier and more difficult it becomes down the road to strand the assets as needed to meet the Paris targets.

'Supply-side' policy solutions

Climate policies have tended to focus on reducing fossil fuel demand, for example by taxing carbon pollution, fostering alternative energy sources, and improving energy efficiency. To tackle the problem of excessive fossil fuel production, the report recommends several "supply-side" climate policies.

For example, while the leaders of the Group of Twenty (G20) countries with the world's largest economies in 2009 committed to "phase out and rationalize, over the medium term, inefficient fossil fuel subsidies", many governments have instead kept most of their fossil fuel production subsidies, and some have even introduced new ones. According to the International Monetary Fund, global fossil fuel subsidies amount to more than $5 trillion per year, accounting for 6.4% of the global gross domestic product (although only $500 billion of this total comes from direct subsidies, with the remainder resulting from a failure to price carbon pollution). Eliminating fossil fuel subsidies is one straightforward supply-side policy solution.

The new UNEP report notes that governments can also limit fossil fuel exploration, production, or export via moratoria, bans, or quotas: "The governments of Belize, Costa Rica, France, Denmark, and New Zealand, for instance, have all enacted partial or total bans or moratoria on oil and gas exploration and extraction." And governments can prohibit development of, or limit permits for, specific resources and infrastructure like oil pipelines and coal terminals, or the use of certain technologies like hydraulic fracking.

State-controlled investment funds can divest from fossil fuel production companies, and policymakers could tax fossil fuel production. Most directly, governments can set targets to reduce rather than expand fossil fuel production, and restrict financing for fossil fuel supply projects through government-owned finance institutions.

Such policies are clearly politically and economically difficult to implement in light of the vast wealth and political influence of fossil fuel companies, and what many see as consumers' virtual addiction to fossil fuels. However, there are many examples of countries already implementing such steps. Experts increasingly have come to agree that to have any chance of meeting the Paris climate targets, governments will have to recognize that trillions of dollars of fossil fuel assets will need to be stranded, and plans and policies undertaken accordingly.

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November 26, 2019

Can mobile payment apps spur green living?

By WANG CHEN
Chinadialogue.net

Ant Forest turns an Alipay user's environmentally friendly actions into "green energy", which they can then use to plant and nurture a virtual tree. When the tree reaches a certain size, Alipay will plant a real one.

In September, Ant Forest won two United Nations awards for scaling up climate action.

"Ant Forest uses technology to link people and the environment, enabling everyone to participate in action to save the planet, and that has a huge impact," said Inger Andersen, executive director of the UN Environment Programme.

The forest that went viral

The mini-app went live in August 2016. Many low-carbon actions can win green energy including: walking (smartphone pedometers corroborate it), riding shared bikes, teleconferencing and declining single-use cutlery when ordering food deliveries – all of which reduce, even if to a small degree, resource use and carbon emissions.

That green energy feeds the virtual trees of Ant Forest. And when a user's tree is big enough, they can opt to have Alipay plant a real tree or adopt a patch of protected land. Different trees – saxauls, lemon trees, Chinese white pines – require different amounts of energy to plant, depending on how hard they are to grow in real life. Users receive a virtual certificate once the tree has been planted. The actual planting and growing of the trees is funded by Ant Forest and carried out by local governments, specialist organisations and local farmers.

It is a social app. Green energy given to a user will disappear if not "collected" within 72 hours. And users can help out friends by collecting their energy before it expires, or by "watering" their saplings. For the users, low-carbon lifestyles become about real trees, rather than abstract concepts, while Alipay gets more user activity.
The app was an instant success: within six months it had over 200 million users, and this April it passed the 500 million mark. More and more services are sharing data with Ant Forest, including mobile phone recyclers, e-conferencing providers, e-reader services and "green" packaging manufacturers.

By August 2019, Ant Forest had planted 122 million trees in places like Gansu province and Inner Mongolia, offsetting 7.9 million tonnes of carbon emissions, according to China's ministry of ecology and environment.

One 25-year-old masters student said she had accumulated 12 certificates since joining Ant Forest in 2017: "I used to go hiking back then, so I got lots of green energy. And I think it's pretty cool to have a tree I planted somewhere in the desert."

From virtual energy to real forests

There is a disconnect between how well many Chinese people understand climate change and how much action they take. In a 2017 study by the China Climate Communication Centre, 90% of respondents said they accepted climate change, but only 27.5% were willing to pay for their emissions. Wang Binbin, who carried out the study, said: "More accessible approaches are needed to guide the public to act – and those actions need to be very easy to take."

Wang Ling, an Ant Forest employee, told China Dialogue that they had never expected to acquire hundreds of millions of users: "Everyone wants to do good, but is limited by their circumstances. Urban white collar workers might care about nature and the environment, but not have time to go tree-planting. Ant Forest allows people to make real change through tiny choices, increasing environmental awareness and improving local environments."

To make the process more tangible, Ant Forest provides satellite photos of its tree plantations, and arranges site visits and spring tree-planting expeditions.

Alipay's huge user base – over 1.2 billion strong – gave Ant Forest a solid foundation and its success has benifted Alipay too. Six months after Ant Forest launched, Alipay's active users per day had jumped 40%.

Deng Guosheng, deputy director of Tsinghua University's Institute for Philanthropy, believes that companies that use corporate social responsibility initiatives to seek customer approval or even extra profits can help achieve environmental aims – a sustainable win-win approach.

Other experts question how long artificially planted forests can survive in deserts without huge amounts on scarce water resources. Others think restoring degraded forests as a far more sustainable strategy. However, the trees planted in China's northwestern deserts – such as the saxual (Haloxylon ammodendron) – are very tolerant of dry weather, and innovative techniques are being employed to minimise the need to irrigate them.

The Ant Forest app won two United Nations awards for scaling up climate action. Photo: UN Environment Programme

How far can Ant Forest reach?

Ant Forest's public participation model is already being tried in other countries.

In July, a version of Ant Forest launched in the Philippines, a country badly hit by deforestation in recent decades. The mobile payments platform GCash plans to plant 365,000 trees within 365 days. According to Wang Ling, GCash Forest already has 1.3 million users and planted its first batch of trees on 12 October.

Deng Guosheng thinks the "tech + environment" model has its limitations. First, Ant Forest users tend to be young. Data released in 2017 showed that 60% were under 28, with less than 20% over 50.

"Young people get more involved with these approaches, they understand how it works. But older folk, or those in rural areas, don't participate so much," he said.

Carbonstop, an emissions management consulting service, pointed out that Ant Forest's way of carbon accounting was lopsided. While low-carbon activities such as cycling are recorded, high-carbon ones such as driving an SUV are not. This leads to a situation where individuals with vastly different carbon footprints are rewarded equally. Serious carbon accounting needs to consider the entirety of a person's emissions footprint, Carbonstop argues.

Deng said the time and money Alipay has invested in Ant Forest is more than most environmental projects could hope for, and so it remains to be seen how easily its success can be replicated. "But its innovation should be recognised," he said. "And I hope everyone will work to find more diverse environmental approaches."

Originally published by China Dialogue November 20, 2019

Are we ready for clean “meaters”?

By EUSEBIO LORIA
ONE

Every year 66 billion animals are butchered for food. Predictions are that meat consumption will rise, with increasing demand for meat from China and other Asian countries as their standards of living increase. According to the Food and Agriculture Organisation of the United Nations, by 2050, the world's population will surpass 9 billion, and meat demand is expected to be 70% higher than today's level. But we don't have enough land and water to increase meat production by 70% using livestock, which means that we either have to reduce our consumption of meat or find a different and more efficient way to produce it.

The potential future scenarios are insect meat, less meat & local, no meat (soy, seitan, lupine, etc.), doing nothing. If we do nothing the meat industry-main companies will become more powerful, monoculture will be the number one type of agriculture, and the whole earth surface will be adapted to the demands of livestock breeding. Fruit and vegetables will be grown in prominent skyscrapers in the cities — an apocalyptic scenario.

The World Health Organisation (WHO) estimates that one-third of the world's population is affected by malnutrition; half of the 10.4 million child deaths each year are attributed to it. Nowadays, we are exploiting the land in developing countries to produce and export feed for animals in the developed world instead of providing food for humans.

A report published by the International Food Policy Research Institute estimates that if we can reduce traditional meat consum-

ption in the developed world by 50 per cent, we can save 3.6 million children in the developing world from malnutrition.

United Nations' Food and Agriculture Organization (FAO) reminds us that the livestock sector is one of the largest sources of greenhouse gases (GHG): meat industry produces 18 per cent of global greenhouse gas emissions. That is more than the emissions of all planes, trains, and cars combined.

There is no quick fix, but there is a way out. Recently research activities are addressed to find methods to make real meat in a sustainable, healthy and animal-friendly way. Lab-meat production should use up to 99% less land and 96% less water. Despite the promising numbers, the lab meat is still an open challenge. Meat cells need to be fed by 600 to 900 billion biogas factories to fix the world hunger issue in 2050.

Let's talk about the present! Mark Post, Chief Scientific Professor at Mosameat.com, revealed the world's first slaughter-free hamburger to a press conference in London in 2013. The burger was harvested directly from cow cells. It was the result of years of research at Maastricht University, whose cost was €250,000 - 75,000 times more expensive than an average Big Mac. It took three months to grow the meat. Since then, the race has been on to produce commercially available synthetic meat.

In 1931, Winston Churchill said: "We shall escape the absurdity of growing a whole chicken to eat the breast or wing. By growing these parts separately under a suitable medium. "

The former British Prime Minister was ahead of his time. Today we all agree "clean meat" is more sustainable and reasonable. But how is it achievable?

The idea is that scientists could grow meat by culturing animal cells, as an alternative to harvesting flesh from an animal. The first patents were awarded to a Dutch scientist named Willem van Eelen in 1999. Shortly after that, NASA sponsored a project to grow fish muscle cells in space. Then, in the Netherlands, the Dutch government sponsored four years of academic research into what was then called "in-vitro meat."

