

UNITED PEOPLE OF CLIMATE ACTION

THE BEAM

WE ARE EATING
OUR PLANET

SPINNING GOLD
FROM CARBON

UP WHERE
THE KITES FLY

FOCUS

CARBON CAPTURE

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Dear THE BEAM Readers,

The latest instalment of a UN landmark Climate Report warns we have a brief and rapidly closing window to adapt to climate change. The risks associated with lower levels of warming are more significant than previously thought.

What is the way out? More than ever, it is evident our answers have to be global, rapid and inclusive. Solutions lie in our creativity and innovation, the will to implement changes by business leaders and politicians, municipalities and grassroots movements alike.

THE BEAM tells you about these solutions and aims to encourage climate action across the globe. We are now proud to be powered by FairPlanet, a global non-profit media organisation for award-winning Solutions Journalism.

With a network of 150 journalists in over 50 countries, we highlight the most exciting solutions and make a concrete contribution to eliminating climate injustice and preserving this planet for all of us in its diversity and beauty.

We hope you find new inspiration in each issue and perhaps even discover new comrades-in-arms. Because one thing is clear: to meet present and future climate challenges, we need a strong United People of Climate Action network.

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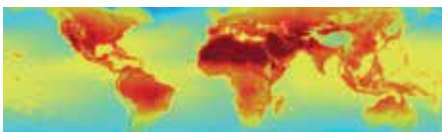
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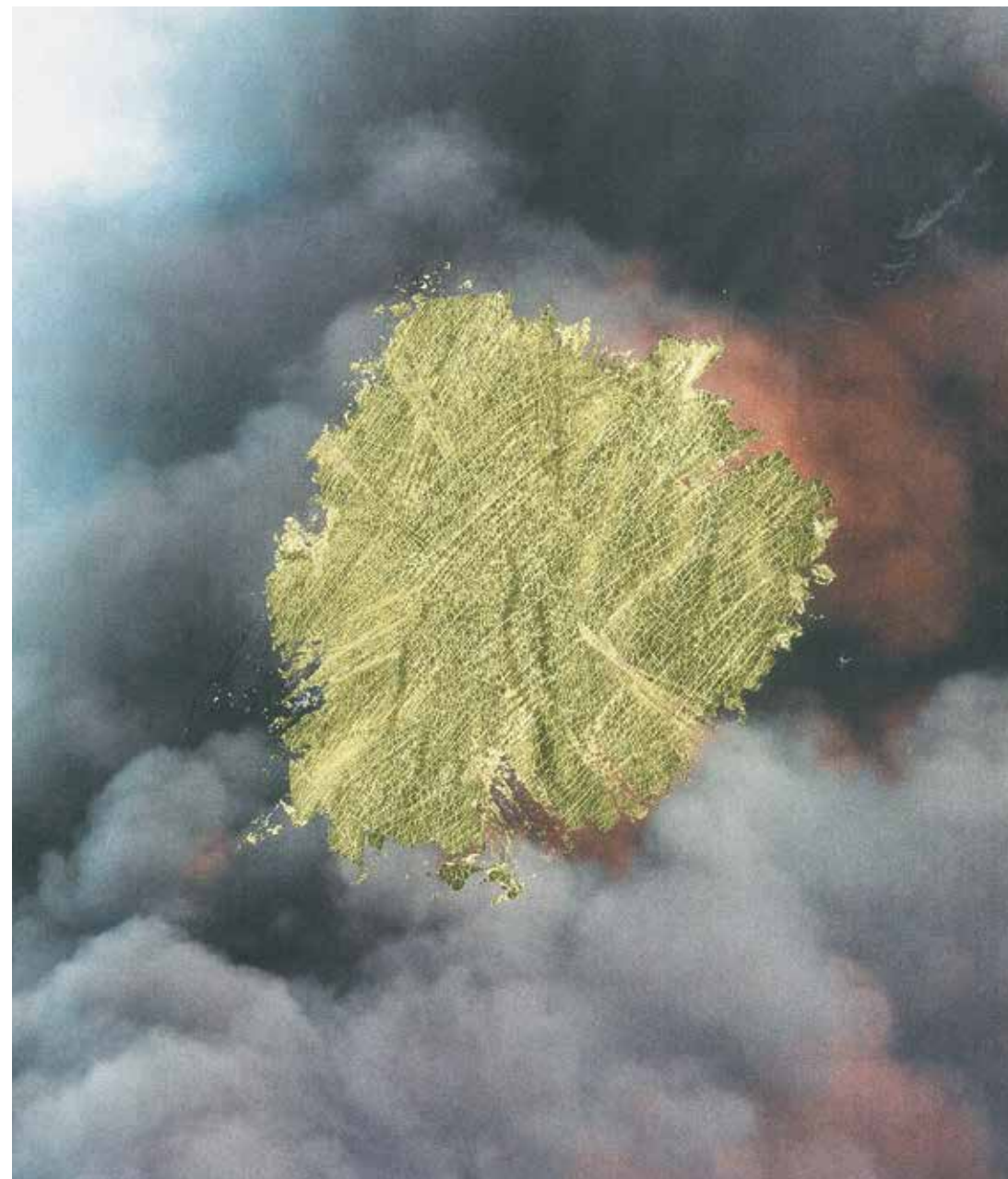
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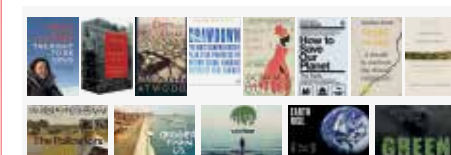
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GERMANY, EUROPE'S LARGEST ECONOMY, WAS ONCE A PIONEER IN CLIMATE PROTECTION. TODAY, BERLIN PRESSES HARD ON THE BRAKES. BUT HELP IS ON THE WAY.

The elections to the German Bundestag are over, and it remains unclear what the new government of Europe's economic powerhouse will look like.

The fight against the climate crisis is likely to be the new government's most difficult and challenging task, since Germany might have to declare that the promises made under the Paris Agreement have failed. Help, however, comes from various civil society groups, including a non-governmental organisation called GermanZero.

THE BEAM: Julian Zuber, tell us what German Zero is GermanZero all about.

Julian Zuber: GermanZero is a non-profit and non-partisan association that is 100% financed by donations. We now have over 16,000 small donors. From time to time we also get project financing through foundations.

We currently have 36 full-time employees and over 1,000 volunteers. We founded

GermanZero around one and a half years ago to develop a 1.5°C legislative package that shows how Germany can achieve the 1.5°C target set out in the Paris Climate Agreement, which Germany signed.

It was a very complex process and also a new way of developing draft laws, namely by starting from the end. It was done intersectionality and with a very well-thought-out process that is both expert and participation-driven. It took one and a half years and over a hundred organisations, and over 260 experts and around 1,000 citizens took part.

This 1.5°C legislative package is currently being expanded to include the area of sustainable finance, because a very important question is: how do you finance all of this? And we are still working on standardising the most important areas to be able to translate them into legal texts, as well as on updating the accounting.

The aim is to present a kind of modular

system and offer it to politicians. Politicians can then take things out, but they should put others in, so that we can comply with this budget limit.

Tell us in more detail about how exactly you approach and interact with politicians.

Politics is above all interest-driven; not only, but primarily, and that's why we have developed two other formats: on the one hand, the so-called political dialogues, in which trained [volunteers] to talk to politicians and try to demand a kind of climate promise from them. That can be quite confrontational by clearly asking politicians: are you for or against a 1.5°C legislative package? We are represented in half of all constituencies with this particular format, and we have had over 200 discussions and received around 100 climate promises.

In addition, we are holding further discussions with politicians in the background in a kind of intersectoral round table, in which we show how we work and why that means assistance as well as relief for politics.

On the other hand, we offer the climate referendums. These are citizens' petitions for climate neutrality, which we're giving a platform. We now have over 60,

which means that over 18 million people in Germany now live in a municipality with a climate referendum.

The idea behind it is: it only works on all levels. It's about political implementation, so plain-talking from civil society is needed. This not only increases the pressure on politicians, it also supports them. As we at GermanZero don't need to be re-elected, we can speak more plainly and uncover hypocrisy on the spot. We thereby support politics in forming opinions.

AFTER GERMANY, EUROPE ON THE HORIZON?

You describe your work at the municipal level. Are there also efforts to expand your engagement in the other direction, for example at the European level?

Our strategy was initially: we wanted to show that a country like Germany, which has recently turned from a pioneer to a laggard in terms of climate protection, can still achieve the 1.5°C target. Because if Germany were no longer on the brakes, but became a pioneer again, that would also help

Europe achieve its goals. That is why we will launch EuropeZero.

However, this is something that we will only tackle after the general election in Germany. We are already in talks with countries where, strategically, it would be just as important right now to take a similar approach to national legislation. This is mainly France because there will be elections there next year. And in 2023 there will be elections in Italy and Spain. So strategically these would be the next three countries where such an initiative could be useful. However, we do not want to get bogged down and therefore, concentrate first on the federal elections in Germany

the coalition talks and the first 100 days of the newly formed German government.

GermanZero recently presented a catalog of measures in September. At one point you recommend splitting the market for emission rights in the EU. Can you explain that?

Of course, we want emissions trading in Germany to be transferred to the European market. But first of all, however, we propose building CO₂ pricing, i.e. emissions trading, at national levels. This should then be integrated throughout Europe. Experts tell us that it is important to do this at the national level first, so that

GERMANZERO ASSISTS POLITICIANS IN TACKLING THE CLIMATE CRISIS

FRANK ODENTHAL FROM THE BEAM
IN CONVERSATION WITH JULIAN ZUBER, GERMANZERO'S CEO



“As we at GermanZero don’t need to be re-elected, we can speak more plainly and uncover hypocrisy on the spot. We thereby support politics in forming opinions.”

things get going. But in the long term it should be integrated at the EU level and then also become a little less complex.

You also propose to set up separate emissions trading systems for aviation and shipping respectively.

Both aviation and shipping are of course of great strategic importance, which is why they must be treated with particular sensitivity. That is why we are proposing separate CO₂ pricing systems and then, additionally, increasing quotas for synthetic fuels. Due to the technological framework conditions for these two modes of transport, they should have their own regulation.

You propose a tax on imported products, which they call a “border tax adjustment” regime. What does it mean?

It is a proposal at EU level. Border tax adjustment is currently hotly debated in Brussels anyway. In essence, it is about the question of whether production will be driven abroad if we make production

more expensive in the EU by CO₂ pricing. So if you want more ambitious CO₂ pricing, there should also be post-taxation, which means that the standards that do not apply abroad do not lead to production migrating and Germany or Europe as a production location to be marginalised. That is why a border tax adjustment is needed, which in our opinion does not mean any violation of WTO trade laws.

Another suggestion is to abolish Germany’s renewable energy law or to replace it with another system. Can you explain?

Originally, the idea of Germany’s renewable energy law was to enable renewable energies to enter the country’s electricity market. Now the question is: how can the following three points be implemented:

1. conversion to 100% renewable energy
2. price stability
3. security of supply.

GermanZero is now proposing a completely new renewable energy law, which

is relatively slim and which essentially requires three things:

1. a central energy agency to handle the expansion that can centrally control the planning for the required areas. What is needed here is a better overview that also works digitally, i.e. in real time
2. a massive expansion of solar and wind energy
3. a massive simplification for regional energy communities. Municipalities must be able to set up decentralised energy supplies without being over-regulated.

Is returning to nuclear power an option?

In principle, nuclear power may also be an option. But if you look at the costs alone, it’s just a lot more expensive than solar and wind. The search for a radioactive waste repository, then the storage itself, these are good arguments against nuclear power. In addition, nuclear power cannot be easily combined with renewable energies, because nuclear power has such a high base load, and you can’t just shut it down so quickly to leave space for renewables. That is why we say nuclear energy is not an option. But basically, of course, we left all options open.

Regarding transport policy, your catalog of measures contains the interesting

observation that when it comes to sustainability, manufacturing is sometimes a lot more advanced than politics. Can you explain this phenomenon?

Politics is slower in many areas, and that, in fact, is often desirable. You don’t want a democracy to make decisions as quickly as a company. Of course, this has disadvantages; one of them is that politicians sometimes don’t even notice that the apparent interests they represent no longer exist because the companies are much further ahead.

That is why it makes so much sense to actively protect the climate as early as possible. Because the future economy will be climate neutral, that is completely out of the question. The only question is: when? So the question arises: who sets the standards? Should Chinese companies do this, or American or European companies? There is a massive entrepreneurial advantage here to starting as early as possible, because leaders are the ones to set industry standards. And that, ultimately, is a cost issue and a strategic issue that companies tend to notice immediately.

You also mention the “exceptional case of agriculture”. What do you mean?

Agriculture has a special position in all of Europe. The biggest driver that shapes how agriculture works is the EU’s common agricultural policy. Farmers who produce sustainably are not rewarded there, but those who are big. And that’s a problem. Many farmers want to be sustainable, but it doesn’t pay off for them. So there’s an incentive problem. We see the greatest leverage here in EU regulation. But there is also a lot that can be done here on a national level. Nevertheless, reforming the common agricultural policy would be a very good option.

You also write about “compensation abroad.” What does that mean? Can companies in Germany that fail to meet their climate targets buy their way out abroad?

That is exactly the danger. And we must make one thing clear to ourselves: we will have to rely on offsetting our emissions. As things stand today, we will miss the emissions targets that we have set for

ourselves. So, if we want to meet our commitments under the Paris Agreement, we need to offset our emissions abroad. That is why our proposals are much more ambitious than what all the other parties are currently calling for. But it will probably be necessary to compensate from 2025 because our budget will then be used up - even with our scenarios.