Some experts would argue that meat is not essential, as a vegetarian or vegan diet is healthier than a meat-based one not only for the single human being but for the whole planet. Meat products have a much larger water footprint than plants.

According to David Pimentel, a water resource specialist at Cornell University, it takes 500 litres of water to produce a kilogram of potatoes, 900 to produce a kilogram of wheat, 2000 for soybeans, and 100.000 litres of water for just one kilogram of beef.

The diet of a meat-eater requires 15 times more water than vegetable-based food diet. A meat-based diet also requires 20 times more land than a vegan one, to allow animal feed pastures and grazing.

Worldwide, we are now using 30 per cent of the earth's land surface for livestock. "For some people, it's easier to imagine that growing meat in a lab—not eating less meat—is the answer to those problems" That's what has been mentioned in Cambridge at the New Harvest conference, an annual conference of scientists and entrepreneurs that constitute the emerging sector called "cellular agriculture".

So why keep on developing meat alternatives – the so-called "fake meat"? Fake meat comes out from plant-based materials that give the taste of meat. Real "meaters" are different, as they can be grown in a laboratory. We can take all sorts of cells ranging from skin and blood to muscle (most wanted) and the brain from different animals, and grow them under controlled laboratory conditions.

The process involves three main steps. First is to select some "starter" cells from the animal and to provide them with the right environment for growth. Second is to let them grow in an environment that mimics an animal body. The third is to switch on the cells to turn into "skeletal" meat by chemical or mechanical signals.

The growing and conversion of cells into skeletal muscle are the significant challenges the industry currently faces. The appearance of this meat is likely "burger-type meat", organised into long strands or fibres; it is not very structured. It's feasible for some types of cells to grow fast and reproduce themselves once every 24 hours in a laboratory – this is much faster than in an animal. The challenge is to achieve this on a large scale in bio-reactors, and then to get all the cells converted from precursor cells to skeletal muscle.

The comparison between traditionally produced meat and "clean meat" says that the latter ensures 96 per cent greenhouse gas emissions reduction and requires 45 per cent less energy. The reason for this is simple: rather than wasting food energy and water on growing inedible animal body parts, all power is used to produce meat tissue. Clean meat can be virtually produced anywhere within a lab space, and it allows for city buildings to be converted into centres for meat production, thus mitigating the need for vast agricultural lands.

However, the methods used to grow meat cells in laboratories are based on regenerative technology, which, although useful, has an exorbitant cost.

The reason is that the process of harvesting the cells, placing them in a nutritional medium, and promoting them to proliferate takes an astronomical amount of money to maintain optimal conditions for only "little loot": a trillion muscle cells only corresponds to a small amount of meat. Therefore, growing a quantity large enough for consumption requires a substantial financial investment.

Price optimisation will be necessary before growing clean meat can be a viable alternative to traditional. But things are moving anyway. "Initially, when people heard about lab-grown meat, [they] expressed scepticism about the project just because it's something different. Now, you find people saying that they'd like to try [lab-grown meat]," said Ingrid Newkirk, president of People for the Ethical Treatment of Animals. Artificial meat is already environmentally sustainable; the next step is to make it financially viable. Not an impossible one. ONE

The Great Biomass Boondoggle

Illegal logging happens for all kinds of reasons, but the demand for energy wood is an increasing driver, as previously "low-value" wood can be monetized.

By MARY S. BOOTH
NYR Daily

The urgency of the climate crisis is inspiring some extreme and unproven ideas for how to hide carbon and cool the planet, such as ocean fertilization, turning CO2 into rocks, and seeding the atmosphere to dim the sun. Arguably one of the most reckless ideas, though, is already well underway: burning "forest biomass"—that is, trees—in power plants as a replacement for coal. The problem with this so-called green energy source is that instead of decreasing greenhouse gas emissions, it increases the amount of CO2 coming out of the smokestack compared to fossil fuels, and the climate "benefit" is claimed by simply not counting the emissions.

While policymakers in developed countries (the European Union, the United States, Canada, Japan, and Korea, among others) seem perfectly happy with this solution, scientists and activists are reacting with bewilderment and fury as entire forests are vaporized into the atmosphere in the name of renewable energy. Meanwhile, the burgeoning biomass and wood-pellet industries are dancing away with billions in renewable energy subsidies. To counter this atrocious trend, I founded an organization in 2010, the Partnership for Policy Integrity, to provide reliable science and policymaking clarity on the forest and climate impacts of burning forests for fuel. Since then, many environmental groups have joined the fight, but we still haven't ended this parade of stupidity, because the forces are powerful and the pool of money is deep.

Like many damaging forms of economic activity, the biomass industry started out small and at first flew under the radar. For decades, sawmills and pulp and paper manufacturers have burned sawdust, wood scraps, and black liquor (the condensed chemical slurry left over from wood pulping) to produce heat and power. Environmental groups were content to call this green energy considering that the alternative had been incineration or dumping black liquor into streams.

And since these other outcomes would generate CO2 anyway, burning such materials was considered to provide carbon-neutral energy. Few people questioned why even the filthiest, most polluting biomass boilers at paper mills—some producing sulfur dioxide emissions to rival those of coal plants—were getting renewable energy subsidies, and over time these subsidies (along with federal renewable energy tax credits) became an important source of revenue for wood-consuming industries.

As more US states enacted renewable energy mandates, however, developers and speculators cashed in on subsidies by building more standalone wood-burning power plants designed solely to put power on the grid. The trend appears to have peaked in the US in 2010 with the post-financial crash stimulus program, which issued cash grants for renewable energy production, including biomass power. Burning wood to produce electricity is expensive, and many plants are not competitive even with supplemental green energy payments. As a result, in the United States the bio-

Botanical Garden of the University of Zurich.
Photo credit: Roland Zh

mass industry has slowed in recent years, although the continued treatment of bioenergy as renewable means it might receive another boost though programs like a Green New Deal.

In the EU, however, where subsidies and incentives have been more consistent and lucrative, wood consumption for energy has careened upward, more than doubling between 2000 and 2017. Eurostat data on renewable energy and forestry reveal that wood comprises about 35 percent of total renewable energy inputs in the EU, though actual delivered heat and electricity are lower because the technologies for converting inherent energy to useful energy are extremely inefficient. Fuelwood now comprises about a quarter of all forest harvesting in the EU, and total consumption of wood for energy has risen to over 400 million tons a year.

A small but increasing portion of this tonnage is in the form of wood pellets, which burn hotter than green wood chips and are easier to ship and handle, making them an effective substitute for coal and residential heating fuels.

Much of the EU's forest industry operates under strictures, with the result that, as demand for "energy wood" increased, so has harvesting in less regulated forests, especially in the southern US and Canada. There, the wood-pellet industry has grown exponentially, but it has also expanded in the less scrutinized corners of Europe, such as the boreal bog forests of Estonia and the ancient forests of the Carpathian Mountains in Slovakia, Ukraine, and Romania, home to the lynx, bears, and wolves of old European folktales.

Wood pellets are still just a fraction of the total wood burned for energy in the EU, yet, even so, the industry's impacts have been horrendous. The wood-pellet industry has become particularly

controversial in the American South, where a company named Enviva, the largest wood-pellet producer in the world, set up shop and quickly got to work liquidating forests. The South is known as the US's "wood basket," thanks to its endless rows of plantation pine, but the wood-pellet industry has also targeted natural forests, including some of the most carbon-rich, biodiverse wetland forest ecosystems of the eastern United States.

Hardwoods are a preferred pellet feedstock because the processing, grinding, cooking, extruding, and cooling of wood pellets made from pine emit large quantities of volatile organic compounds (VOCs), a class of federally regulated pollutants. Enviva did not want to pay for the installation of VOC pollution-control technology at some of its plants, so officials in the state of Virginia who issue air permits instead required the company to use a minimum amount of hardwood feedstock in order to reduce VOC emissions. Soot emissions have also emerged as a chronic problem at wood-pellet production plants in the US South.

Clearcutting is never pretty, but there is something especially sickening about seeing a forest annihilated for supposedly green energy. The wood-pellet industry's excesses—including its misleading claims that it uses only "forestry residues," commonly understood to be the tops and limbs of trees that have otherwise been harvested for lumber—are exposed in a half-hour documentary, *Burned: Are Trees the New Coal?*, made by Lisa Merton and Alan Dater of Marlboro Productions, and now streaming for free at Link TV (full disclosure: I gave technical advice to the filmmakers and appear in the film). The film features the intrepid staff of a North Carolina environmental group, Dogwood Alliance, as they wade chest-deep though snake-infested wetlands to reach forest clearcuts and then follow trucks loaded with logs back to the pellet plant.

The film then follows the pellets as they are shipped overseas and burned for electricity, including at Drax, a 4,000 MW power plant in the UK that has converted four of its six boilers to burn wood pellets instead of coal, and currently provides around 7 percent of the UK's electricity. The scale of this operation is astounding, with a year's worth of pellets consumed by Drax representing wood mass approximately equivalent to clearcutting a forested square extending to eighteen miles on each side.

Not content with the existing supply of pellets from Enviva and other companies, Drax has built its own pellet plants in the US. The paradox of Drax's investment in such "vertical integration" is that it will likely make the company more vulnerable when the bioenergy scam inevitably fails. In the meantime, though, Drax receives renewable energy subsidies funded by the British public to the tune of about a billion dollars a year, or $2.78 million per day, as of 2017.

While wood pellets from North American forests feed Europe's large biopower plants, much of the biomass harvested within the EU ends up as green wood chips that fuel thousands of smaller heat and power plants, and as pellets that are sold for residential and commercial heating. Traditional firewood harvesting also still constitutes a large share of this domestic use. Wood fuels are shipped all over the EU, and the fragmented nature of the industry, with tens of thousands of suppliers, means that there is little transparency in the supply chain and an increasing risk of wood coming from forests that are supposed to be protected.

Illegal logging happens for all kinds of reasons, but the demand for energy wood is an increasing driver, as previously "low-value" wood can be monetized. Working with the Environmental Investigation Agency, the Romanian nonprofit Agent Green has exposed, sometimes at great personal risk, how wood logged out of the primeval forests of the Carpathians ends up as firewood or bagged wood pellets sold at Austrian hardware stores as a source of "green" heat. Analysis of satellite imagery reveals tree cover decimated throughout the Carpathians—and indeed, the same liquidation of forests is happening in Estonia, Latvia, the southern US, and British Columbia in Canada. These are all places where the wood-pellet and biomass industries have taken hold and are adding to existing pressures on forests.

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How, then, did trees from southeastern US we-

tlands and ancient European forests come to be classified as a zero-carbon renewable energy source—not just in the EU, but also in Japan and Korea? For these countries, too, are increasingly importing wood pellets from more forested nations as they phase out coal. The rationalizations involved in this scheme induce moral and intellectual whiplash, because they seem to shift constantly, and ultimately, to make no sense.

Countries all over the world report their greenhouse gas emissions annually to the United Nations. International carbon-accounting rules require carbon loss from forest harvesting to be reported in the "land sector." The first problem is that harvested forest wood is not reported as an emission, even if it is burned for energy, but simply shows up as a reduction in that country's reported forest carbon uptake year to year. However, since the lost forest carbon has ostensibly already been noted in the land sector, energy sector emissions of CO2 from burning the resulting biomass are counted as zero, to avoid counting the carbon loss twice.

Although it inevitably undercounts forest-harvesting impacts, this system by and large works as a way of characterizing gross fluxes of forest carbon at the national level. The problem is that in justifying subsidies for renewable energy, policymakers and forest industry representatives (who may sometimes be the same people) have reified the concept of bioenergy as counting as zero when burned, to bioenergy actually having emissions of zero globally. This means that when it comes to financial support, bioenergy is usually treated as equivalent to zero-emissions technologies such as wind and solar as a way of mitigating climate-warming.

Wood-burning power plants in fact emit more CO2 per megawatt-hour than even coal plants. In order to reconcile this physical reality with the billions provided in subsidies intended to reduce emissions, the biomass industry has come up with more and more outlandish explanations for why burning trees should be considered automatically carbon-free.

When annual crops are used to make liquid biofuels like corn ethanol, the biomass portion of the fuel's net emissions is considered carbon-neutral because yearly crop regrowth and carbon uptake are assumed to offset the CO2 emitted by fuel combustion the year before. Clearly, this argument does not work for forest biomass, because trees take decades to regrow. Deprived of the regrowth argument, the biomass industry claimed for years to utilize only mill waste and forest residues from sawtimber harvesting (wood that, it was claimed, "would decompose anyway"), even when the industry was deliberately cutting forests for fuel. For far too long, policymakers accepted similar claims from the wood-pellet industry, even as environmental groups on the ground documented widespread clearcutting and the use of large-diameter timber as pellet feedstock.

Lost in this argument, though, was the important fact that even if the biomass and pellet industry were only using forestry residues, burning those residues emits CO2 instantly, while the same wood left to decompose emits it over years, if not decades. Thus, far from being zero-carbon, the cumulative net emissions from burning forestry residues for fuel still speeds the transfer of forest carbon into the atmosphere, and the accumulated net impact of such emissions likewise speeds warming.

When the pellet industry ran out of road for its false claims about residues, it came up with a new rationale to justify biomass as instantly carbon-neutral: as long as forests are growing more wood than is being cut, and are thus harvested "sustainably," burning any of that wood has zero net emissions. This sophistry gained a surprising amount of traction with policymakers considering it essentially postulated that the carbon just disappears, thus violating a basic physical principle of the conservation of mass.

By this logic, even as the biomass industry levels more forest, it must claim offsetting carbon uptake in an ever-increasing area of forests elsewhere to neutralize those emissions. But this notion quickly bumps up against the reality that the amount of carbon locked up in forests is decreasing globally;

Whyalla Pellet Plant from Hummock Hill. .
Photo: Stephen Edmonds

there is no epic and immediate regrowth on this planet that is compensating for all the supposedly sustainable harvesting. (The correct accounting approach, in fact, recognizes that forest carbon uptake is already counted as offsetting a portion of existing fossil-fuel emissions; the biomass industry's claim seeks to double-count that benefit.)

The concept of carbon neutrality is so central to the biomass industry that if it were overturned, the entire rationale for the industry would virtually disappear. Companies know this, which is why they continually make misleading statements such as Enviva's claim that burning its pellets "reduces" greenhouse gas emissions compared to burning fossil fuels. The company does not reveal that this claim relies on reporting only fossil-fuel CO2 emissions from manufacturing and transporting pellets, and on simply not counting the CO2 coming out of the smokestack when the pellets are burned.

Since publicly traded companies like Enviva have a duty to disclose information that is material to shareholders' interests—and a corresponding duty not to make false statements—my group filed a complaint with the Securities and Exchange Commission against the company in 2016 over its misleading claims about emissions. On the recommendation of the SEC's secretary, we also petitioned the SEC for a rule-making that would require all publicly traded bioenergy companies to disclose their real emission impacts. We still await action from the SEC, even as billions more dollars flow into "green" bioenergy investments.

It's not just the companies that want to ignore emissions. Pro-bioenergy legislators in both the US and the EU also regularly mislead the public on the impacts of the industry. In the US, Maine Senators Susan Collins and Angus King, both strong biomass boosters, shoehorned a rider into a congressional appropriations bill, enacted in 2018, that forces the EPA to treat forest biomass as carbon-neutral—despite the recent findings of a multiyear EPA task force, which concluded that burning wood can have significant net emissions. (One of the more darkly humorous moments in Burned is watching Senator Collins spout, almost verbatim, talking-points scripted by biomass industry lobbyists in a floor speech on bioenergy.)

The US senators and their industry allies hoped to build markets for biomass by replacing coal. Unfortunately for them, not even the Trump EPA was up to the deception required to claim that burning biomass reduces emissions.

Despite the legislative order to treat biomass as carbon-neutral, the EPA's final "Affordable Clean Energy" rule concluded that burning biomass emits more CO2 than fossil fuels, and that co-fi-

ring biomass with coal degrades a power plant's efficiency. So much for the "trees are growing somewhere" theory.

In the EU, though, pro-bioenergy legislators have been more adept. The EU sets the rules for renewable energy implementation and subsidies in member states, revising its Renewable Energy Directive every ten years. Horrified by the accelerating forest carnage under the current directive, the nonprofit and scientific communities lobbied hard at the EU for constraints on the use of forest wood as a renewable fuel in the 2018 RED that sets policy for 2021–2030.

The EU's own team of advisers, the European Academies Science Advisory Council, warned the EU's president, Jean-Claude Juncker, in January 2018 that: *The legal mandate to record forest biomass-fired energy as contributing to the EU's renewable energy targets has had the perverse effect of creating a demand for trees to be felled in Europe or elsewhere in order to burn them for energy, thus releasing the carbon into the atmosphere which would otherwise stay locked up in the forest, and simultaneously drastically reducing the carbon sink strength of the forest ecosystems… [T]he current use of imported pelleted forest biomass was leading to increased greenhouse gas emissions with no guarantee of when (or even if) the additional carbon released to the atmosphere would be offset by forest regrowth.*

Rather than conclude that the biomass subsidy program is based on a fraud, the EU policymakers' response was to devise a Potemkin set of "sustainability" criteria for biomass that will do almost nothing to protect forests and the climate. The revised directive claims that the new constraints will "continue to ensure high greenhouse gas emissions savings compared to fossil fuel alternatives" and "avoid unintended sustainability impacts"—as misleading a statement as I have ever seen in public policy.

Since all the usual tactics of the nonprofit community had failed, including documentary photos, briefings, and scientific evidence, we felt we had no choice but to sue the EU (with the European Parliament and Council as defendants) over the new rules. My organization thus coordinated a March 2019 lawsuit that challenges inclusion of forest biomass in the new renewable energy directive. We worked with plaintiffs from the EU and the US who demonstrated in their testimony how the biomass industry is causing direct harm to their health and livelihoods, and we are now waiting to hear whether the EU court will accept the case.

Climate science shows that to avoid the most catastrophic warming impacts, the world must cut its carbon emissions in half in the next few years, and be carbon-neutral, balancing emissions with carbon uptake, by 2050. There is no way to achieve this without a vast restoration and expansion of the world's forests. Provided these forests are natural and not monoculture plantations, this initiative could also help to address another great environmental crisis we face, the extirpation of so many of the world's species. Many member states have signed on to the EU goal of carbon neutrality by 2050, but a great deal must change: right now, EU member states allocate billions in renewable energy subsidies to promote wood-burning, but little to forest restoration.

A new law enacted in Slovakia is a brave start, given the typical bullying from the forest industry. After forest activists at WOLF Forest Protection Movement (the lead plaintiff in the biomass lawsuit) demonstrated damage to forests from biomass harvesting, the government last year restricted bioenergy subsidies to mill residues and energy crops, eliminating subsidies for forest wood.

On this side of the Atlantic, similar rules in Massachusetts took low-efficiency wood-burning power plants off the renewable energy menu in 2012—although the state's current Republican governor seems intent on overturning those forest protections. It really is this simple: to mitigate climate change, we need to grow more trees, not burn them for energy. Policymakers need to wake up, because we're running out of time.

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Using language to make the world of fossil fuels strange and ugly

By MATTHEW HOFFMANN
The Conversation

They weren't getting it.