That is why we need rules for how such compensations should work. We have now also launched our theses for international exchange. The aim is to enable compensation partnerships, such as the one between Mongolia and Japan. We need standards for state and for private compensation in order to avoid this greenwashing, where some pointless project is financed just to be able to continue to discharge. For example, it should no longer be possible for two companies to claim the same reforestation project, i.e. it should not be charged twice.

How were the first reactions to the publication of your catalog of measures?

So, before the release, the reactions were mainly: are you crazy? That is far too complex!

We are now getting a lot of positive feedback, from civil society, but also from companies, and from climate researchers. Of course, there were also critical voices, which is very important because constructive headwinds have also helped us so far. There are still many unanswered questions, but more in relation to the technical implementation than the regulatory issues. But, overall, the response is extremely positive.

Which of your demands do you think are the easiest to implement and which are the most difficult?

Our proposal on CO₂ pricing should be easy to implement, but you have to do it right because it only works in an integrated manner. The conversion to renewable energies or the introduction of electric cars and social compensation measures and subsidies should be introduced in a concerted action. Massively raising petrol prices now and then introducing compensation payments six months later would not work. We, civil society, are here too to promote such measures. Ultimately, it’s a matter of teamwork. The exit from combustion technology in cars could be a bigger problem. In 20 years’ time this may no longer be an issue because everyone is enjoying their great electric cars, but today one or the other might feel annoyed or even attacked.



Julian Zuber (34) was born in Coburg (Bavaria) and grew up in Munich. He has worked as a strategy and policy advisor with a focus on the public sector. Before that he completed a PhD in Political Science and a Masters in Economic and Social History. While still a student, he founded the NGO “Polis 180”, a think tank on European and foreign policy, at that time purely on a voluntary basis and worked as a strategy consultant. In 2020, Zuber joined GermanZero as CEO.

→ [GERMANZERO.DE](https://germanzero.de)



GermanZero is working with experts, scientists, and citizens to develop a 1.5°C legislative © Julian Peters

TAKING A LOOK BACK: 350.ORG'S GRASSROOTS CAMPAIGN

"KEEP IT IN THE GROUND" IS A SUCCESS STORY – AND NOT YET FINISHED.

By taking a step back, sometimes solutions for complex problems seem to be surprisingly easy. If you don't want carbon in the air, leave the raw materials that produce it in the ground.

That's the approach the Keep-it-in-the-ground movement chose as a starting point in the 2000s. It was a time when the George W. Bush administration made way for further oil and gas explorations on vast areas of public land. Especially indigenous peoples were forced to watch historical levels of extraction of fossil fuels on their lands.

That's where a new found organisations of environmentalists took action: 350.org. The 350 in the name stands for 350 ppm (parts per million) of carbon dioxide, which has

been identified as the safe upper limit to avoid a climate tipping point. That was in 2007, when 350.org was founded. As of today, we are way above 415 and rising.

Fighting the Keystone XL pipeline, with which crude oil from Canada should be transported to refineries in the US, was a first milestone for 350.org, as co-founder and current CEO May Boeve recalls. "Winning a fight in such an iconic case gives huge momentum."

IT'S A FIGHT BETWEEN DAVID AND GOLIATH

At that time, in 2011, the project 'Keep it in the ground' was introduced. The idea of divesting out of harmful industries,

especially out of fossil fuel production was inspired by the divestiture movement against South Africa's apartheid regime, Boeve says. "Like in South Africa it started like a fight between David and Goliath." And getting investors, banks, insurers, and anyone who is in the financial sector to get out of investing in what's harmful for the planet is truly a fight against Goliath.

But guess what: David is getting bigger and bigger. As of today, an amount of astonishing 14,6 trillion Dollars have been divested out of fossil fuels. Not too bad for a campaign that started just a few years ago.

"The very first city to divest in the US was the city of Seattle", Boeve says. "And that really gave us momentum, because it showed that an entire city's holdings could make a powerful decision like this." The Rockefeller family divested,

too. That also was quite a signal, as the Rockefellers made their entire fortune out of oil. "For them to say: 'No more, this is wrong' was a powerful statement", Boeve recalls.

Most recently Harvard University just declared to divest. "That's important not only because of the size of their portfolio, but also how influential Harvard is in the world", May Boeve explains. "Think of the amount of people who run other institutions that have some affiliation with Harvard. And I've even heard anecdotally that other organisations that were on the fence of divesting, did it once they saw that Harvard did it."

There've been other very large wins, like the New York state pension fund divested, which in terms of value of money was an enormous commitment, since it is worth \$224 billion.

Even some of the most notable faith institutions have divested, like the Church of England, and that also sent a big ripple affect, according to Boeve. It's a success story, but will it have a happy ending? "With the climate problem, the odds are not good", says Boeve. "But I'm still optimistic."

→ [350.ORG](https://www.350.org)

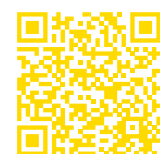
GRASSROOTS KEEPIN' IT

IN THE GROUND

WRITTEN BY FRANK ODENTHAL



Ende Gelände – Environmental activists blocking a disputed mine in Germany in 2016. © 350.org / Jannis Große



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WORLD SUMMIT
ON SUSTAINABLE
DEVELOPMENT

With the industrial revolution, mankind embarked on a path that has been both a blessing and a curse. It is a blessing because our lives have become easier, more pleasant and more mobile in many respects. It's a curse, because we are disregarding planetary boundaries with our hunger for growth; blessed developments are now being reversed.

This same paradox can also be found with the topic of chemicals. Currently, there are over 40,000 industrial chemicals in commerce worldwide, and hundreds of new chemicals enter the market every year.

Chemicals help to improve the quality of life in many areas, and they are essential in order to meet the social and economic needs and goals of all nations. Still, at the same time, many of them have undesirable and harmful effects on human health and the environment, are burdening health and education sectors and are impacting economic productivity.

In the European Union, for instance, costs resulting from neuro-behavioural deficits caused by exposure to certain chemicals is estimated to be more than USD 170 billion per year.

Particularly problematic are chemicals that cause hazards to our environment - in water bodies, soil or air, in the food chain or drinking water - and which accumulate in our bodies. Hazardous chemicals, including phthalates, heavy metals, such as lead, pesticides, and environmentally persistent pharmaceutical pollutants, can cause irreversible harm to the health of humans, fauna, flora and ecosystems. Children can be particularly affected, and babies can be born with harmful chemicals in their bodies.

Over the last decades, it became more and more obvious that sound management of chemicals across the lifecycle (production, use and disposal) requires global policy frameworks, commitment and co-operations. This has already been called for at the [2002 World Summit on Sustainable Development](#) ⁷, which resulted in the first international Conference on Chemicals Management (ICCM1) in Dubai in 2006, at which governments adopted The Strategic Approach to International Chemicals Management (SAICM)- a global policy framework to foster the sound management of chemicals.

The Dubai Declaration emphasises the importance of sound management to achieve Sustainable Development and reduce poverty. The holistic protection of human health from hazardous environmental

effects is a major focus of sustainable development. Hardly any sustainability goal for the implementation of the 2030 Agenda can be achieved without responsible chemicals and waste management.

SUSTAINABILITY REQUIRES FRAMEWORKS AND REGULATIONS

The [2030 Agenda for Sustainable Development](#) and its 17 Sustainable Development Goals (SDGs) ⁸ adopted by the international community in 2015 is a plan of action for the prosperity of people and the planet, and stresses the need for transformative actions to "shift the world on to a sustainable and resilient path."

It focuses on eradicating (extreme) poverty and hunger, realising the human rights of all and achieving gender equality and the empowerment of all women and girls. It also determines the importance of protecting the planet from degradation by promoting sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change.

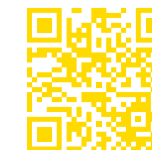
All SDGs are interlinked, integrated and indivisible, and are addressing the three dimensions of sustainable development: economic, social and environmental.

Nearly all SDGs and their targets call for actions related to chemical safety and hazardous chemicals, but particularly prominent is Sustainable Development Goal 12, which ensures sustainable consumption and production patterns. Target 12.4 works towards achieving the environmentally sound management of chemicals and all wastes throughout their life cycle to minimise their adverse impacts on human health and the environment.

GOOD POLICIES CRUCIAL FOR SOUND MANAGEMENT OF CHEMICALS AND WASTE

The Future Policy Award 2021 contributed to highlighting how countries have set out in recent years to achieve the SDGs and to set comprehensive policies to protect human health and the environment from hazardous chemicals. 55 policies from 36 countries across the globe were nominated and screened.

Establishing a 'Globally Harmonized System of Classification and Labelling of Chemicals' (GHS) regulations and making them legally binding is an essential fundament of the sound management of chemicals and waste, including the control and supervision of production, import, sale, use, and end-of-life management.



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TRANSFORMING OUR WORLD:
THE 2030 AGENDA FOR
SUSTAINABLE DEVELOPMENT

GOAL 2

End hunger, achieve food security and improved nutrition and promote sustainable agriculture. Target 2.4: ensure "sustainable food production systems and implement resilient agricultural practices" and Target 2.5: "maintain the genetic diversity of seeds, cultivated plants..."

GOAL 3

Ensure healthy lives and promote well-being for all at all ages. Targets 3.9: "substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination."

GOAL 4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all which can be transferred to people exposed to toxic substances.

GOAL 5

Achieve gender equality and empower all women and girls. Risk reduction measures with regard to toxic chemicals are key to address the adverse health effects of chemicals on the health of children and pregnant women and the need to raise awareness.

OP-ED

HOW POLICY CAN ADVANCE CHEMICAL SAFETY

WRITTEN BY ANNA-LARA STEHN



ABOUT THE AUTHOR

Anna-Lara Stehn joined the World Future Council Team in February 2019. As Media and Communication Manager, she works on all media activities such as public relations, communications, and social media. In her previous role in the food industry, she was a student assistant in the sustainable marketing department. Anna finished her Bachelor's degree in Business Psychology and holds a Master degree in Sustainable Marketing and Leadership.

→ WORLDUTURECOUNCIL.ORG

Kyrgyzstan's Resolution No. 43 on Approval of the Chemical Hazard Classification System and Hazard Information Requirements (2015) is the first in Central Asia and was awarded Gold for its comprehensive approach and successful implementation of GHS regulations.

Hazardous chemicals can be successfully phased-out through the procurement system, show the Phase-Out Lists for Chemicals Hazardous to the Environment and Human Health (2012–2016, revised for 2017–2021) of the Region Stockholm. The Gold awarded phase-out lists identify toxic chemicals with the goal to phase out these substances step by step in the procurement system, as a persuasive precedent for all other users, retailers and consumers.

The lists comprise chemicals in chemical products as well as in products such as consumables and articles used in laboratories, healthcare, dentistry, IT, cleaning or textiles.

Exposure to lead can cause 143,000 cases of death, and 600,000 cases of intellectual disabilities in children every year, states the Future Policy Award's report. Since many low and middle-income countries impose either none or insufficient limits on lead paint, it is estimated that children in these areas are most severely affected.

The internationally agreed upon figure is a total lead concentration limit of 90 parts per million (ppm). With the Chemical Control Order (CCO) for Lead and Lead Compounds, which won the Special Award, the Philippines were the first Southeast Asian country to successfully implement legislation towards lead-safe paint.

What also makes this policy outstanding is the extensive cooperative efforts of various stakeholders, including the industry itself, during the policy formulation and implementation. The policy has also inspired this element of the UNEP's Model Law and Guidance for Regulating Lead.

More efforts and regulations are needed in order to realise the 2030 Agenda and manufacture toxic-free products for the sake of people and the environment. Still, it is encouraging to see that many countries, especially middle and low-income countries, have already embarked on this path with international support and are working towards effective regulations of hazardous chemicals.

These policies can serve as an example for other countries and regions so that we can strengthen global and sustainable chemicals management and thus contribute strongly to achieving the Sustainable Development Goals.

CARBON FOOTPRINT 188,451,472.00 t CO₂e

SCOPE 1	668,798.00 t CO ₂ e
SCOPE 2	432,348.00 t CO ₂ e
SCOPE 3	100,121,490.00 t CO ₂ e
PURCHASED GOODS & SERVICES	298,500.00 t CO ₂ e
CAPITAL GOODS	221,712.00 t
FUEL & ENERGY RELATED ACTIVITIES	843,07
UPSTREAM TRANSPORT & DISTRIBUTION	6
WASTE GENERATED	
BUSINESS TRAVEL	
EMPLOYEE COMMUTING	
UP	

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IN ORDER TO TRULY SEE OUR WAY THROUGH THE CLIMATE CRISIS, WE MUST ACKNOWLEDGE SOME OF THE BASIC REALITIES OF OUR EXISTENCE, LEARN FROM OUR WEAKNESSES, AND THEN REGAIN OPTIMISM AND RECALIBRATE OUR APPROACH.

failing because of the conflict between two primal human characteristics that could not be more opposite: cooperation versus selfishness.

Why is humankind now in danger of failing after six millions years of survival on this planet?

We have the innate ability to cooperate with each other to a high degree and even to be kind to one another. In contrast to traditional Western thought, historian Rutger Bregman claims, human beings are not evil but, on the contrary, fundamentally good. Reviewing the last 200,000 years of human history, Bregman shows in his acclaimed book "Humankind" that we are evolutionarily oriented towards cooperation rather than competition, and that our instinct to trust one another has a solid evolutionary foundation that dates back to the origins of Homo Sapiens.

We are indeed able to achieve societal change. However, social achievements such as the introduction of democracy, the struggle for decolonisation or for women's rights - once considered radical and now more or less accepted - required hundreds of years of struggle and thousands and thousands of lives.

Unlike with these social advances, however, the clock is now mercilessly ticking on climate change. What's more is that because the climate has tipping points, the clock is ticking faster and faster, and once those tipping points are surpassed the changes in our global ecosystem will become irreversible. Now, at 1.2 degrees above the pre-industrial levels measured in early 2022, we have 10 years to remain within the 1.5 °C range of global warming to avoid the climate crisis' most adverse and irreversible consequences . And so, the fight against man's selfish and self-serving nature is likely to fail in the short term.

Shall we start with the dire part? Then let's face it: The global climate crisis, which goes hand in hand with the mass extinction of species, is an overload for human civilisation. Although we are destroying the very foundations of life on our planet, we are in danger of



IT'S THE INEQUALITY, STUPID

The second important factor is structural inequality. All these social advances mentioned above were achieved due to uprisings against inequality. They were, and still are, led from the bottom up; from poor against rich or from the many against the few. In the fight against climate change, both factors - time and inequality - come into play together.

Let's look at some facts along this distribution of wealth and power. Oxfam's 2020 Global Study clearly shows where the responsibility for climate change lies based on the share of carbon dioxide emissions between 1990 and 2015.

The emissions released by the richest 10% of the world's population are as high as the entire rest of the globe. And the richest 1% are responsible for twice as many emissions as 50% of the world's population.

So a fraction of the world's population causes the problem, while the rest of humanity, mainly the global south, suffers most. This is made possible due to the political and economic structures of inequality that the powerful and wealthy cling to in order not to lose

OP-ED

HUMAN CIVILISATION vs THE CLIMATE CRISIS:

LESSONS FOR THE CLIMATE MOVEMENT

WRITTEN BY MURAT SUNER





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COP26: TOGETHER FOR
OUR PLANET

their privileges. The core of these privileges lies in the practice of maximising and concentrating profits while externalising costs, thus passing the burden onto the general public and the environment or into the future - until it is no longer possible.

All of this is embedded in the false narrative of infinite growth - from which the poor would, theoretically, ultimately benefit. However, the neoliberal mantra of trickle-down, so to speak, will not work on a finite planet. The poorer countries of the Global South bear the majority of consequences and, at the same time,, unlike the richest industrialised countries, are urged to abandon the use of fossil fuels for their economic development. This conflict of interests has been named, but not sufficiently addressed, let alone solved.

SIGNS OF HOPE AND DISAPPOINTMENT

The Paris Climate Agreement was indeed an extraordinary sign of hope, with 192 countries and the EU, representing over 98% of global greenhouse gas emissions, signing it. However, it largely failed to live up to its promise of getting the main drivers of the climate crisis to make crucial structural changes and to support poorer countries in order to enable true global cooperation.

In 2009 at COP15, the rich industrialised nations in Copenhagen made the unkept promise to pay \$100 billion a year into a climate fund for the world's poorer people from 2020 onwards. A year later at COP number 16, the promise was repeated in Cancun, and was again unfulfilled. In Glasgow at COP26(!) it's been postponed to 2023. ↩

The overall results of Glasgow are telling. Even if all the decisions - binding or not - were to result in concrete action, COP26 will most likely lead to a +3.2° C increase. No one should live in such a world.

COPS FAIL BY DESIGN

While COPs are necessary gatherings where decision-makers from across the globe come together to negotiate and



Climate action at COP26 in Glasgow © William Gibson

collaborate, we need to recognise that the format of the summits is not working. This is because COPs try to negotiate an almost impossible outcome: a solidarity agreement, and despite the certainty that the catastrophic consequences will inevitably occur if appropriate action is not taken, there is no mechanism to punish those who refuse to act.

The structural problem of COPs is that their decisions are based on unanimity. The intention that everyone must be on board in order to build global consensus on a global problem seems right, but the fact that everyone is invited, including the worst polluters - such as the fossil fuel and gas industries, thwarts any meaningful consensus. It is absurd that the largest delegation at COP26, larger than that of any country, represented the fossil fuel industry. It's like holding a global conference on drug addiction and having the largest participating faction be drug dealers. This must be changed.

IT'S SIMPLE: NO GLOBAL SOLUTIONS WITHOUT GLOBAL INCLUSION

What are the lessons for climate movement?

Unfortunately, climate activism is part of the problem. The climate movement emerged in the West, and so did its language. It is full of stories about polar bears, Greta, degrees Celsius and parts per million, which excludes 90% of humanity from the discussion.

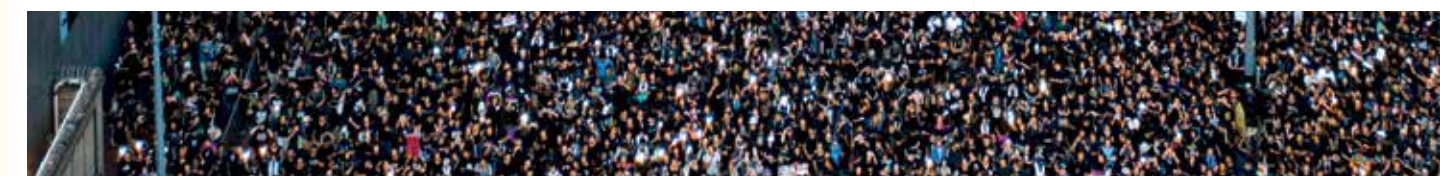
And so, firstly, the discourse has to take into account the reality of life for the majority of the world's population. When one in three people worldwide does not have access to clean drinking water, nearly one billion people do not have enough to eat, two in five people do not have the means to wash their hands with soap and water, and nearly 800 million people still practice outdoor defecation; when 750 million people do not have electricity ↗ and more than 200 million people are displaced, we need to recognise that climate change is about food and agriculture, water and sanitation, housing and security - and yes, green energy too.



PM Boris Johnson speaks at Cop26 © Karwai Tang



WORLD BANK.ORG
UNIVERSAL ACCESS TO
SUSTAINABLE ENERGY WILL
REMAIN ELUSIVE WITHOUT
ADDRESSING INEQUALITIES



ABOUT THE AUTHOR

Murat Suner was born in Germany and studied Economics, European Affairs and Political Science in Germany, Turkey and Japan. Since his early twenties he has been engaged in political activism and social entrepreneurial activities in Germany and Europe. In 2013, he cofounded FairPlanet, a globally operating non-profit enterprise for solutions journalism and activism for which he has won multiple awards. He also been working with the German Foreign Office's strategy group to help define its policies towards illiberal regimes. Murat lives in London and manages FairPlanet's global activities promoting social and environmental justice. He is also THE BEAM's creative director.

Secondly, we need to strike a balance between speaking truth to power against the backdrop of existential crisis, while remaining hopeful and talking about solutions so that people are motivated to mobilise to build and sustain pressure.

Thirdly, activism coming from the Global North focuses too much on how people in the Global South are oppressed and marginalised. While this is true, we also need to emphasise that people still have agency. Otherwise, we make people spectators instead of actors and participants. We need to harness what people have to offer in terms of skills and assets, such as their consumption power, wealth and potential investments, as well as their political voices as citizens.

But perhaps the most complex task facing climate activists is understanding and simultaneously addressing the contradictions of the resolution process.

On the one hand, we need systemic redesign and transformation, as we cannot expect that the current economic system, which has brought us to the edge of the abyss, could be the solution. Especially, the people of the Global North have to understand that the way to achieving a meaningful and decent life cannot be to accumulate more and more, because we live on a finite planet with great social and economic inequality.

On the other hand, we cannot wait until we have undergone a fundamental change. Climate change does not afford us that time. The world is messy, and so we need to address the crisis systemically and pragmatically. We can draw on our cooperative capacities to build alliances with very different actors from different sectors, including businesses, who work towards the same goal, even if the means are different.

Finally, the good news is that we are in fact the majority. Almost two thirds of humanity, to be precise. That's because, according to the "People's Climate Vote", the world's largest survey on climate change, conducted by the UNDP and Oxford University in 2021, the vast majority of humanity has agreed that climate change is an emergency and sent a clear and compelling call to governments and policymakers to step up their ambition.

We, the ones who believe in cooperation and kindness, in hope and agency, are the many - not the few.

Do you feel the impacts of the climate emergency at all? Do you want to see faster and greater action to slow down global warming and mitigate its damage?

Your answer probably depends on where and how you live, what your level of education is and how old you are. Although numbers are only a part of the problem, let's look at some of them first. ↗

SO WHAT DID THE "WORLD" THINK ABOUT THE EMERGENCY AND WHAT TO DO ABOUT IT?

Overall, 64% of people said that climate change is an emergency; this on its own is a clear and compelling call for decision-makers to step up their ambition.

DOES IT MATTER WHERE YOU LIVE?

If you live in a small island developing state (SIDS), i.e. a country with a low coastline, your likelihood of viewing the climate crisis as an emergency increases to 74%. If you are a citizen of a least developed country, it drops to 58%. →

WHAT ABOUT PEOPLE'S SOCIO-ECONOMIC BACKGROUND?

The most crucial socio-demographic factor influencing belief in the climate emergency and climate action is a person's educational background. If you have been privileged to enjoy higher (post-secondary) education, your belief in the climate emergency and the call for climate action will be above 82%, whether you live in Bhutan, the Democratic Republic of Congo, France or Japan.

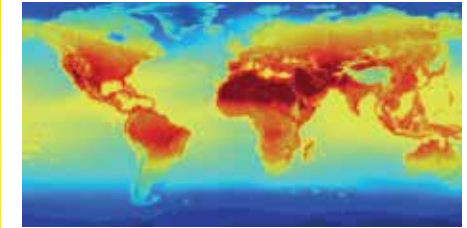
WHAT DOES HUMANITY THINK ABOUT THE URGENCY OF ACTION?

Of those who said climate change is a global emergency, 59% said the world should do whatever is necessary to urgently respond. 20% said we should act slowly, while 10% thought the world was already doing enough.

HUMANITY IS FURTHER ALONG THAN GOVERNMENTS ADMIT

It seems certain, then, that people around the globe are demanding much more climate action than our decision-makers are pledging and implementing.

→ In early 2021, UNDP published the People's Climate Vote, the world's largest survey of public opinion on climate change. 1.2 million people from 50 countries, covering 56% of the world's population, responded.



→ Support was highest in SIDS (74%), followed by high income countries (72%), middle income countries (62%) and LDCs (58%). Regionally, the proportion of people citing climate change as a global emergency was high across the board.

WHAT DOES THE WORLD THINK ABOUT THE CLIMATE EMERGENCY?

WRITTEN BY MURAT SUNER



UP WHERE THE KITES FLY

FRANK ODENTHAL FROM THE BEAM IN CONVERSATION WITH ROLAND SCHEMEL, KITEPOWER'S CO-FOUNDER

WINDS AT HIGH ALTITUDE ARE STRONG AND HAVE ENORMOUS POTENTIAL FOR GENERATING ENERGY. BUT SO FAR THEY HAVE NOT BEEN TAPPED. A DUTCH START-UP IS SET TO CHANGE THAT.

Accelerating the transition to renewable energies is key to fight the global climate crisis. Photovoltaic systems and wind turbines are important building blocks for a sustainable future, but they also have their limitations: Solar energy is only available during daylight, photovoltaic power stations come with high installation costs and substantial space requirements, and conventional wind turbines are transport cost intensive and need massive foundations. Dutch start-up Kitepower offers a mobile wind energy solution that is easy to transport, easy to install, and only requires small ground space. It consists of a ground station, a tether, a kite, and a kite control unit hanging just underneath the kite.

The system is operated cycles. In each of these cycles, energy is generated during the reel-out phase, when the kite is flown in a cross-wind figure-of-eight pattern to achieve a high pulling force. In phase two, when the maximum tether length is reached, the kite's profile is adjusted in order to reel-in the tether, consuming a small fraction of the previously produced energy. THE BEAM met up with Roland Schmel, co-founder of Kitepower and leading academic in the emerging field.

THE BEAM: Mr. Schmel, Kitepower has developed a system called Falcon which generates electricity using a kite. Can you explain the steps that led to this innovation? When did you start developing it?

Roland Schemel: I have been involved in the development of airborne wind energy since 2009, when I was hired as a research

group leader. With the university team we initially developed a 20 kilowatt system that used a robotic kite control unit and a tether that is reeled in and out between 200 and 600 meters. In 2014, an angel investor approached us with the aim to commercially develop the technology. A year later, we were awarded an EU funding of about 3.7 million euros and in 2016 we founded Kitepower as a spin-off from Delft University of Technology in the Netherlands. With the start of the commercial development we have been working on a 100 kilowatt system called Falcon scaling up from 25 m² to 60 m² wing area.

AIRBORNE WIND ENERGY SYSTEMS ARE MUCH MORE VARIABLE

At what height does wind power actually turn into airborne wind power?

Good question. Conventional blade tips of towered wind turbines reach heights of up to about 200 meters, with the largest turbines reaching even 260 meters. Although these turbines are getting



bigger and bigger there is a physical limit for towered systems. Airborne wind energy systems are much more variable, i.e. can be operated with tether lengths of up to currently 600 meters. Technically it would be possible to harvest energy even higher, however, this gets much more complex because the kite is further away, the visual contact is gone, the tether dynamics become more complex, and there is also a higher aerodynamic drag on the tether; all of this has a negative effect on performance.

In addition, the airspace for normal air traffic at our first test site near to Leiden, the Netherlands, begins at a height of 500 meters; To operate the kite in this airspace, there are not only technical but also increased legal hurdles requiring different permits. That is why Kitepower operates in the height range between 150 and 450 meters.