I had a room full of bright first-year university students in front of me, but confusion reigned as I tried to describe how embedded fossil fuels are in every aspect of society.

"OK, let's try this. What do you call a car that uses both gasoline and battery power?" Relieved to be asked a question they could confidently answer, a few students piped up: "Hybrid car!"

"Right. Now, what do you call a car that you plug in?" The number of students joining the chorus grew: "Electric car!"

"Right again. So, what do you call a car that runs only on gasoline?" The response was a bit delayed this time, but some wry smiles of understanding accompanied the answer: "A car."

Making the invisible visible

Despite dire warnings of climate catastrophe and research showing that fossil fuels need to stay in the ground, the fossil fuel system remains dominant, normal and even invisible.

We have cars and electricity and home heating and transportation systems and agricultural and industrial production. None of them normally have adjectives that denote their reliance on fossil fuels. That reliance is natural and therefore invisible and unspoken. Normal.

As a society, we have not made the status quo strange and the negative aspects of fossil fuel dominance visible in our language and labels: dirty, gas-powered cars; polluting, coal-fired electricity; unsustainable, oil-dependent agriculture. And we need to.

In their book *Ending the Fossil Fuel Era*, Thomas Princen, Jack Manno and Pamela Martin explore U.S. philosopher Richard Rorty's provocative idea that major social change is in part dependent on "speaking differently" to the problem of climate change. Making the fossil fuel world strange and negative in our thoughts, speech and labels is part of pursuing the transformation that we need to stave off the worst implications of climate change.

Feminist and critical race scholars taught us this lesson in other realms. Language matters because it helps us to construct our reality. Adjectives or the lack thereof can signal the dominant and non-dominant entities.

If your cause or identity has to use, or is subject to, adjectives, you are often at a disadvantage. You're not the norm. You're not dominant. Health and women's health. Students and Black students. Such modifiers serve to marginalize.

A number of climate policy scholars are convinced that part of the transformation we need in order to address climate change is for people and societies to positively imagine and envision a low-carbon life, taking for granted the fossil fuel-free world on the horizon.

Perhaps the best indication that societies are succeeding on climate change is not the increase of renewable energy capacity or investments in low-carbon infrastructure, but instead the transformation of adjectives — when descriptors like "renewable" and "low-carbon" be-

come superfluous because they are the natural, normal state of energy and infrastructure.

Language as strategy

Changing our language and labels can be part of active strategies to bring about change. It may not be as dramatic as political debates and court cases over carbon taxes or marches in the streets. But this kind of language strategy could contribute to change by making the fossil fuel-dominated world visible and strange, and the low-carbon world normal.

An example of this active language work just emerged in the United Kingdom, where the *Financial Times* reported that the London stock exchange, known as the FTSE, recently changed the labels of energy stocks: *"BP and Royal Dutch Shell, and other U.K.-listed exploration and production companies like Cairn Energy and Tullow Oil, are now grouped in the 'non-renewable' index, previously called 'oil & gas producers.'"*

Just in case anyone thinks this is merely a semantic change, the Financial Times story goes on to note that Norway's $1 trillion sovereign wealth fund, which is actively decarbonizing, will use the classification to: *"…determine which fossil fuel companies to divest, with the changes potentially affecting the inclusion or exclusion of an oil company or security from the fund's blacklist."*

This strategy of making the fossil fuel world strange and negative must become standard as we transition to a low-carbon future.

Journalists, thought leaders and politicians all have a role to play here. They should commit to putting descriptive and even negative adjectives on things that do not normally have them — modifiers like "gas-powered," "polluting," "high-carbon" — both in speech and on labels that have material impact, like the categorization of stocks on the FTSE index.

Adjectives are not magic, and they do not preclude the hard work of political change. But if imagining and speaking the world we want to see is crucial in building support and momentum for transformation, then what is visible and invisible, strange and normal, positive and negative, has to change.

I told my students I would have more hope for the prospects for avoiding climate catastrophe when "gas-powered" was necessary to modify "car" because the natural state of cars had changed to electric. Changing how we think, talk and label the world we're in and the world we'd like to be in is part of that transformation.

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Kayenta Coal Mine.
Photo credit: Peabody Energy

Clean coal: a mirage or a forced marriage?

By ALICE MASILI

ONE

What's the real meaning of affordable energy? Something you can buy cheaply or something you can rely on to improve your well-being? The answer is not straightforward. The most developed economies have built their wealth over the last two centuries, mainly thanks to fossil fuels and in particular to coal.

However, the scientific literature that documents how fossil fuels pollution causes serious human pathologies is boundless and, in particular, identifies in coal, the main responsible for the highest emissions. Coal-Fired power plants have a negative impact not only on the environment but also on our health. Burning coal releases other greenhouse gases in addition to carbon dioxide, heavy metals such as arsenic and mercury, fine and ultra-thin powders, sulfur dioxide and nitrogen dioxide, to name a few.

Recently, the research group coordinated by Stefanie Hellweg (Institute of environmental engineering in Zurich, Switzerland) has created a very sophisticated calculation model to estimate the adverse side effects produced by coal for each of the 7,861 coal-fired power plants operating in the world. The study, published on Nature Sustainability, provides the most detailed worldwide situation of site-specific airborne coal power plant emissions, including mining, coal preparation, trade and transport, mechanical power plant modelling and flue gas treatment.

Toxic substance emissions are principal from China, US, India, Germany and Russia and depend on the quality of the coal. Researchers link coal rank to the power plant with a transport model, which uses, where possible, plant-specific coal origin data. The coal rank considered are anthracite, bituminous coal, sub-bituminous coal and lignite.

Unlike the global effects of greenhouse gas emissions, the health effects caused by particulate matter, sulphur and nitrogen oxides, and mercury are closely related to the emission zones as they result from the actual intake of humans. It follows that the density of the local population near the power plant is the dominant parameter that determines the absolute impacts on health. The regions showing the most significant exposure risks are India, eastern China, central Europe and the East coast of the United States.

The comprehensive framework of coal energy production highlights the gap between privileged and disadvantaged regions. In wealthier countries, where environmental awareness is growing, more prudent choices have been made on the coal front using high-quality fuel, with a high calorific value and suitable technologies for treatment and fume abatement. A rare but virtuous example comes from Japan, where is located the cleanest coal plant in the world in terms of emission intensity: unit 2 at the J-POWER Isogo Thermal Power Station, an ultra-supercritical 600 MW unit, unusually located to 6 kilometres from central Yokohama. The emissions reduction has been accomplished through a costly but also highly effective system that captures SOx, mercury, and NOx while only using 1% of the water required by conventional wet FGD systems. Thanks to an accurate layout of the green area, the visual impact has also been reduced.

Even China in recent years has invested in modern technologies for the latest coal-fired power plants. Despite this effort and though policies limited the operation of plants near major cities, the risks of emissions increased due to the elevated production of energy from coal, heavily contaminated by mercury, and the high population density.

By contrast, the least developed, or least sensitive countries, which are often large coal exporters use or hold low-quality coal for the domestic industry, which burns in obsolete power plants with inadequate treatment of fumes and sequestration of sulphur dioxide. According to Hellweg's research, the most polluting power stations probably burn low-grade coal, such as in Poland where a significant part of the electricity is supplied by lignite. There are also states where risks are associated with high population density, like in the region of

Vado Ligure Tirreno Power plant.
Photo credit: Davide Papalini

Pretoria in South Africa, or with inadequate fumes treatment, as in Moscow, Russia, or near Jakarta in Indonesia.

According to the study since 2000, there has been a decrease in greenhouse gas emissions, mainly due to the introduction of highly efficient technology, such as super-critical and ultra super-critical coal power plants in China and India. Unfortunately, they have not replaced the whole fleet yet. When emissions drop, there will be significant health improvements in those places.

A confirmation of the Swiss research main findings comes from the study "Mortality and hospitalisation associated with emissions of a coal power plant", published in Science of the Total Environment. «The health risk is so high that, the sooner we get out of coal, the better. Decarbonisation is necessary, not only to save the climate, but also human lives ". The appeal of Fabrizio Bianchi, head of the IFC-CNR research unit of Pisa and co-author of the epidemiological survey, is unconditional.

The research was performed on 144.019 people residing in 12 municipalities around the coal power plant of Vado Ligure (Italy) from 2001 to 2013 or in sub-periods. The results showed an excess of mortality in the areas with the highest exposure of polluting sources equal to 49 per cent. In particular for disease to the circulatory system (men + 41%, women + 59%), the respiratory system (men + 90%, women + 62%), the nervous system and sense organs (men + 34%, women + 38%) and to lung cancer among men (+ 59%). Even the analysis of hospital admissions has provided results consistent with those of mortality. These findings, therefore, indicate that it is necessary to reduce the exposure to pollutants, keeping concentrations emitted well below legal limits. These legal limits are often considerably higher than those suggested by the most recent scientific evidence.

The Italian owner company Tirreno Power, now on trial for environmental and health disaster, immediately branded the IFC-CNR study as "based on old data". Epidemiologists countered that those adverse events are not guessed or potential, as Tirreno Power stated, but deaths and illnesses that really happened".

Nowadays, when we talk about coal, the attention is generally focused on the climate and on the environmental pollution associated with its combustion, overlooking the positive economic impacts that activities related to its use may have. According to the IEA Clean Coal centre report "The economic and strategic value of coal", the use of coal has positive effects not only on related activities, such as mining and production of electricity and heat but also on entire communities and the supply chain closely linked to the industrial system.

The ripple effect on the rest of the economy generates benefits in terms of direct, indirect and induced wealth. Among the main positive impacts: employment, support for communities with tax revenues, affordable electricity supply, resilience in the electricity grid and reliability of primary energy supplies. In Asia, the coal sector still provides a driving force for economic growth and employment. China covers half of the production and consumption of coal in the world, and the coal sector alone employs about three million people.