What are the technical challenges of a kite system for generating electricity?

There are a number of challenges. For example in flight control. In contrast to a wind turbine, a kite power system has an almost infinite number of degrees of freedom. To say it simple; the turbine can only rotate around the rotor axis, whereas a kite can fly in all directions. There have been attempts to develop a kite that flies circular or figure-eight-shaped patterns all by itself without any control. This is theoretically possible, but difficult to implement in practice because the wind always fluctuates in magnitude and direction and varies in altitude. Therefore, all current prototypes have an automatic flight control. We developed and demonstrated automatic flight in Delft back in 2012.

Are there also innovations in terms of material?

Absolutely yes. We work with suppliers who provide us with high-performance materials. For example a tether made



“We see kite power as a useful addition to existing renewable energy sources.”

from a high-performance fibre called Dyneema. This is a polyethylene-based plastic in which the molecular chains are straightened by a special manufacturing process, giving this fibre a breaking strength that is 15 times stronger than steel. The material is also used in other areas, such as the military, because it is bulletproof and can be used in helmets, for example. For the kite itself, we use nylon and dacron, textile fibres one might know from backpacks and camping equipment. The latest generations of kites also contain reinforcements made of carbon fibre composites. And even Dyneema can now be used as a textile material, for heavily loaded parts. Actually these high-performance kites should be called a hybrid of an airplane and a kite. And in order to advance into the megawatt production of electricity in the

future, larger and even more powerful kites will be needed.

How does a kite compare to wind turbines and solar power systems in terms of energy generation?

Comparing kites with wind turbines and solar power systems is difficult because the technologies function quite differently, using different resources. In fact, we want our kite power systems to complement the existing renewable energy sources. Wind turbines are operated close to the ground, up to about 200 m. However, if you go higher, the wind becomes stronger and more constant. And the idea of airborne wind is that you can still generate electricity even when the wind turbines are stationary on the ground or have a poor yield. We see kite power as a useful addition to currently

operated wind turbines. And it's similar with solar energy. Nothing is produced there at night. With airborne wind energy, however, you can also produce electricity at night. The problem of the base load, i.e. being able to supply electricity continuously, not only temporarily or under suitable conditions, could thus be defused. And that is the key advantage.

Are there any other innovations, for example in the ground station?

Yes. The ground station is the most expensive component of the kite power system, the generator is also located there, but in terms of new technological developments, the ground station is not the highlight. The aircraft, i.e. the kite, and the control of the kite are more the focus of innovation. I would say that the automatic flight control of the kite is the key enabling innovation for airborne wind energy.

Can kite power be used in all weather conditions?

Basically yes. Rain and snow, for example, are easy to handle. In theory, even strong winds can hardly harm the kite because

the flight maneuvers can be stopped which decreases the aerodynamic load on the kite. One problem, however, are thunderstorms. Lightning strikes are a problem for the system, especially if the tether is wet and conducts electricity. Therefore it is better to haul in the kite during thunderstorms.

Is kite power particularly maintenance-intensive, since it is exposed to wind and weather?

Yes, that is another challenge for the future. The materials used, Dyneema, Nylon and Dacron, are subject to dynamic bending stress during the entire period of use, because the tether is constantly bent when it is rolled up. There is also UV radiation. And the combination of both ensures that both the tether and the kite have to be replaced quite often. We are working on improving this in the future. The installation of the 100 kW system, however, is straightforward. The system comes in a normal shipping container. Everything is in there. You can then put it anywhere and everything is set up within a few hours.

Is the system also suitable for metropolitan areas?

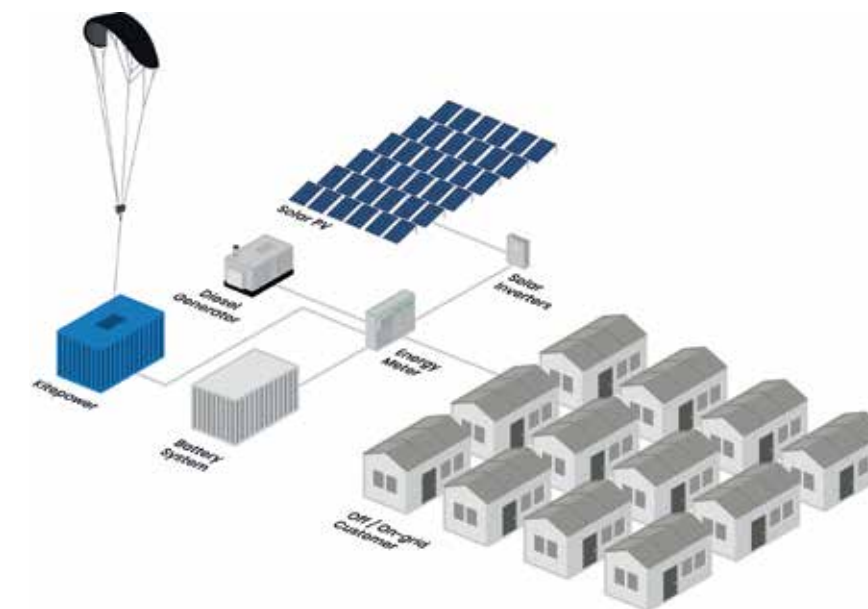
The use of airborne wind energy systems is primarily intended for remote areas that are difficult to reach, at least for now. Basically, a kite power system by itself is a kind of micro-grid. It has its own rechargeable battery and supercapacitors to buffer and store the generated electricity. And then you can adapt the module with inverters to the respective local grid and feed in the electricity.

We currently research how to place several systems next to one another. The tethers shouldn't tangle with each other and the kites should not collide. Plans for entire kite parks have yet to be worked out, except for theoretical studies.

LARGE-SCALE PRODUCTION IS STILL A LONG WAY OFF

The company tested the Falcon in the Caribbean. What happened there?

We operated the Falcon on the island of Aruba which is part of the Kingdom of the Netherlands. The Dutch military approached Kitepower in April 2021 with the proposal to participate in a joint exercise of the engineering corps on Aruba in October 2021. They see the mobile system of Kitepower as the ideal solution to avoid being dependent on diesel fuel



in their camps. They already use solar cells, but Kitepower has the decisive advantage of being more compact and also being able to be put into operation more quickly. At that military exercise, the goal was to provide electricity from the Kitepower system. It worked.

How much have the development costs been so far?

There was public funding from the EU and European national governments respectively of around 55 million euros. But it was not only for Kitepower, but also for several other companies in that sector. As far as Kitepower itself is concerned, there was the funding of 3.7 million euros from the EU in 2015, but this financing was shared with supplier companies and the university, who were project partners. In spring 2021 there was a private investment of 3 million euros. And then there are the smaller projects with the military, but I cannot say what sums were involved here.

How much will the unit costs be once the product is ready for the market?

That is a more difficult question. The Kitepower CEO always says he would like to get under 100,000 euros with the Falcon. However, we are talking about small series here. Large-scale production is still a long way off.

When will the Falcon be launched on the market?

There are already some power plant operators who are very interested in airborne wind energy. If all goes well, there will be first pilot plants in 2022.



Roland Schmehl (54) is a professor at the Technical University of Delft, Netherlands. He is German but was born in the USA. Schmehl studied at the Karlsruhe Institute of Technology and received also his doctorate from this university. He is a co-founder of Kitepower and is currently in a senior advisory position.

→ [THEKITEPOWER.COM](https://www.kitepower.com)

Mountaintop removal mining devastates the landscape, turning areas that should be lush with forests and wildlife into barren moonscapes. © Curioso Photography



IN THE APPALACHIAN REGION OF THE UNITED STATES, MOUNTAINTOP REMOVAL COAL MINING IS STILL A COMMON PRACTICE. WITH THE HELP OF TECH, ALGORITHMS, AND SATELLITE IMAGERY IT MIGHT FINALLY COME TO AN END.

For millions of people around the world, burning coal as a source of energy is a daily reality. Despite the damages coal and other fossil fuels cause to the environment, especially to our climate, it's still being dug for, even in advanced economies like Germany or the UK.

Surface mining is particularly harmful, as it literally puts the terrain upside down and leaves it massively degraded. One of these surface mining techniques is actually so bad that you wouldn't expect it to happen in the 21st century at all, no matter where. It's called mountaintop removal coal mining. And it's still happening in the United States of America.

When you happen to live in one of the central Appalachian states of Virginia, West Virginia, Kentucky, or Tennessee, mountaintop removal mining is a daily reality for you, too. "You need very big machinery and a lot of explosives, and then you blow off the top layers of the mountains to expose the coal seams below", Erin Savage explains. She's a senior programs manager at the Appalachian Voices, a non-governmental organisation out of West Virginia set to stop mining via mountaintop removal.

Over the last several decades, at least the last 40 years, coal companies have been looking for cheaper and cheaper ways to extract the coal. About 500 mountaintops have been removed so far, and even today some coal mining companies.

ALL THAT BLASTING, ALL THAT COAL TRUCK TRAFFIC
The impact to the environment is severe. One of the main problems is the excess material that used to be on the top of the mountains. In a lot of cases, the coal companies put some of it back to re-shape the mountain up to its approximate original height. But when you blow up all that material, the volume tends to expand. "So they

always have excess material", Erin Savage says, "and a lot of times what they do then is push that excess material over the edge of the mountains into the valleys below, burying headwater streams, which can cause a lot of longterm water pollution in the downstream areas."

In addition, rebuilding mountaintops doesn't really bring back the original state, because all that material is broken up now, so rain water infiltrates much more quickly than it would if it was the original geology. So the water picks up and dissolves pollutants in a much faster rate, and they end up in the streams below, where it causes a number of problems. Adding to that, there is a lot of aquatic life, like juvenile fish, and macro invertebrates, and all the little insects living in the water, that are sensitive to those kind of pollutants.

And there are a lot of human health studies about the correlation between close proximity to mines and having various negative health outcomes. Dust seems to be a major contributor, coming from all that blasting, but also from the coal truck traffic close to homes. And black lung is having a resurgence in the region, as not only more and more people from the mines are getting it, but also people who are no miners but living nearby.

Mountaintop removal even made it into international headlines lately, as another non-governmental organisation out of West Virginia called Skytruth published some impressive



Draglines dig into the heart of the mountain to extract the coal. © 123rf.com

COAL MINING IN EXTREMO

WRITTEN BY FRANK ODENTHAL



SKYTRUTH.ORG
DATA ON MOUNTAIN-TOP
MINING IN CENTRAL APPALACHIA

footage of Appalachian mountains with their tops blown away. "We've been working a lot with Skytruth over the years", Erin Savage recalls. To many people even from the region it was the first time they could really see the

devastating impact of that particular mining practice.

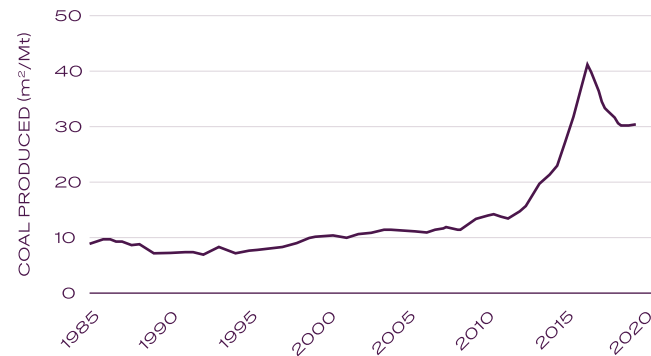
MEASURING DIFFERENT WAVE LENGTHS OF LIGHT

Skytruth is specialised in remote sensing, using Google Earth and other providers of publicly available satellite imagery to take a closer look at the land from above.

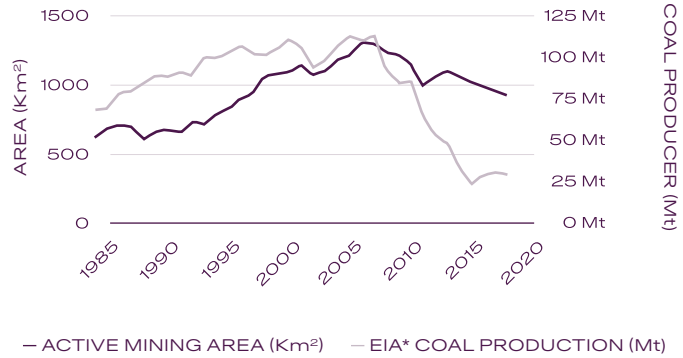
"Most recently, we started a project with them, where they essentially wrote an algorithm to use publicly available remote sensing imagery to measure how the reclamation of the degraded mountains and valleys is going", Erin Savage explains. "They look at the vegetation cover basically. How many trees are there, and how much grassland?"

Skytruth's approach is to measure different wave lengths of light. They are using their algorithms to differentiate

LAND DISTURBED PER METRIC TON (Mt) OF COAL PRODUCED (1985-2019)



ANNUAL ACTIVE MINING & EIA* REPORTED COAL PRODUCTION (1985-2019)



*US ENERGY INFORMATION ADMINISTRATION (EIA)

between the light that comes from a forest versus, say, a parking lot. But they also managed to identify areas that had some reclamation done, but were growing back as simple grassland or not native plants. "That was really pretty successful" Savage remembers. "They were able to write a paper about how well reclamation is going."

Coal mining companies in the four central Appalachian states are obliged by law to restore the land they've left behind. But a lot of the companies are falling behind on the reclamation standards. With the help of Skytruth, Erin Savage and the Appalachian Voices were able to quantify it.

"But the problem is that some of the enforcement mechanisms, that the law has, don't really work anymore", Savage explains. "For example, if coal companies have too many violations at previous mines, they get put on a list and can't get new permits. But now, with an end to the coal era at sight, a lot of these coal companies don't want new permits anyway, so they don't really care about their environmental obligations."

THE BEAM was trying to contact one of the major coal companies in the region, Bluestone Coal Company, owned by West Virginia's governor Jim Justice. As of today, there has been no reaction.



An explosion was poured into these holes and mountaintops are literally blown apart © Appalachian Voices

SOME INDUSTRIES, INCLUDING STEEL AND CEMENT, EMIT CARBON DIOXIDE AS PART OF THE MANUFACTURING PROCESS, AND COULD BENEFIT FROM CARBON CAPTURE TECHNOLOGIES

means possible. Carbon capture and storage (CCS) or carbon capture, utilization and sequestration (CCUS) are included in the mitigation pathways set out by the Intergovernmental Panel on Climate Change.

Despite this, carbon capture technologies have been labelled as a distraction from supporting renewable energies and as extending the life of the oil and gas industry. But CCUS is a technology we cannot ignore.

CCUS are technologies that concentrate carbon dioxide from various streams, including combustion stacks, industrial processes and air, and either make use of the carbon dioxide or store it away. I research the technical development of carbon capture and previously oversaw the innovation around CCUS through Carbon Management Canada, and have come to understand these technologies.

THE CLIMATE EMERGENCY IS A COMPLEX PROBLEM

Mitigation — finding ways to avoid the worst effects of the climate emergency — is a hugely complex problem. The problem itself is multifaceted, value-laden and carries uncertainty. There is no silver bullet.

Complexity science — a research approach that studies the interconnectedness of dynamic systems — tells us that in order to deal with complex problems, we need to apply non-linear thinking (draw connections from multiple concepts) and be adaptive and learn. Given the urgent need to decarbonize, we need renewable energy sources to replace fossil fuels to produce electricity. But this will take time, and it is here, through this transition period, that CCUS can provide a much-needed technical solution.

We also need CCUS to decarbonize heavy industries such as cement and steel, which account for about 10% of greenhouse gas emissions in Canada. Using renewable energy won't affect

With the ongoing climate emergency and nations' commitments to meet net-zero goals by 2050, there's a heightened need to significantly reduce greenhouse gas emissions through whatever

their emissions much because carbon dioxide is released from the material used in the process, and not through combustion. CCUS technologies can be a strong part of the arsenal to accelerate the decarbonization of industries.

Time matters in the race to decarbonization. Fortunately, CCUS technologies are no longer a curiosity or experimental, but are ready or nearly ready to be exploited.

Canada has successfully demonstrated CCS at Boundary Dam, a coal-fired power station near Estevan, Sask. The technology is based on a liquid that absorbs carbon dioxide from emissions and lets the other gases through, and then releases pure carbon dioxide into another stream, allowing it to be captured and stored.

Over the past seven years, this demonstration project — the world's first — has provided much information about capturing carbon dioxide from a coal-power plant, and has become a benchmark for technology developers. Researchers like myself learned that a liquid sorbent (the substance that absorbs the carbon dioxide molecules) requires large amounts of energy ↗ for regeneration (compared to solid sorbents) and degrades over time, releasing toxic chemicals.

Identifying challenges like these — and proposing solutions — is how technological breakthroughs evolve. This project also demonstrated how carbon dioxide can be safely stored in geological formations and how technology can be used to monitor that containment.

ENCOURAGING INNOVATIONS

The small CCUS steps taken almost a decade ago are now being followed by a flurry of innovative technologies whose commercial deployment can be measured in months or in a few years.

For example, Svante is developing a carbon capture technology using structured solid sorbent to bind carbon dioxide. The solid sorbent is placed in a rotating column that captures diluted carbon dioxide from flue gas and releases concentrated carbon dioxide when it's

“The small CCUS steps taken almost a decade ago are now being followed by a flurry of innovative technologies whose commercial deployment can be measured in months or in a few years.”



THECONVERSATION.COM
HOW SOON COULD CARBON
CAPTURE TECHNOLOGY SOLVE
INDUSTRY CO₂ SHORTAGES?

OP-ED

THE KEY TO AVOID THE WORST EFFECTS

OF THE CLIMATE EMERGENCY

WRITTEN BY BY NAKO ELLIS



AIRMINERS.ORG
EXAMPLES OF CCUS
INNOVATIONS



SCIENTIFIEDIRECT.COM
WHAT WENT WRONG?
LEARNING FROM THREE
DECADES OF CCUS PILOT
AND DEMONSTRATION
PROJECTS

exposed to steam. Svante is currently scaling its operations and working with hard-to-abate industrial emissions — such as in cement and steel industries.

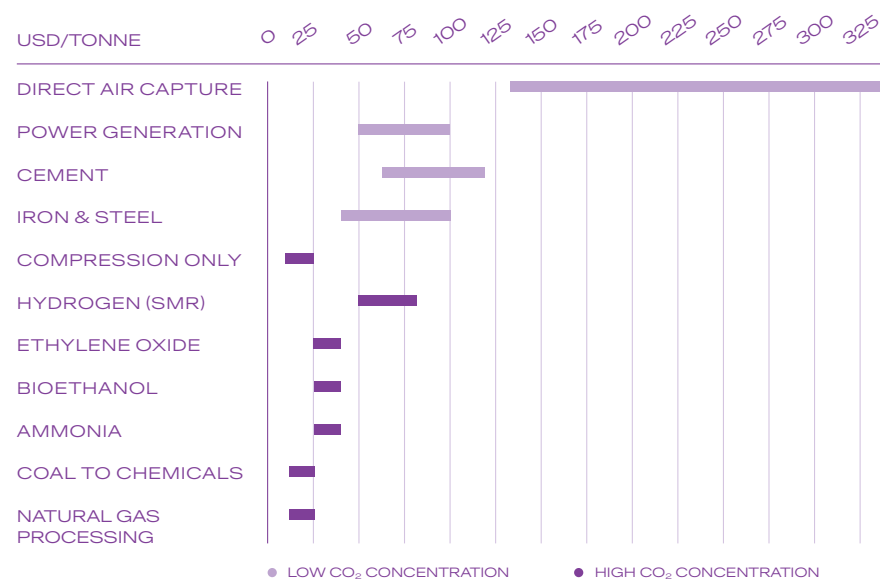
Marketed as an industrial lung, CO₂ solutions Inc. is also developing carbon capture technology using a naturally occurring enzyme to capture carbon dioxide from flue streams and provide pure carbon dioxide stream as chemical feedstock for building material and fuels.

These are just a couple, from a large number of [examples of CCUS innovations](#) being developed and commercialized by start-ups and small-to-medium enterprises all over the world. Yet the perception of CCUS technologies continues to be that they are [high-risk and too costly](#).

WE NEED COMMITMENT AND WILL

The cost of carbon capture reflects the capital cost of building the system, concentrating the incoming carbon dioxide stream and providing the energy required to purify the carbon dioxide stream. As technologies develop and more versions are adopted, the cost of carbon dioxide capture and conversion will decrease.

LEVELISED COST OF CO₂ CAPTURE BY SECTOR AND INITIAL CO₂ CONCENTRATION (2019)



SOURCE: IEA

However, they will remain costly even with the best of scenarios. If we want to add value to carbon dioxide, thermodynamics tell us that it will inevitably require energy — and energy has a cost.

Just as we, as a society, have come to accept paying for the proper handling of our solid wastes, industry must accept paying for the proper handling of its carbon dioxide emissions. Clearly, we can no longer expect to limit the global temperature rise to 1.5° C without considerable commitment of funds and political will.

Critics may say that we are gambling with unproven technologies, but many of these technologies are far from unproven. Yes, many are being challenged through their scale-up, but this is typical of any new technology in any industry. We shouldn't paint CCUS with a large brush stroke, but rather understand these technologies with granularity and in context.

There are many industrial emissions, such as lime kiln in the cement and pulp and paper industries, that require carbon dioxide capture from their processes. Just as we need to consider alternative fuel sources for transportation, heating and others, we need to look at industrial emissions in various sectors in context.

Demonstration projects allow us to continuously learn about how technologies improve, how the social systems react and adjust to changes, and how to change policies. At this point, we no longer have the luxury of finding the best solution that addresses such a complex problem as the climate emergency.

Instead, we need to deploy some technologies based on our best judgement, learn from the cases and improve our understanding and technologies. We need to embrace some carefully chosen CCUS technologies and try to reduce emissions quickly, while we continue to develop and improve them and as we continue to deploy renewable energy sources.

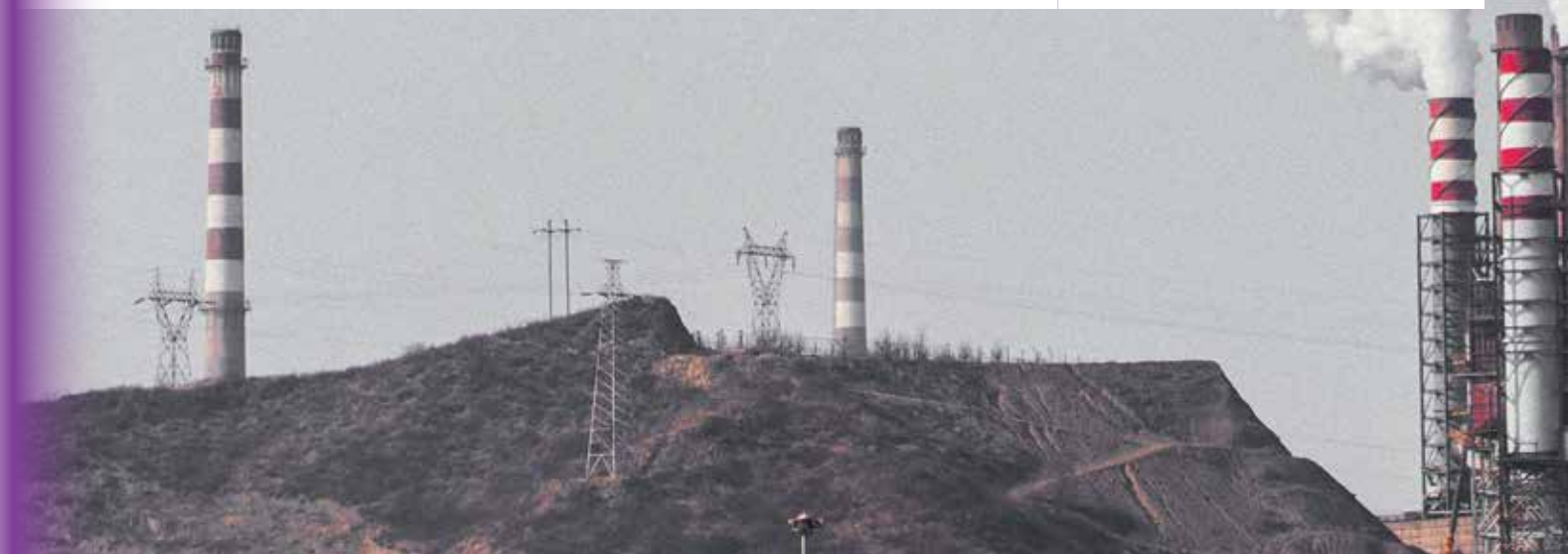
Canada has contributed to CCUS through research and innovation, and demonstrated a few successful CCUS projects. With our commitment to [place a price on carbon](#), we have a greater chance at succeeding in applying CCUS technologies to decarbonize our activities. We have now entered the all-hands-on-deck phase to quickly mitigate the devastating effects of the climate emergency. Let's shift the narrative on CCUS and reduce carbon emissions with all the available tools.



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CANADA'S FEDERAL
ELECTION MADE BIG STRIDES
FOR CLIMATE AND
THE ENVIRONMENT

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THERE ARE CURRENTLY SEVEN RECOGNISED NEGATIVE EMISSIONS TECHNOLOGIES (NETS). WHAT ARE THEIR GLOBAL CO₂ REMOVAL POTENTIAL, COSTS AND RELEVANT SIDE EFFECTS? AN OVERVIEW OF THE PROS AND CONS OF CARBON CAPTURE AND STORAGE.



THE 7 WAYS OF GETTING CARBON DIOXIDE OUT OF THE ATMOSPHERE

WRITTEN BY FRANK ODENTHAL AND AMA LORENZ

1

AFFORESTATION AND REFORESTATION (AR)

Afforestation is the establishment of a forest or stand of trees in an area where there was no previous tree cover. Meanwhile, reforestation is the natural or intentional restocking of existing forests and woodlands that have been depleted, usually by deforestation. Both are available at large scale - theoretically - but they currently lack incentives for widespread adoption. They are likely to increase in costs as land gets more scarce. They could have positive side effects on biodiversity and soil and water quality, if they are not applied as mono-cultures.

Example: 11 countries have set out to build the Great Green Wall, a 7,000 kilometre belt of trees stretching from Senegal in West Africa to the coastal areas of Djibouti in East Africa.

This, the project's organisers hope, will trap the sands of the Sahara desert, halt the desert's further expansion, restore 50 million hectares of land and absorb some 250 million tonnes of carbon. Around 15% of the wall of trees has already been planted, according to the Sahara and Sahel Great Green Wall Initiative.

The "Wall" promises a compelling solution to the many urgent threats facing not only the African continent, but the entire global community - in particular climate change, drought, hunger, conflict and migration. When completed, the Great Green Wall will be the largest living structure on the planet: three times the size of the Great Barrier Reef.