When it comes to coal exploitation China and the rest of the world are not on the same wavelength. In the period between January 2018 and June 2019, countries outside China have decreased their total coal capacity by 8.1 gigawatts (GW) - shutting down old plants turned out to be faster than building new ones. But over the same period, China increased its coal fleet by 42.9 GW (NGO Global Energy Monitor).

In emerging economies and developing countries, as India

and Pakistan, the internal resources of coal and lignite play an essential role in the security of supply, helping to guarantee energy security and reduce high dependence on imports. In Africa, too, the aim is to increase the role of coal in the energy sector to promote fuel diversity and lower oil and gas dependence.

In 2023, Africa will be the most populous continent in the world and providing energy at a low cost is the next challenge on the global energy market.

On the contrary, the European economy of coal-fired power plants is not at all prosperous. According to the latest Carbon Tracker report, "Apocoalypse Now", four out of five plants, in the EU borders, do not guarantee profits but losses which have been estimated by the think-thank financial analysts, at about 6.6 billion euros for the only 2019.

The continuous fall in the cost of renewable energy, the regulations on air pollution and the recent collapse of gas prices in the EU have made coal less and less competitive (even though coal price itself has fallen).

A severe blow came from the soaring rights for CO2 emissions, whose value has tripled in the last year, stabilising between 25 and 30 euros per ton: levels that, for the first time in the history, make little even lignite convenient, says Carbon Tracker.

Unless a reversal of the market situation occurs, coal could theoretically become extinct for economic reasons in Europe before 2030, the desired date for the phase-out of the Paris climate agreements. But it is a matter of theory. The phase-out has already begun. Compared to 2018, the generation of hard coal decreased by 39%, whereas lignite by 20. Carbon Tracker estimated that 76% of EU hard coal and 84% of lignite generators are currently at a loser. The Germany, which however set the final closure of all its plants back in 2038, could lose € 1.97 billion in 2019 and, according to the IEA scenario over 2°C, the EU should be coal-free by 2030.

Losses do not affect everyone in the same way. In some countries, thanks to government aid and high prices in the electricity market, burning coal can still be convenient at least from a financial point of view. An excellent example of large profits comes from Poland, where the government heavily subsidises the coal sector, from which about 80 per cent of the national energy mix derives, and the prospect is to continue to depend on coal at least until 2050.

The growing tendency among western European countries to formally announce policies for the gradual abandonment of coal, Eastern Europe still depend heavily on hard coal and lignite. Coal accounted for 80% of total production in Poland, 43% in the Czech Republic and 39% in Bulgaria. It is also a truth that the growth of renewable energies in those countries struggles due to the lack of political subsidies.

Although a gradual elimination of the use of coal from the energy mix is in progress, and there is no way back, there are still large communities that depend heavily on local mining. The gradual elimination or complete elimination of the carbon assets will hit hard in those communities.

The decarbonisation process will undoubtedly bring benefits to the environment and health. Still, the complex transition phase of the industrial economy will have to be tackled comprehensively, providing full support to the entire supply chain closely linked to the coal industry system. It is a necessary action to avoid choosing between starving or getting sick.

ONE

Isogo Thermal Power Plant,
Yokohama City., Japan.
Photo credit: Σ64

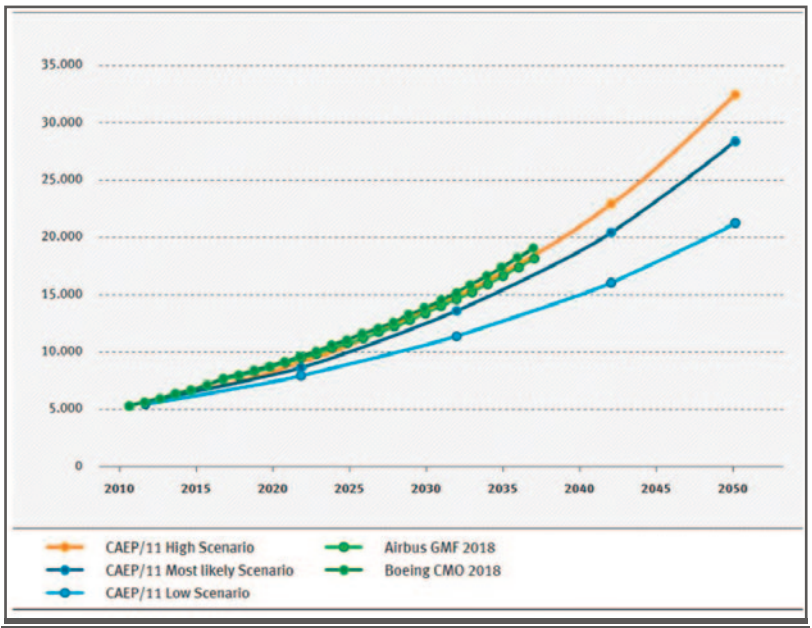
Renewable fuels will not solve aviation's climate dilemma

By SÖREN AMELANG
Clean Energy Wire

Powering aeroplanes with renewable fuels is crucial for making flying less climate-damaging, but it will get aviation nowhere near climate neutrality, environmental NGOs, industry representatives and researchers agreed at a conference in Berlin.

They said that making synthetic fuels with renewable power – so-called power-to-liquid – is a top priority for the rapidly growing sector and requires immediate government action to get the technology off the ground to reach industrial scale so it can have a real impact soon. But experts also warned that planes' CO2 output is only part of the problem, because their "non-CO2 effects" - such as condensation trails, particles and other greenhouse gases emitted at high altitudes – contribute even more to the climate crisis.

This is why Germany's environment agency (UBA) has proposed a host of measures to make flying more environmentally friendly. However, it also suggested in a new study that flying longer distances will never be climate-neutral.



A comparison between aviation growth scenarios.
Photo: UBA / Institute for Applied Ecology

Urgent action is needed around the globe to reduce aviation's often underestimated climate impact if the targets of the Paris Climate Agreement are to be met, industry experts said at a conference held in Berlin. However, a number of factors make it particularly difficult to get emissions in the sector down. Experts singled out strong growth rates – current projections assume passenger kilometres will grow world-wide almost five percent per year –, the severe climate effects unrelated to direct CO2 emissions and caused by condensation trails and many other factors, and the need for international agreements.

"Aviation is probably the most difficult sector on the way to reaching the targets of the Paris Agreement," said Jürgen Landgrebe, head of the climate division at Germany's Federal Environment Agency (UBA), which hosted the conference.

No silver bullet

Conference participants were in broad agreement that synthetic fuels made with renewables are key for significantly reducing aviation's direct CO2 emissions. But they also warned that the technology, which is often referred to as "power-to-liquid" and does not yet exist on an industrial scale, is no silver bullet.

"A single solution simply does not exist," said environment minister Svenja Schulze. "We need a whole range of measures," she said with reference to taxes and other economic incentives to push the transition, emission reduction limits, quota for renewable fuels, and shifting to alternative modes of transport. The

measures mentioned by Schulze mirrored the recommendations of a new study published by the environment agency. It recommended raising existing taxes and introducing them for kerosene, replacing domestic flights with rail travel, and supporting climate-neutral fuels.

At present, air traffic taxes only amount to one tenth of that levied on other modes of transport in Germany despite air traffic's status as the most climate-damaging mode of transport, the UBA said.

"We have to build up a market for power-to-liquid. But we can only provide the initial impetus, and won't be operating international production facilities," Schulze said, adding that building up an infrastructure for renewable fuels required international cooperation and treaties.

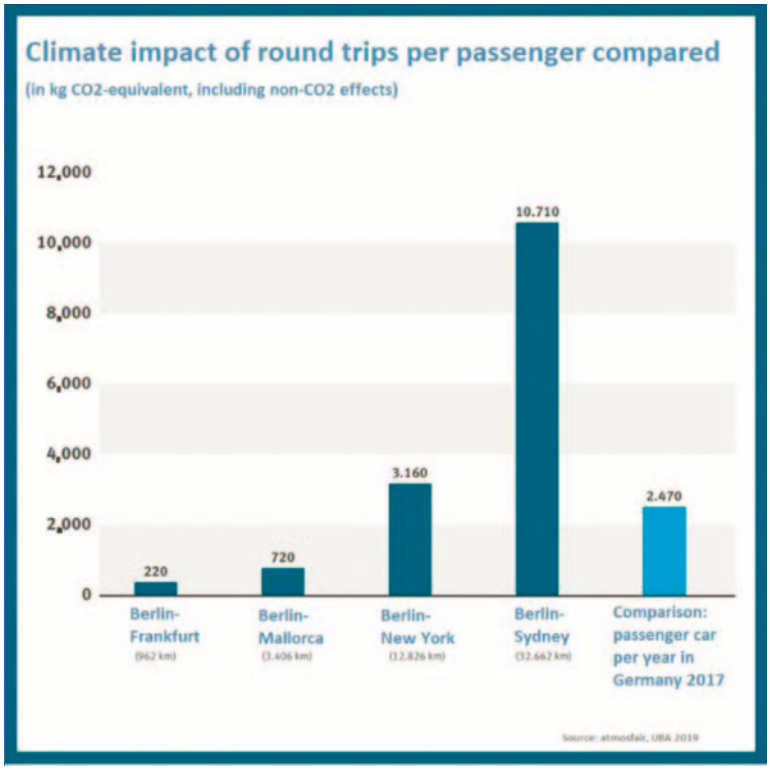
"I'm worried that we won't have enough renewable fuels," Schulze said, adding that huge demand was also expected from the chemical and steel industries, where no alternatives existed to reach CO2 neutrality.

In its study, the UBA recommended extending public support for developing power-to-liquid installations in Germany and abroad, because the country will very likely have to import large quantities of the green fuel in the future. It also proposed binding quotas for adding a climate-neutral alternative to the kerosene used today. By 2030, ten percent of aviation fuel should be sustainable, the UBA said.

The experts cautioned that using green fuels will push up demand, because people will fly more if they can do it with a cleaner conscience – a phenomenon known as a rebound effect, which might sharply reduce green fuel's positive effects.

Sustainable aviation academic Stefan Gössling from Sweden's Linnaeus and Lund Universities pointed out that not all countries were as focused on renewable fuels as Germany. "Norway focuses on battery electric planes, the UK on hybrid electric models with biofuels, and Sweden on biofuels."

Gössling also cautioned that betting on future technologies to cut emissions is an open invitation to postpone tackling the problem by other means today – for example by flying less.



Non-CO2 effects mean "there will never be a truly climate-neutral flight"

Focusing on power-to-liquid also posed the risk of neglecting the very climate-damaging side-effects of flying, which are unrelated to CO2 emissions – such as condensation trails, particles and other greenhouse gases emitted at high altitudes, conference participants warned. The UBA said these so-called "non-CO2 effects" likely harm the climate twice as much as direct CO2 emissions, according to most estimates. However, these are ignored by many industry lobby groups and the UN's International Civil Aviation Organization (ICAO), according to the UBA. It also remains an open question how exactly to deal with these effects, according to industry experts.

"We still have no solutions for the non-CO2 effects," the UBA's Landgrebe said. In its study, the UBA said both aviation's direct CO2 emissions and the non-CO2 effects should be integrated into the European Emissions Trading System (ETS). Atmospheric scientist Robert Sausen from the German Aerospace Center (DLR) said it might be possible to halve aviation's non-CO2 effects on long-distance flights in the longer term. These effects depend strongly on weather conditions, altitude, time of flight, and countless other factors. "There will never be a truly climate-neutral flight," Sausen said.

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Brazil sugarcane growth can meet biofuel need and not drive deforestation

By CLAIRE ASHER
Mongabay News

Sugarcane production in Brazil could expand by more than 5 million hectares (19,305 square miles) by 2030 to meet demand for ethanol biofuels, according to a study published in the journal Energy Policy – with potential impacts on the nation's carbon emissions and deforestation.

Biofuels are liquid fuels produced from crops, such as biodiesel produced from soybeans and ethanol made from fermented corn or sugarcane. They've been presented by advocates as a silver bullet for reducing global greenhouse gas emissions, but critics argue that the clearing of native vegetation to make way for biofuel plantations, and the carbon emissions associated with that land-use change, can exceed the emissions savings gained by avoiding fossil fuels.

Despite these concerns, Brazil has embraced ethanol biofuels, and is now a world-leader in their production. The majority of the country's sugarcane ethanol is sold to domestic consumers, who in 2018 used 33 billion liters (7.26 billion gallons). This biofuel surge is partly driven by Brazilian law which requires that gasoline be mixed with 27 percent ethanol to produce a blended fuel. In Brazil, the majority of light vehicles are known as "flex-fuel," able to run on either blended fuel or 100 percent ethanol, giving individual drivers a choice.

Measuring future demand

The study, led by Milton de Andrade Junior, a PhD researcher at Australia's University of Queensland, investigated the impact on sugarcane plantation expansion by modeling a range of ethanol demand scenarios likely by 2030 based on variable GDP projections, population growth, and fuel price forecasts.

Researchers considered three policy scenarios: a high-demand scenario in which renewable fuels are favored and the mandated fuel

blend increases to 35 percent ethanol; a low-demand scenario where fossil fuels are preferred and the mandate decreases to 20 percent ethanol; and a business-as-usual scenario where the blend remains steady at 27 percent. The authors predicted ethanol demand would increase by 17.5 million tonnes (of oil equivalent) in the fossil fuel scenario, and 34.4 million metric tonnes in the renewables scenario, representing an increase of 11 percent and 119 percent, respectively, over current levels of production. Policies favoring fossil fuels would lead to demand for 1.2 million hectares (4,633 square miles) of new sugarcane plantations by 2030, whereas renewables-focused policies would spur that expansion to 5 million hectares (19,305 square miles) – an area of new production roughly the size of Costa Rica.

David Lapola, an earth-system modeller at the University of Campinas in São Paulo state, not involved in the research, says he's not surprised by the findings. "Of course, the demand for transport and the policies related to that ... will affect the future demand," he said. However, "the good thing is that they put that in numbers."

Lapola does point to some uncertainties: ethanol isn't the only possible product of sugarcane – harvested canes can also, for example, be processed into sugars for use in food – something he says the authors didn't take into account. So even if Brazil's domestic demand for ethanol subsides, sugarcane production may grow along with global demand for sugar.

Managing production to reduce emissions and deforestation

While sugarcane-based biofuels are typically dubbed as renewable, "whether ethanol use actually reduces greenhouse gas emissions depends on how the sugarcane is produced," explains geoscientist Akenya Alkimim from the Universidade Federal de Vicosa in Minas Gerais, Brazil. Last year Alkimim reported the results of computer modeling, showing that for every hectare deforested in the Amazon, sugarcane plantations would release 608 tonnes of carbon dioxide into the atmosphere, creating a total "carbon debt" that would take 62 years of biofuel production to payback. So, she asks, "What would be the purpose of switching over to a 'clean energy' [renewable biofuel] if it would result in a higher overall carbon debt?"

However, if Brazil meets its rising sugarcane production needs not through new deforestation, but by converting existing pasture to cropland, that would release less than a tenth of the CO_2 and take only six years to repay the carbon debt.

The need for intensified cattle ranching

Expansion of sugarcane into existing pasture could still indirectly drive increased carbon emissions if that land-use shift merely displaces cattle from already degraded grazing lands, causing ranchers to deforest elsewhere. In a 2010 study, Lapola estimated that sugarcane expansion could result in up to 52,000 square kilometers (20,077 square miles) of this kind of indirect deforestation by 2020, creating a carbon debt that would take 40 years to repay.

Thankfully, this worst case scenario has not been borne out. Instead, Lapola and colleagues have observed a different sequence of events: cattle ranchers giving up degraded pasture, tend to intensify land use by multiplying the number of cattle grazed per hectare elsewhere, a best use practice known as "increased stocking density" which minimizes new deforestation.

This land use intensification trend is predicted to continue in de Andrade Junior's models, with increases in stocking density crucial to preventing sugarcane expansion from driving deforestation. "Since the stocking rates in Brazil are very low compared to their potential... higher pasture yields spare land for agriculture expansion without compromising beef and milk production," said de Andrade Junior.

Accounting for changing government policies

In the present study, de Andrade Junior and his colleagues applied GLOBIOM-Brazil, a land use model created by Brazil's to predict what types of land would bear the brunt of the projected sugarcane expansion. The team suggests that government fuel policies will have only a minor effect on future native vegetation loss, because all three study scenarios predicted that expansions would take place almost exclusively within pastures and not require new deforestation.

This is partly because the models included the Zoneamento Agroecologico de Cana-de-açúcar (ZAE CANA) – government zoning rules approved in 2009 that exclude federal subsidies for sugarcane producers in environmentally sensitive regions, including the Amazon and Pantanal wetlands. But on November 5, President Bolsonaro issued a decree revoking zoning regulations for the sugarcane industry, opening up the Amazon and other areas of primary forest to expanded cane cultivation. While the government claims the move is necessary to reduce bureaucracy and boost the ethanol industry, experts criticized the move, saying that opening up two extremely fragile biomes to sugarcane expansion is unjustifiable – and unneeded.

"Bolsonaro must understand that Brazil does not need to choose between conservation and economic development," Alkimim explained.

Aline Soterroni, the modeling study's co-author, described Bolsonaro's move as "completely unnecessary ... It is possible to meet a high demand for sugarcane ethanol in the coming years by expanding the sugarcane area over low productive pastures, and fully respecting the [zoning rules]," she said. ZAE CANA left around 60 million hectares (231,661 square miles) in Brazil outside the Amazon and Pantanal open to sugarcane cultivation – an area six times the extent of current sugarcane plantations in the country, and more than enough to meet even the highest demand scenario while avoiding primary forest.

The repeal came as a surprise for many, as it wasn't apparently driven by industry pressure. Local industry representatives have previously rejected the idea as an unnecessary risk to the positive environmental reputation of the cane industry, which has historically distanced itself from Amazon deforestation.

In a statement published on the Brazilian Sugarcane Industry Association (UNICA) website, the organisation reaffirmed their commitment to the National Biofuel Policy (RenovaBio), a voluntary initiative that prohibits deforestation and rewards fuel producers that emit less carbon into the atmosphere with "decarbonization credits," which is set to come into force in 2020. Experts hope that RenovaBio combined with the current Brazilian Forest Code, which mandates that 80 percent of privately owned land in the Legal Amazon must be conserved, will constrain sugarcane expansion to degraded pasture and other already existing agricultural land, despite the loss of ZAE regulations.

Staying within these areas serves industry interests because the Amazon and Pantanal ecosystems are poorly suited for cane cultivation and lack existing infrastructure to support new plantations. Areas elsewhere permitted by the now-revoked ZAE included the "most favorable soil and climate conditions for sugarcane crops in Brazil, so producers are naturally likely to favor those regions — regardless of the current political climate," said de Andrade Junior.

"At least in the [next few years] it shouldn't bring much difference to the sugarcane game," agreed Lapola. "There [will be] no sugarcane plantation where there is no mill to process the harvest."

Saving the Amazon to save face

In the longer term, it may not make economic sense for sugarcane producers to expand into the Amazon or Pantanal, because doing so could limit the export market. If even a fraction of Brazil's bioethanol became associated with Amazon deforestation, the entire industry could be subject to boycotts at the consumer-, distributor- or national-level.

"The sugarcane industry doesn't want to get involved in deforestation issues, so they might stay away from the region," said Lapola.