- A. **Tech readiness:** ready for large scale deployment
- B. **Positive side-effects:** good for soil quality
- C. **Negative side-effects:** Albedo effect, threats to food security and potentially negative implications for biodiversity
- D. **Permanence:** reversible



2

BIOCHAR (BC)

Biochar has a high carbon content of up to 90% and binds carbon material reliably, for long-term and without negative side effects. Obtained by pyrolysis from biomass, it will capture CO₂ from the atmosphere during its growth. Carbon is stored in plant material while oxygen is released into the atmosphere. A large part of the carbon can be captured in a gas, a liquid and a solid phase. While providing climate-neutral energy using the gas phase (Syngas) and the liquid phase (Bio-Oil), the material use of the solid phase (Biochar) allows for carbon capture and storage, thus leading to a net positive climate process.

The costs of this technology are rather moderate. The broad application of biochar makes negative emissions possible at a large scale. Increased crop yields and improved soil carbon and nutrients, alongside reduced N₂O emissions, are expected outcomes.

Example: As Europe's first manufacturer of biochar, Swiss Biochar has been offering biochar of high-EBC quality since 2010. Together with the Ithaka Institute, they have developed humus-rich soil substrates with activated plant carbon. EBC-certified biochar meets the highest quality standards with a carbon content of over 80%. Since 2021, they have been part of the NovoCarbo Group to optimise their product range for a wide variety of applications - from viticulture to greenery and balcony plants.

- A. **Tech readiness:** limited pyrolysis capacity
- B. **Positive side-effects:** good for soil quality
- C. **Negative side-effects:** reliant on biomass availability
- D. **Permanence:** stable, depending on soil type

3

SOIL CARBON SEQUESTRATION (SCS)

Soil carbon sequestration comprises a series of practises that deliver negative emissions by organically storing CO₂ in soils. Scientists have estimated that soils - mostly for agricultural uses - could sequester over one billion additional tonnes of carbon each year. This technology is also available at large scale, but there are concerns about its permanence. There are hundreds of millions of farmers around the world, mostly farming small plots of land. To take full advantage of soil-based sequestration as a climate solution, it would require many of them to change the way they farm, now and for hundreds of years in the future. This is a big social and economic challenge, and experts debate how much soil-based sequestration is really possible in the long term.

Example: Soil carbon sequestration has gained traction within the Biden administration as a way for farmers to reduce, or even reverse, American agriculture's greenhouse gas (GHG) emissions. To advance this technology, Congress proposed the bipartisan Growing Climate Solutions Act, which is intended to help farmers participate in voluntary markets that pay them to store carbon in the soil.

- A. **Tech readiness:** ready for large scale deployment
- B. **Positive side-effects:** a possible concomitant reduction of N₂O as another (hard to reduce) greenhouse gas
- C. **Negative side-effects:** insecure permanence
- D. **Permanence:** reversible in certain conditions



4

ENHANCED WEATHERING ON LAND AND IN OCEANS (EW)

Enhanced weathering delivers negative emissions by accelerating the mineral weathering process of rocks and distributing the ground-up rock over land. Enhanced weathering results in carbonation (i.e. carbonate rock formation), which may be considered a form of geological storage.

Example: Mission-driven companies, like The Project Vesta, are executing direct action measures by investing in research, conducting field tests to develop practical solutions at scale to remove large amounts of CO₂ from the atmosphere and to galvanise global deployment. The NGO captures CO₂ by using an abundant, naturally occurring mineral called olivine. Ocean waves grind down the olivine, increasing its surface area. As the olivine breaks down, it captures atmospheric CO₂ from within the ocean and stabilises it as limestone on the seafloor. This approach provides permanent sequestration with the potential for very high volume at a low cost. Questions remain about its safety and viability: to validate coastal enhanced weathering, more lab experiments and pilot beach projects must be performed.

- A. **Tech readiness:** limited mineral production
- B. **Positive side-effects:** a possible concomitant reduction of N₂O as another (hard to reduce) greenhouse gas
- C. **Negative side-effects:** water and ground pollution, as well as supply chain risks involving mining, extraction, and the energy-intensive process of grinding rocks
- D. **Permanence:** stable

5

OCEAN FERTILISATION (OF)

Ocean fertilisation delivers negative emissions by enhancing the carbon uptake of oceans.

This is achieved by increasing the nutrient supply in the near-surface, by adding micro or macronutrients. This technology has only been tested in small scale demonstration plants so far, but there is likely to be a large potential to increase scale. Its impact on marine biology and food web structures is unknown.

In addition to reducing emissions, seaweed cultivation may also reduce ocean acidification. In some places, this application is already in use for shellfish aquaculture to reduce acidification and improve shellfish growth.

A. Tech readiness: only small-scale demonstrations

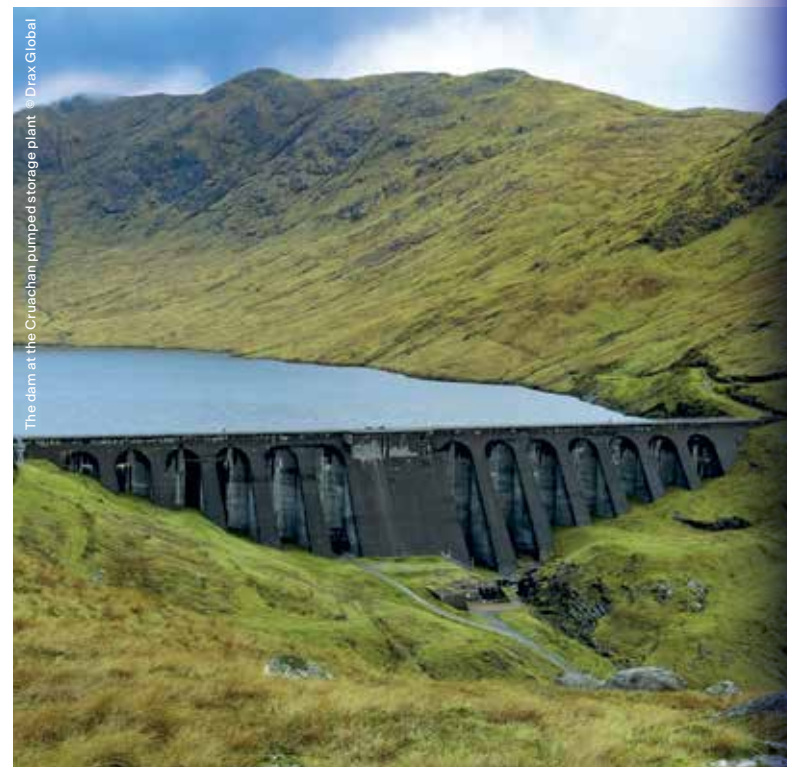
B. Positive side-effects: unknown

C. Negative side-effects: unknown

D. Permanence: stable but uncertain



Seaweed farming in Nusa Lembongan, Bali © Janne Heilsten



The dam at the Crusachan pumped storage plant © Drax Global

6

BIOENERGY COMBINED WITH CARBON CAPTURE AND STORAGE (BECCS)

BECCS deliver negative emissions by capturing and storing the CO₂ released from biomass during combustion. This technology has good market opportunities, but its impact on biodiversity and land degradation are likely negative.

Example: The British company began to pilot the first bioenergy carbon capture and storage (BECCS) project of its kind in Europe at Drax Power Station in October 2018. The pilot project with C-Capture technology captured its first carbon molecules at the UK's largest renewable power station in early 2019.

A second BECCS pilot facility has been installed by Mitsubishi Heavy Industries (MHI) within the North Yorkshire power plant's carbon capture usage and storage (CCUS) incubation area in autumn 2020.

A. Tech readiness: only 1 full scale demonstration

B. Positive side-effects: low footprint

C. Negative side-effects: risk of negative side-effects for biodiversity, air pollution, trace GHGs, and for food security

D. Permanence: stable

7

DIRECT AIR CAPTURE AND STORAGE (DACCS)

This is one of the few technologies that extracts carbon dioxide from the atmosphere and is viewed by scientists as vital to limit global warming. DACS technology extracts CO₂ directly from the atmosphere through chemical processes. This is then permanently stored to achieve negative emissions. If CO₂ captured with DAC is used in short-lived products, such as fuels, it is an example of CCU, and therefore is not considered a negative emission. The energy intensity of the direct air capture process may involve trade-offs with a scarce supply of climate neutral electricity and heat.

Example: In September 2020, Swiss and Icelandic companies announced the start of operations for the world's largest direct air carbon capture plant. The Orca plant - a reference to the Icelandic word for energy - consists of eight large containers similar in appearance to those used in the shipping industry, which employ high-tech filters and

fans to extract carbon dioxide. The facility will capture and store up to 4,000 tonnes of carbon dioxide per year.

Direct air capture is still a fledgling and costly technology, but developers hope to drive down prices by scaling up production as more companies and consumers look to reduce their carbon footprint.

A. Tech readiness: deployed in niche markets

B. Positive side-effects: energy sources are renewable energy, energy-from-waste or other waste heat

C. Negative side-effects: little known but significant potential opportunity costs

D. Permanence: stable; CO₂ captured by Orca is stored underground for mineralization. This is a safe and accelerated replica of a natural geological process. No weather conditions or fire can cause an outbreak of carbon dioxide; it is stored permanently.



Orca is the world's first and largest direct air capture and storage plant © Climeworks



SPINNING GOLD FROM CARBON

WRITTEN BY AMA LORENZ

AVOIDING THE WORST EFFECTS OF THE CLIMATE EMERGENCY IS A HUGE COMPLEX PROBLEM. WHERE CAN WE STORE ALL THE CARBON WE HAVE BEEN BLOWING INTO THE ATMOSPHERE FOR YEARS? 'JUST CAPTURE IT, RECYCLE OR BURY...' CARBON MANAGEMENT IS THE POPULAR MAGIC WORD. BUT NEW TECHNOLOGIES LIKE CARBON CAPTURE ALSO SHOW THAT THERE IS NO SILVER BULLET.

Do you know the quote: 'Most problems arise when they are solved'? One of the main causes of climate change, CO₂ is a powerful problem - and it is getting worse. To offset one ton of CO₂ emissions alone, you would have to plant 80 trees. According to a forecast on global CO₂ emissions, the amount will rise to as much as 43.1 billion tonnes in the next 30 years - so we would need 3,448,000,000,000 trees. Sounds unfeasible, and it probably is.

But what if, statistically speaking, each of us didn't have to plant 35 trees? What if we didn't have to decide in the future whether to drastically change our CO₂-heavy lifestyle or to protect our environment and still be profitable?

Wind turbines and solar panels are spreading fast, but not fast enough to offset our CO₂ emission rate and avert the worst consequences of climate change. And so it is appealing to put the cart before the horse. Not to tackle the cause, i.e. the use of fossil fuels, for example, but fixate on its consequences.

For decades, researchers have been looking for ways to remove the dangerous carbon from the chimneys of tens of thousands of fossil fuel power plants and from the atmosphere. The promising technologies currently on everyone's lips range from "filtering out" the carbon dioxide on its way to the smokestack of a power plant or factory to removing the carbon dioxide that is already in the air, a process called "direct air capture."

But what happens to the carbon after it has been captured or filtered? It can either be permanently stored underground or converted into a carbon-containing product and be put back into the commodity cycle. And, in a way, that could permanently change the global economy.



Scientists at the Hellisheidi geothermal power plant in Iceland have demonstrated a carbon capture and storage cycle at half the cost of previous estimates.

THE MAGIC OF CARBON CAPTURE AND STORAGE (CCS)

The Global CCS Institute's new climate report has analysed the continued growth of carbon capture and storage (CCS) worldwide. According to the report, in 2021 the total capacity of the CCS project pipeline increased for the fourth consecutive year by almost a third compared to the previous year. CCS is recognised by experts as an essential element in achieving global climate protection goals. However, as is so often the case, new technologies such as CCS are primarily driven by economic interests. It is therefore not surprising that many CCS projects favour the storage of carbon dioxide, mostly in order to squeeze more oil out of aging wells, and then store the carbon underground in air pockets in the porous rock of depleted wells. "Cap rock" on top to prevent spillage - problem solved. See Quest, an oil sands project operated by Shell Canada.

But what was that again about the problem and the solution? We are already dumping pollutants into groundwater, burying nuclear waste and drilling holes in the deep sea, "fracking" our way into infinite depths. The consequences are uncertain and threatening.

But it can also be done quite differently. The goal of Canada's InnoTech - Alberta Carbon Conversion Technology Centre on the outskirts of Calgary is not just to capture and "bury" harmful greenhouse gas emissions, but to find a way to turn carbon dioxide into money. The \$20 million centre is a testing ground for cutting-edge technologies that can turn carbon dioxide gases into so-called



Replacing fossil fuels with biofuels—fuels produced from renewable organic material—has the potential to reduce some undesirable aspects of fossil fuel production and could also increase farm income.

CO₂-negative products like bio-fuel, nutritious protein, bio-plastics, nutrients for fish, nano-fibres and all the way to alcohol and furniture.

InnoTech allows companies from all over the world to test their technology in a ready-to-use industrial facility and, according to official figures, is one of the few centres in the world where technologies for carbon conversion into consumer goods, building materials or even pharmaceutical drugs can be tested on this scale.

"All these companies have already proven that their technology works. Now they are proving that it works on a commercial scale," said Deron Bilous, Alberta's then Minister of Economic Development and Trade, at the centre's inauguration in 2018. A lot has happened since then. In 2021 alone, 71 new CCS plants were planned. This brings the total number of commercial CCS plants worldwide to 135, with 27 fully operational, four under construction and 102 under development. North America is the world leader in CCS deployment. This is mainly due to the tax credits in place there, with a tax credit for CCS investments also coming into effect in the Canadian budget from 2022. But stronger climate commitments - including the US rejoining the Paris Agreement - and the expected increase in demand for low-carbon energy products also pay into this. By September 2020, the CO₂ capture capacity of all CCS plants under development has increased from 75 million tonnes per annum (Mtpa) to 111 Mtpa - almost half more than in 2020. This is an impressive amount of material that could be used by a wide range of economic sectors.