Unlike corn ethanol produced in the U.S., which emits more greenhouse gases than it absorbs, sugarcane ethanol is accepted for import to the EU, Japan and other countries with strict import regulations, giving Brazil a competitive environmental advantage over other big biofuel producers. Amazon expansion could tip the balance on greenhouse gas emissions from sugarcane ethanol, making it hard to market as a renewable energy source and hampering Brazil's own efforts to curb carbon emissions per the 2015 Paris Climate Agreement. Bolsonaro's "decision may put this important commodity under risk of boycott, something that is not in the economic interest of the ethanol sector itself," said Soterroni.

Bolsonaro's ZAE decision a threat to cane industry?

Bolsonaro's repeal of the ZAE coincides with the publication of greenhouse gas emissions statistics for 2018 by the greenhouse gas monitoring initiative Sistema de Estimativas de Emissões e Remoções de Gases de Efeito Estufa (SEEG).

The figures show that Brazil's total greenhouse gas emissions remained stable in 2018 despite increasing deforestation, as a result of increasing bioethanol consumption, which reduced carbon emissions from the energy sector by 5 percent. However, dramatic increases in deforestation and forest fires seen in 2019 make it unlikely that the renewable energy sector can compensate for future surging emissions.

Despite diminishing Amazon and Pantanal protections, ethanol biofuel production may yet turn out to be a practical means of meeting Brazil's growing transportation demands, while avoiding forest loss and keeping carbon emissions low

Alkimim suggests that this combination of factors may eventually lead the powerful Brazilian agricultural lobby, known as the bancada rurlista, to pressure Bolsonaro to reinstate ZAE to avoid tarnishing the industry's renewable energy reputation. The President "will be forced to change his policies if they [negatively] affect Brazilian agribusiness."

Thus, despite diminishing Amazon and Pantanal protections, ethanol biofuel production may yet turn out to be a practical means of meeting Brazil's growing transportation demands, while avoiding forest loss and keeping carbon emissions low. "The conversion of pastures, especially degraded pastures, to ethanol production could be considered as a viable strategy for Brazil to combat GHG [greenhouse gas] emissions," concluded Alkimim. But Lapola warns that liquid biofuels might soon lose their appeal: "I think the authors here, and probably everyone, are underestimating the speed at which hybrids and fully electric cars can dominate the market in the next decade or two."

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Booking the future

By LENORE HITCHLER

ONE

A crystal ball? Tea leaves? Astrology? How do we predict our future? The negative effects of climate change are increasing and will only escalate. Fortunately, fiction can provide creative ideas to deal with this challenging future. This article provides a synopsis of some speculative novels that do just that. These works are categorized as ecotopias.

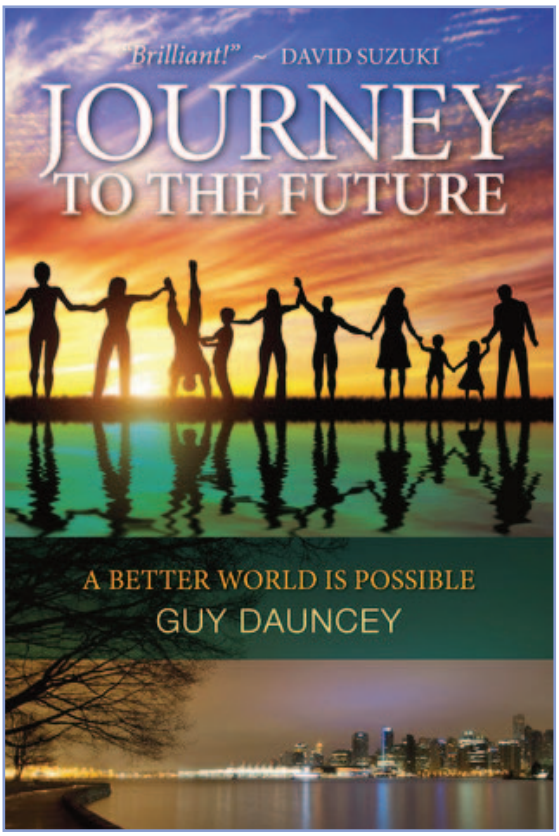
However, before discussing these books, we should concede the limitations of speculative fiction. A large number of adults are simply not book readers. A 2018 Pew Research poll found that one in four Americans hadn't read a single book in the previous year. Even many book readers don't read fiction as shown by the 2012 Survey of Public Participation in the Arts. This study found that of all readers, only 44.4% had read novel in the previous twelve months.

Another hindrance is that speculative fiction is labeled science fiction, and this is a turn-off for many. An informal study by Mark Niemann Ross found on the Science Fiction & Fantasy Writers website reported that only twenty-one percent of respondents had read science fiction.

Thus, the vast majority of Americans don't read speculative fiction. However, it is still worthwhile to consider these books as they provide examples of improving social and environmental conditions. To fight climate change and promote social equality, alternatives to fossil fuels, deforestation, toxic petroleum guzzling agriculture and industry, and wasteful consumption, etc. must be found. Speculative fiction can spark ideas as to how we might accomplish this.

Speculative fiction includes various stories set in the future. Stories are very effective methods of communicating, and the climate change movement has found that stories, as opposed to mere facts, reach many more people. The Viable Cities program in Sweden features Per Grankvist as "Chief Storyteller."

Grankvist discusses the importance of stories when motivating people to act on climate change. He states: *When you tell stories effectively, you have the power to change peoples lives for the better by connecting with them emotionally to make them rethink needs and behaviors, and to engage in being proactive in the inevitable change to climate neutral cities. It's about engaging the heart and the mind.*



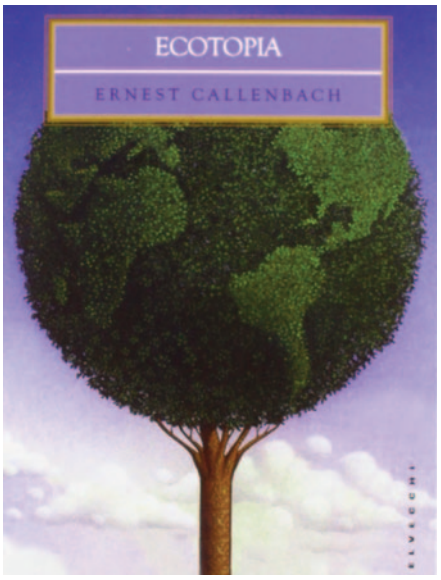
Ecotopian stories envision cooperative, egalitarian, and environmental futures. If choosing to read only one book, *Journey to the Future—A Better World is Possible—An Ecotopian Novel* by Guy Dauncey is highly recommended. The story is written from the perspective of Vancouverite Patrick Wu, who slips through time to explore the city of June 2032. Egalitarian and environmentally sustainable practices are the basic principles of society. The novel is so fact-based that a bibliography and almost one thousand endnotes based on contemporary research and practices are included.

In Dauncey's novel, the global effects of climate change have increased. However, Vancouver has taken active measures to slow down the calamity. The use of fossil fuels has decreased. Solar power, including solar photovoltaics, huge solar floating installations, and wind farms are major sources of energy. Canada has mandated that new construction must follow passive solar guidelines. Pollution is reduced. Agriculture includes organic farming, and permaculture. Garbage is composted. Social conditions have improved with the economic system emphasizing cooperation. There are four-day work weeks, and a guaranteed basic income. Healthcare, food, transportation and childcare are affordable.

Maintaining egalitarianism is essential to citizens. One of Wu's sources, particularly interested in equality, refers to various historical examples of egalitarianism.

For example, the Penan people of Borneo felt that the most significant transgression that people could make was "sihun," which means failure to share. Squamish elders said that "the very thought of owning more possessions than another when someone was in need was inconceivable."

A major criticism of Dauncey's work is that it includes myriads of computers that are pervasive everywhere. The book ignores their vast negative environmental and health effects. These effects include the destructive ramifications of extracting natural resources, particularly toxic metals, that are used in manufacturing computers. The health effects of handling and disposing of computers are also neglected.



Another inspiring novel is *Ecotopia* by Ernest Callenbach. In this novel, Northern California, Oregon and Washington seceded from the United States. Twenty years later newspaper journalist Will Weston travels to Ecotopia to report on the new country. He finds a much more ecological society with less pollution. Energy is solar-based, and plastics are produced from plants rather than fossil fuels. Urban sprawl has been replaced with densely populated cities that are surrounded by forests.

Besides environmental improvements, Weston finds a more egalitarian society. The economics of the country are very progressive. Ecotopians work a twenty-hour week, and they use their extra free time to pursue educational and artistic endeavors. Businesses are worker-owned. Women are politically powerful, and racial minorities control their communities.

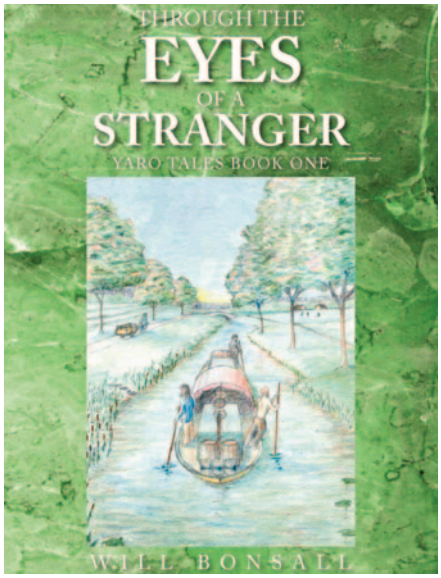
People are physically fit because of both increased walking in their daily life and the use of free bicycles that are found scattered around urban areas. Railroads are another primary form of transportation.

Many readers have criticized the violent team games of younger adult males. However, since the contests are fought with spears, no harm is done to either the environment or to civilians. Military preparation is exclusively defensive, and the country does not engage in regime change.

Dragonfly's Question—Principles for "The Good Life—After the Crash is another recommended ecotopian novel. This novel by Darcy Hitchcock is set eight years into the future. Tess, a resident of Portland, is visited by Joe, her conservative businessman father. Tess is a consultant who helps her clients become more environmentally sustainable. Her father is extremely critical of her lifestyle, and she educates her father on the ways of life that are an improvement on the standard American lifestyle.

Fewer consumer goods are purchased. Thus, people need to work fewer hours. Fewer toxic chemicals are manufactured. Permaculture methods are common, and many people grow organic gardens.

Less waste is produced. Instead of disposing of used products, they are reused or recycled. Rather than everyone owning the same tools, they are borrowed from the local tool lending library. Graywater, from showers, sinks, and washing machines, is filtered on-site through artificial wetlands. Sewage is sent to local biogas plants which produce gas used to generate electricity.

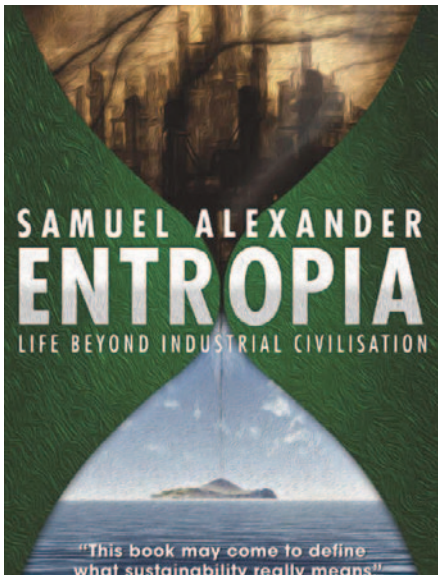


Through the Eyes of a Stranger by Will Bonsall is another recommended novel. After Yaro Seekings, the main character, flees his country because he is falsely accused of murder, he becomes a refugee in Esperia.

The time is five centuries after the "Calamitous times" of the 21st century.

In Esperia, collectivism is favored over individualism. People live communally in small "households."

These households are expected to be self-reliant regarding food production and generation of household energy. For example, every family has its own windmill. With the exception of honey production, the country is vegetarian. Each household specializes in producing several items, which are bartered with other households. Their mixed economic system includes communal families, co-ops and private businesses which aren't allowed free reign. One example is that different products made with slave labor are banned.



Entropia by Samuel Alexander is about a small Pacific island isolated from the rest of the world. Society is egalitarian with everyone eligible for both a guaranteed income and housing. A maximum income is maintained through the tax system. There are many provisions from their "Charter of the Deep Future" that could be adopted to make societies more ecological and egalitarian. Some examples are: *"We affirm that providing 'enough, for everyone, forever' is the objective of our economy. … We affirm that property rights are justifiable only to the extent that they serve the common good, including the overriding interests of humanitarian and ecological justice."*

The entire island is run in an environmentally sustainable manner. Food production is local and organic. Wind and hydro systems provide energy. Water is very carefully conserved. A major source of water is provided by rooftop tanks. Greywater is recycled, and composting toilets are replacing old flush toilets. The ending is a bit perplexing. The islanders were not aware that the society had been set up by the government of New Zealand to determine if a better environmental society could evolve. After the egalitarian and ecological community developed, a New Zealander official visits the island. He convinces the residents to disperse over the globe to teach other countries how things could be done better.

The way the island was set up was manipulating and misleading, and when it was disrupted, it was extremely disappointing. If this kind of thing happened in the real world, people would become devasted facing the truth of their existence and then having to disperse all over the globe.

The social support networks of their community that they had relied on their whole lives would no longer exist. The previous ecotopias are forms of utopias and are the opposite of dystopias. In speculative movies and novels, dystopias are much more prevalent than ecotopias. Dystopias tell of societies that collapse because of various calamities, and they are dehumanizing and dreadful places where people can barely survive.

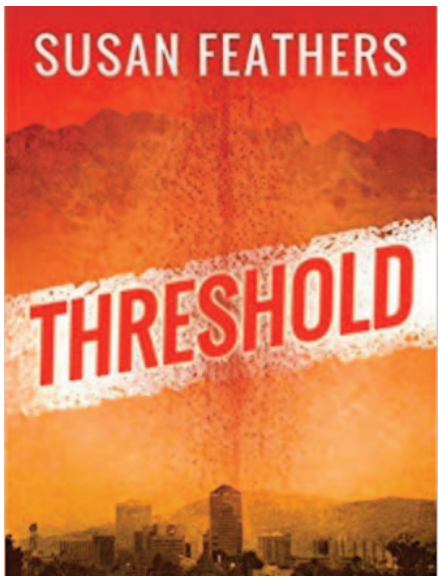
Dystopias might not be effective ways to influence people. Dr Denise Baden, professor of sustainable business, points out that dystopias are poor motivators for change, and they provoke fear of the future. Baden states: *Research increasingly suggests that trying to promote behavioural change through fear can be counterproductive, leading to anxiety or depression that results in an issue being avoided, denied or met with a sense of helplessness. However, in education, news and fiction, stories with positive role models and which focus on the positive outcomes of solutions are much more likely to inspire action to solve it.*

Even though dystopias are filled with gloom and doom and hopeless scenarios, real-world evidence paints a different picture. Catastrophes actually bring out the best in people. Humanity is not necessarily doomed to a violent, nasty future as depicted in movies and dystopian fiction.

Contrary evidence to the dystopian view of humanity is provided by *A Paradise Built in Hell-The Extraordinary Communities that Arise in Disaster* by Rebecca Solnit. The book is filled with inspiring examples of people's positive response to disasters. Solnit states: *The image of the selfish, panicky, or regressively savage human being in times of disaster has little truth to it. Decades of meticulous sociological research on behavior in accidents, from the bombings of World War II to floods, tornadoes, earthquakes, and storms across the continent and around the world, have demonstrated this.* Solnit goes on to point out: *Studies of people in urgently terrifying situations have demonstrated—as Quarantelli [Sociologist Enrico Quarantelli, who pioneered the study of disasters] puts it in the dry language of his field—that instead of ruthless competition, the social order did not break down, and there was "cooperative rather than selfish behavior predominating." Quarantelli states that more than seven hundred studies of disasters demonstrate that panic is a vanishingly rare phenomenon. Subsequent researchers have combed the evidence as meticulously—in one case examining the behavior of two thousand people in more than nine hundred fires—and concluded that the behavior was mostly rational, sometimes altruistic, and never about the beast within when the thin veneer of civilization is peeled off. Except in the movies and the popular imagination. And in the media.*

Solnit provides many examples of people throughout history spontaneously helping others. For example, immediately after the 1906 San Francisco earthquake and fire, many average people instinctively did valuable and cooperative things such as setting up public kitchens. One of the many other examples scattered throughout her book is that two hundred thousand people volunteered to take in homeless Katrina hurricane survivors. She also reports that "crises and stresses often strengthen social bonds rather than breed competition and isolation."

There are several books that are neither ecotopias nor dystopias. These novels depict societies after horrendous environmental disasters that cause suffering and death. However, these stories are heartening because they suggest that humanity is capable of surviving terrible catastrophes and doesn't necessarily have to run amuck.



Threshold by Susan Feathers is an inspiring book set in Tucson, Arizona. This recommended novel includes the calamities of a dystopia but the decency of an ecotopia. Tucson has experienced a heatwave and drought lasting many years. Several elderly vulnerable residents have perished, and the ecosystem has been devasted.

However, the main characters are kind and decent people who struggle to adapt to horrendous changes in the ecology of the region. Some even blossom.

New York 2140 by Kim Stanley Robinson is another suggested book that is neither ecotopian nor dystopian. Manhattan has been overridden by the rising ocean. Water damaged foundations cause buildings to topple over. People drown during storm surges. It is disappointing that greedy people and businesses are allowed to take advantage of a disastrous situation. However, most Manhattanites quietly adapt by becoming more giving and cooperative, and some even thrive.

Thus, literature shows that even though climate change will cause many to perish and will drastically change their lives, it is possible to create more resilient communities. People don't necessarily have to act out a Hollywood dystopia with survivors going rogue. ONE

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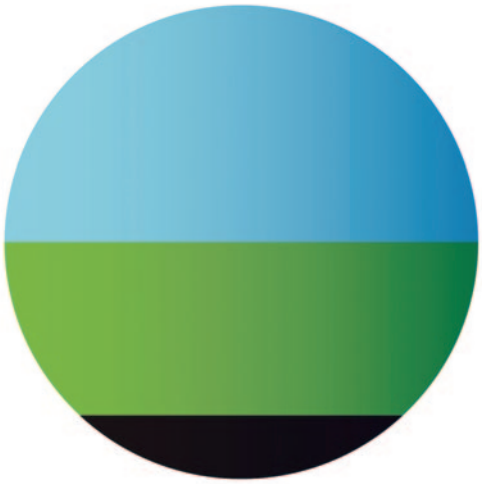
MONTEPONI

Located in the outskirts of Iglesias (Sardinia, Italy), the Monteponi site has a unique place in the history of Italian mining activity.

The operation began in the second half of the 19th century, and it became rapidly one of the most advanced mining sites in the country. In less than 15 years from its opening, the Monteponi mine could benefit of the Vittorio Emanuele II and Sella shafts but also of a 20 miles railway line that connected the mining site to Portovesme's harbour. Before the end of the century, two modern gravity-separation plants – Laveria Calamine (1887) and Laveria Mameli (1893) – replaced the original treatment facilities.

The postwar development signalled the beginning of the end. The Italian national government tried several times to rescue and postpone the inevitable closure, especially during the Seventies. In the 1990s the mine was officially shut down. Despite being abandoned, Monteponi still represents one of the most important and beautiful pieces of industrial archaeology in Europe. ONE

SOTACARBO



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