VEGREVILLE, AB, May 18, 2021

InnoTech Alberta (InnoTech) a subsidiary of Alberta Innovates, is breeding, developing, and enhancing a new hemp seed variety known as Silesia. InnoTech signed a distribution agreement with UniSeeds Inc. to sell the enhanced Silesia variety of hemp seeds. Silesia is a seed variety approved by Health Canada and the distribution agreement commercializes InnoTech's innovation in its enhancement.

ENVIRONMENTALLY-FRIENDLY CARBON

Among the companies using the Alberta Carbon Conversion Technology Centre are winners and finalists in the International Carbon XPrize, a high-stakes competition to convert carbon dioxide emissions from the energy industry into usable products.

One of the two main winners of this year's prize is a Canadian company from tranquil Nova Scotia, which secured a multi-million dollar prize ahead of innovations such as using photosynthesis to convert carbon and converting acid rock and CO₂ emissions into a stable substance. Similarly to the other award winner, Los Angeles-based UCLA CarbonBuilt, CarbonCure Technologies injects carbon dioxide into concrete to make it harder while reducing its CO₂ footprint. After injection, the CO₂ undergoes a mineralisation process and is permanently bound. This results in economic and climatic benefits for concrete producers - a real win-win situation.

"Annually, buildings account for 40% of global greenhouse gas emissions, and the global building stock is expected to double by 2060," says Marcius Extavour, Executive Director of Carbon XPrize.

The use of CO₂ in concrete is now expected to become a \$400 billion market. CarbonCure concrete is already used in more than 300 concrete plants around the world.

If concrete isn't your thing, you might enjoy some CO₂-containing furniture - or something high-prozentual.

The start-up Air Company began selling its spirits to bars and restaurants in New York City in November. The CO₂ stock used



CO₂Concrete uses a new material that absorbs CO₂ to produce concrete building materials for the home, buildings and infrastructure.



Brooklyn-based Air Co. makes pure and sustainable vodka out of thin air. The team uses solar power to capture excess carbon from the air, which is distilled and filtered to produce ethanol, the base ingredient for all alcoholic drinks.

Gaurav Sant and UCLA Carbon Upcycling developed the eco-friendly building material CO₂Concrete to replace traditional concrete.



to make their vodka comes mainly from beverage manufacturing plants that produce waste gases during fermentation. Instead of escaping into the air, the molecules now end up in the vodka bottles.

Drinking to combat climate change might be an appealing cause on its own for some, but vodka is supposed to be just the beginning if Gregory Constantine, the company's CEO, has his way. The team hopes that by selling a consumer product, it will be able to expand its pilot alcohol production operation so that the company could branch into alternative fuels, chemicals for plastic production or other markets.

ALL THAT GLITTERS IS NOT GOLD

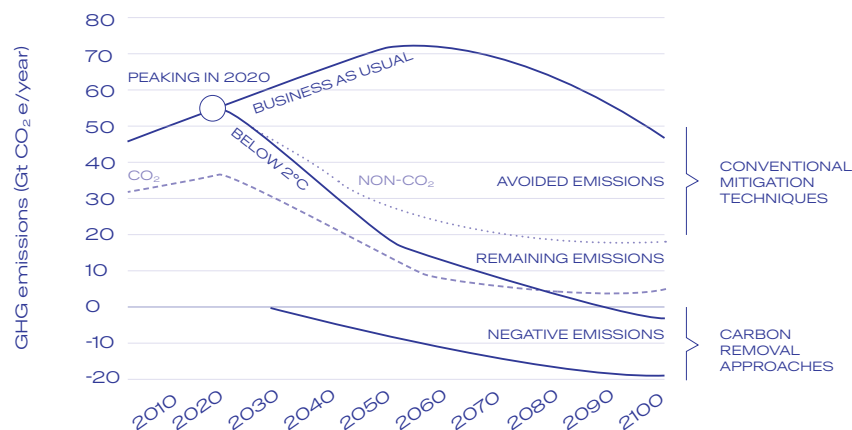
The potential global market for waste CO₂ products could be worth \$5.9 trillion a year, according to Carbon180, a non-profit organisation based in Oakland, California. Cement, plastics and fuels account for most of this potential market, while consumer goods are likely to account for only a tiny fraction: less than 1%. So there is still a lot of room for improvement.

You can already buy watches, pens or incense holders made from carbon absorbing materials. Two other start-ups, Carbon Upcycling Technologies and Sky Baron, have recently launched a range of such products, and jewellery companies are increasingly selling lab-grown diamonds made by exposing carbon to high pressure and chemical fumes; the result is stones that sparkle just as brightly but are much cheaper than natural diamonds.

For any developer in this growing industry, simply developing and scaling technologies is not the only challenge. Companies also need to figure out how to do this without leaving a significant environmental footprint themselves. Many factors determine a product's cradle-to-grave emissions, and not all new technology "hype" fully takes these into account. For example, carbon captured from chimneys is usually captured and cleaned before being used for other purposes. This process can consume large amounts of electricity and water, thus driving up costs and emissions, especially if the electricity comes from coal-fired power plants. Carbon is not necessarily free in terms of its environmental impact.

The lifespan of a product also makes a big difference. Plastic polymers used for packaging and building materials, for example, can sequester CO₂ longer than biofuels, which immediately release CO₂ back into the air when burned in engines. Nevertheless, even short-lived products can benefit the environment if they displace those made from fossil fuels. Whether this will be the case remains an open question for both industry developers and us, the consumers.

THE CARBON MITIGATION & REMOVAL IMPERATIVE



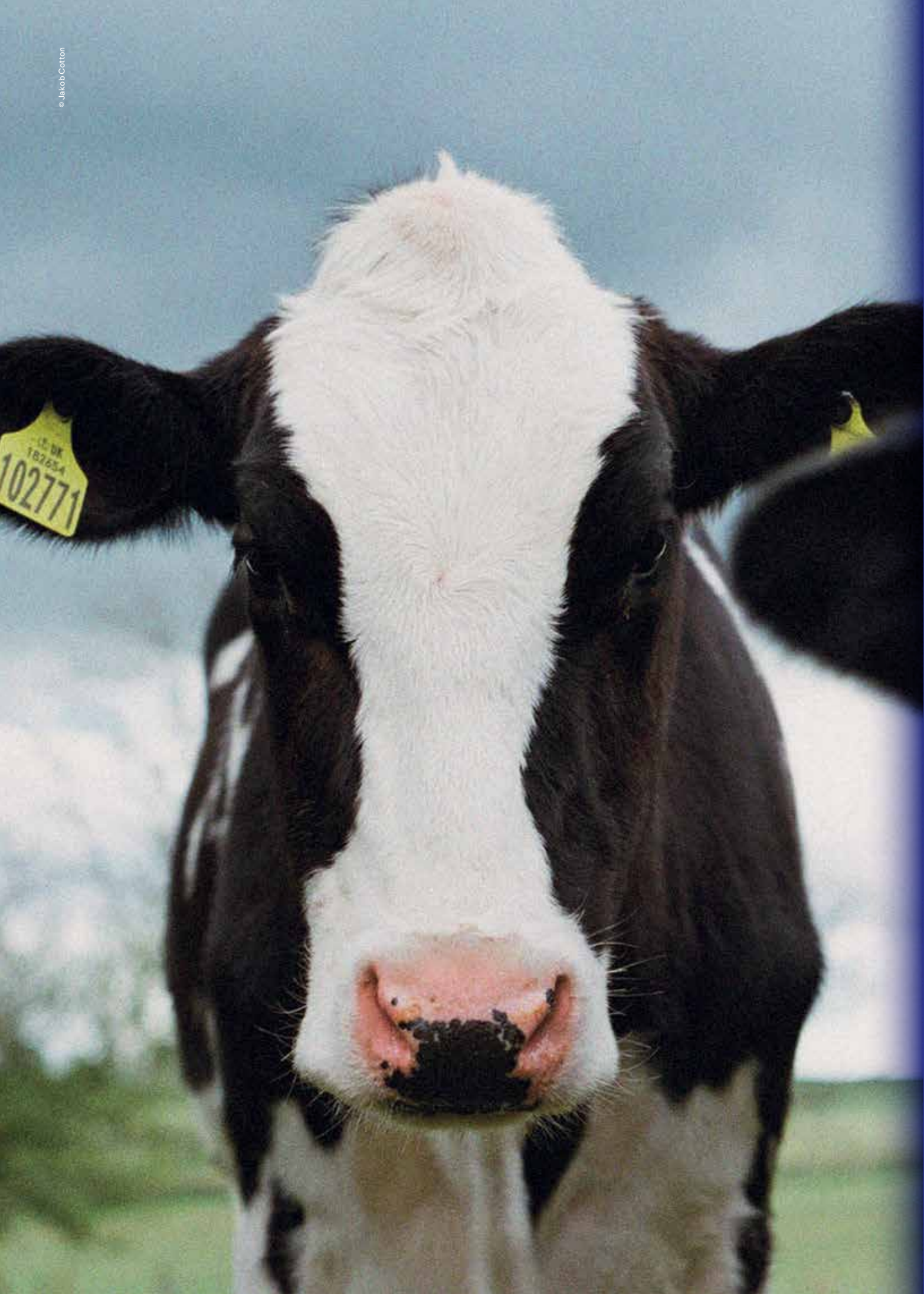
Robert Niven, Chair and CEO of CarbonCure Technologies, founded the company in 2012 with the simple goal of making concrete sustainability both profitable and easy for industry.

Incidentally, CarbonCure founder Rob Niven thinks the [Carbon XPrize](#) → was worth the three rounds over a 54-month period and the effort the company put in to win. The company plans to use the prize money to achieve its own corporate goal of reducing 500 million tonnes of carbon emissions annually by 2030; that would be like taking 100 million cars off the road. The company also plans to invest some of the money in social justice initiatives. A good example of saving the climate and doing good for society.

Of course, carbon capture alone won't solve the problem - we also need to stop using fossil fuels, use value-added products from these new technologies and restore nature's ability to remove carbon from the air - plant trees after all, for example. That said, using carbon capture in the circular economy can be an important part of the solution.



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NON-PROFIT ORGANIZATION
THAT DESIGNS AND HOSTS
PUBLIC COMPETITIONS



© Jakob Cotton

Beef and dairy production contributes to climate change. According to the United Nations Food and Agriculture Organisation (FAO), livestock's share of anthropogenic Greenhouse Gas (GHG) emissions is up to 14.5%, representing 7.1 gigatonnes of CO₂ equivalent gases per year – which takes into account the proportionate effects of all GHG.

Cows mostly emit methane (CH₄) and nitrous oxide (N₂O) in their digestive process, a problem that gets considerably worse when we put it in context: around 1.5 billion cattle worldwide each emit between 70 and 120 kg of methane per year.

Furthermore, cattle ranching demands large expanses of land, which is frequently associated with deforestation. Even though an increasing number of people have been switching their diets to a plant-based one, this is still not the mainstream. Nearly 72 million tons of beef and 860 million tons of milk are produced every year, according to a 2020 report by FAO.

In order to reduce the impact of these foods, scientists around the world have been working on solutions. One of them is the new additive recently presented by the animal nutrition and health company DSM. Commercially called Bovaer®, the additive could potentially reduce cows' emissions by anywhere between 30% to 90%, depending on the kind of livestock (for dairy or beef production) and a combination of factors, such as the quality of feeding. "For a dairy cow this equates to a saving of more than 1 ton CO₂ per cow per year," calculated Mark van-Nieuwland, a Program Director at DSM.

The product is a powdered combination of nitrate and a

biobased alcohol. Adding a quarter of a teaspoon per cow per day to cattle feed, says the company, produces immediate (but reversible) results, without any damage or side effects – neither for animals nor for humans. "When cattle digest feed they produce hydrogen and carbon dioxide as by-products. Microorganisms in a cow's stomach turn these gases into methane via an enzymatic pathway," van-Nieuwland explained. "Bovaer® suppresses the last enzymatic step of this pathway thereby preventing the production of methane."

Other studies have also led to the development of additives to be included in cow's diet in order to reduce their methane emissions. What makes Bovaer® different, according to researchers who spoke to THE BEAM, is the greater potential of reducing emissions. "There is a class of additives used for over 40 years, that of ionophores, which has as one of its positive effects the reduction of methane emissions, but with more modest results than the Bovaer®, which recently received approval," explained Sérgio Raposo, an agronomist and researcher at the Brazilian Agricultural Research Corporation (Embrapa), who did not take part in Bovaer®'s development process and has no ties to DSM.

Another difference that makes Bovaer® stand out is that it does not offer the risk of intoxication in case of over administration and does not use antibiotics. "It is an additive that will greatly help to reduce our emissions related to the production of meat and milk, reducing the carbon footprint of these foods.

At the same time, it improves animal performance, helping to enable cleaner and more efficient production," affirmed Raposo.



THE REVOLUTIONARY ADDITIVE TO REDUCE COWS' METHANE EMISSION

WRITTEN BY ELLEN NEMITZ



DSM.COM
MORE SUSTAINABLE FARMING WITH
BOVAER® CATTLE FEED ADDITIVE

BRAZIL AND CHILE ARE FIRST TO APPROVE BOVAER®

The first two countries to approve the use of Bovaer®, in September 2021, were Brazil and Chile. The authorisation was based on the results of Project Clean Cow, which has been gathering scientists and partners from 13 countries (including Brazil and Chile) for more than 10 years. Each experiment was carried out more than once, in several farms and universities, and was attested in more than 48 peer-reviewed studies published in independent scientific journals.

Although other countries may soon join the Latin American pioneers, the two approvals are already promising due to those nations' massive cattle herds. "Brazil has one of the largest bovine herds in the world, about 230 million heads, ranking second globally in terms of meat production and fourth position in dairy production. Chile, on the other hand, has a bovine herd of around 2.9 million heads," said Mauricio Adade, President for the Latin America division of DSM.

SYSTEMATIC CHANGES NEEDED FOR GENUINE SUSTAINABILITY

Despite all the potential benefits of Bovaer®, the product would add a cost to the production, so convincing farmers to embrace it could present an additional challenge before its large-scale implementation. DSM affirms that this is something they take into account in the company's expansion plans. "We are an animal nutrition company and we fully

understand the economic difficulties faced by producers, and we recognise that Bovaer® will need to adapt to these conditions," stated Adade.

The additive is not a silver bullet that can single handedly fight livestock-related GHG emissions, however. There are a series of practices that should be altered in order to establish a truly sustainable production process. According to several studies, the correct management of the pastures is essential to preserving soil and grass quality and enabling cows to gain weight more rapidly, avoiding deforestation and fires to clear new land for livestock. Science-based techniques can also help stock carbon in the ground.

Providing the right combination of food is a strategy defended by Ricardo Andrade Reis, a professor at the Animal Science Department at São Paulo State University (UNESP), who took part in the studies to develop Bovaer®. He explains that what causes methane production is fiber. Its digestion produces hydrogen, which makes the digestive tract more acidic. To deal with that, microorganisms combine hydrogen with carbon to produce methane. Offering starch as food would tackle the problem, but also compete with human feeding. "So, what we do is to manage the grass to increase the proportion of leaves, offering more digestible nutrients and less fibers, preventing grass from producing the stems," he stated.

Other products not consumed by humans can be added to this "low methane diet," such as sorghum, cassava zest, soy husk and peanut skin.

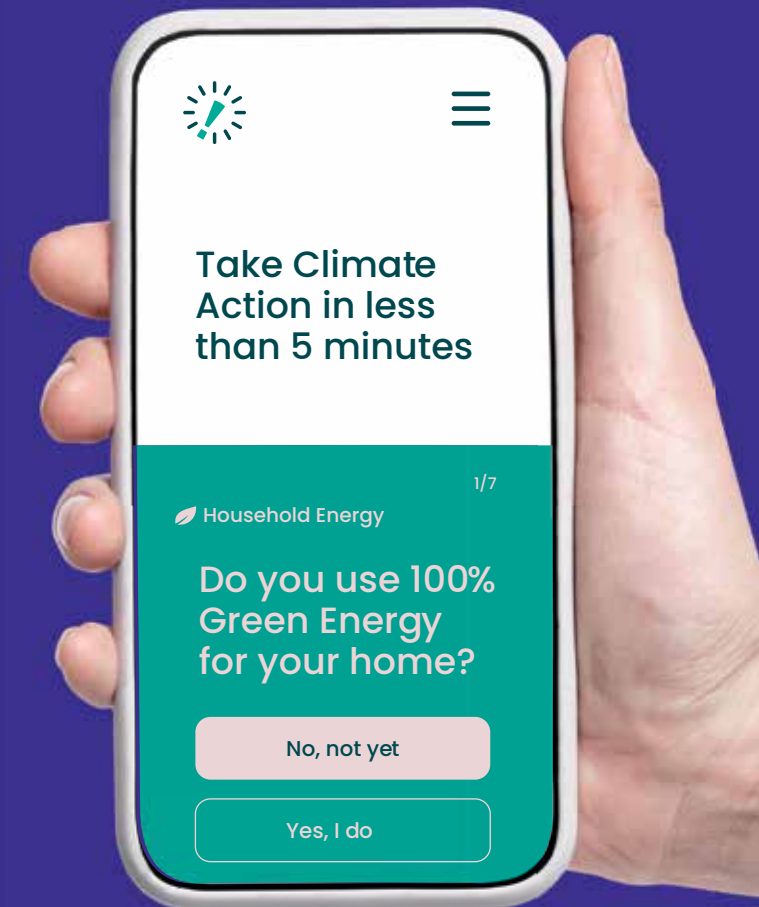
Additionally, natural oils from cinnamon, lemon and clove, for example, contain tannin, which reduces nitrous oxide emission (while methane is 28 times worse for the climate than CO₂, nitrous oxide is 298 times more potent for global warming).

"It is a set of actions that we call sustainable intensification. We increase the efficiency of using the inputs, reducing the waste. We need to pursue the best use of natural resources to achieve both food security and environmental benefits," the researcher concluded.



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WITH THE RAPID GLOBALISATION THAT HAS OCCURRED OVER THE PAST 50 YEARS, THE WORLD HAS INCREASED ITS CAPACITY FOR EXPORTING AND IMPORTING FOOD PRODUCTS FROM ALL AROUND THE WORLD.

It's not shocking that a grocery store in Germany and one in Peru could carry the same exact product shipped from Thailand. As transportation has become less of a barrier for market expansion, rising demand for food products in developed countries, coupled with a growing cultural expectation of availability, has placed intensive pressure to ramp up production – and has increased the stress humans place on the environment. While many of our favourite foods are damaging to the environment when not sourced sustainably, less harmful alternatives are available to help minimise our own carbon footprints.

It's estimated that about 25% of the world's greenhouse gas (GHG) emissions come from food and agriculture. Surprisingly, the emissions from transportation account for only 6% of the total, meaning that eating locally-sourced products is not necessarily more sustainable. Meanwhile, land change – the alteration or degradation of land to create farms or fields – constitutes the largest menace since it releases the carbon stored in plants and fungi into the atmosphere and prevents future carbon intake, while also killing and endangering animals.

With the urgent challenge to reduce our carbon emissions by 2030 to prevent 1.5°C global warming, it is important to know what the impact of our diets are on our own carbon footprints so we can reduce our consumption and reliance on these foods, or search for more environmentally friendly alternatives.



1 BEEF

Overwhelmingly, beef is the highest emitter of greenhouse gases, producing over twice as much emissions per kg as the second-highest food emitter. This is especially destructive as the demand for red meat from beef has skyrocketed in the past 50 years: since 1961, total beef production has tripled worldwide and fast food restaurants sell over fifty billion burgers every year. The high potency of beef's environmental impact boils down to two factors: land use and methane emission.

Cattle require land to graze and roam, as well as vast fields of grass to eat. To create the large fields that these animals require, cattle ranchers have resorted to clearing or burning forests and other natural environments to convert into cattle ranches. This releases drastic amounts of greenhouse gas emissions as these ecosystems, including plants and the fungal networks below them, are 'carbon sinks' that capture carbon dioxide from the atmosphere and either use or store it. Destroying these habitats could release these captured gases and prevent future emissions from being absorbed.

Beef also produces large amounts of methane gas as it digests grasses and grains through a process called enteric fermentation. While this is a natural process for cows that can hardly be avoided, the consequences are dramatic: methane gas, which accounts for 49% of beef's emissions, is a much more potent GHG than carbon dioxide in the short term.



2 CHEESE AND DAIRY

While cheese and dairy also come from cows, the cows that are used for beef production have a higher GHG emission than those raised for dairy products, largely due to the amount of land that free-roaming beef cattle require. Nevertheless, cheese and dairy production is still one of the highest emitters of GHGs, emitting over 30kg of greenhouse gas per kilogram of food. The water used to produce cheese is another environmentally-tolling factor: about 1,000 gallons are required to produce just one ounce of cheese.



3 FARMED SHRIMP

Although small in size, farmed shrimp have a high environmental impact, mostly due to the land change required to create their farms. Mangrove trees, which are important carbon capturers in Latin America and Asia, are destroyed to make room for shrimp farms along coasts. This environmental impact is so large that it's estimated that one 100-gram shrimp cocktail could have the same carbon dioxide release as burning 90 litres of gasoline.



4 PALM OIL

Palm oil has a variety of uses - from cooking oil and pizza dough to cleaning agents and detergents. Due to its flexibility and relatively high yield per crop, demand for palm oil has skyrocketed in the past 50 years: production of palm oil has increased from 2 million tonnes in 1970 to 71 million tonnes in 2018. To fulfill this drastic change in demand, many diverse forests along the equator have been cut down to create a monoculture of palm oil farms.

Nevertheless, it is also conceded that using palm to meet the world's vegetable oil demand has prevented more drastic deforestation since it has a much higher oil yield per hectare of land than all other vegetables.



5 COFFEE

Similarly to chocolate, coffee, when not produced sustainably, has a high carbon footprint due to the deforestation conducted to make coffee farms. Large droves of diverse forest lands are cleared to meet the world's growing demand for their morning cups of coffee. Fortunately, many certifications exist to denote producers that source their coffee sustainably from unchanged land and that pay fair wages to farmers.



6 CHOCOLATE

Cacao products have high emissions when they are not farmed sustainably. As the worldwide demand for chocolate increased, many exploitative companies resorted to clearing rainforests - important carbon sinks - to plant cacao trees. On average, 1kg of cacao releases 34kg of GHG into the atmosphere when not sourced sustainably. Fortunately, many new producers seek to source their cacao from sustainable farms that do not clear rainforests, and organisations like the Rainforest Alliance can help consumers choose chocolate from responsible producers.



7 RICE

Rice's contribution to climate change comes from its emissions of methane during the growing process. As rice is grown in flooded fields, the water prevents oxygen from penetrating into the soil, allowing for bacteria underground to produce methane.

Fortunately, more sustainable rice farming methods are being implemented where possible, such as intermittent flooding, which drains the rice paddies for a few days before flooding the fields again to prevent methane build-up. Many recent initiatives, such as the Sustainable Rice Platform, seek to help farmers implement practices that minimise environmental damage and certify rice that is farmed sustainably.

SUSTAINABLE CHANGES

Many of the foods on this list are prominent parts of our diets and may be considered integral for cultural dishes. It feels unfair to have to strip these out of our menus. Yet, it's undeniable that with the current agricultural practices, these foods and the disruptive methods used to produce them contribute to the harm humans commit against the environment.

Reducing our dependence on and consumption of these foods can be an invitation to creatively reimagine recipes, explore new dishes with lower carbon-emission ingredients or investigate responsibly-sourced products.

While a large change is required on the production side to use agricultural practices that respect the environment, consumers can influence this decision by carefully choosing where to place their demand. Channeling parts of our budgets from high-emission foods, like beef and dairy, to low-emission foods, like tofu or nuts, could persuade producers and governments that replanting their fields to grow more sustainable and diverse agricultural products can be profitable.

Many livestock ranches and dairy farms in Brazil have already responded to shifts in demand and, under the guidance of local initiatives, have replanted their fields to grow more environmentally-friendly and highly-demanded produce. The accumulation of small efforts can create large impacts.

7 FOODS

WITH A HIGH

CARBON FOOTPRINT

WRITTEN BY GERARDO BANDERA

WHY COP26 PLEDGES ON FARMING AND FOOD FALLS SHORT



Last Saturday at COP26, the UK led an announcement from 45 countries pledging action to protect nature and make

global farming and food systems more sustainable. However, the announcement fails to address the 800 kilogram cow in the room - the meat and dairy industry which needs urgent, critical overhaul to protect people and planet from the climate and biodiversity crises.

Environment Secretary George Eustice said: "To keep 1.5°C alive, we need action from every part of society, including an urgent transformation in the way we manage ecosystems and grow, produce and consume food on a global scale. We need to put people, nature and climate at the core of our food systems."

That is absolutely true. We must end the destruction of the ecosystems that form our life support. But this new pledge to protect nature will fail to do that unless world leaders address the issue of the production and consumption of meat and dairy industries, as well as the seafood industry, which are driving habitat destruction from the Indonesian rainforest to the Cerrado savannas of Brazil.

TOXIC FOOD

The way we eat is responsible for around a third of global greenhouse gas emissions producing more greenhouse gases than all the world's cars, HGVs, ships and planes, making it a major driver of the climate crisis according to the UN Food and Agriculture Organization.

In 2016, the world's top 20 meat and dairy companies alone emitted more greenhouse gases than the whole of Germany, Europe's biggest climate polluter. The seafood sector, including highly destructive forms of fishing such as bottom trawling releases as much CO₂ from ocean sediments into the water as the entire aviation industry emits atmospherically.

Agriculture is arguably the biggest contributor to biodiversity loss worldwide, including the destruction of critical carbon sinks such as the Amazon for soya plantations and cattle.

Acknowledging these hard facts, however difficult they may be to digest, makes clear how a substantial reduction in the impacts

of food systems, especially of the meat and dairy industries, is key to keeping the 1.5°C Paris Agreement target within reach.

THE PLEDGE

The new pledge contains some promising language around support for regenerative farming methods and increased supply chain transparency, as well as announcing new signatories to the conservation pledge to protect 30% of land and sea by 2030. The announcement also commits to developing crops resilient to droughts, floods and heatwaves that could potentially benefit farmers across the globe as they are forced to adapt to a changing climate.

Overall though, this latest COP26 announcement is widely seen as a cop out - by failing to meaningfully address the devastation caused by meat and dairy, this pledge is a gift to the large agribusiness lobby. A [small proportion of companies](#) are responsible for the majority of deforestation risk in soy, beef and palm oil supply chains. We cannot allow these companies to continue to destroy our planet with impunity.

TOWARDS SOLUTIONS

The scale of the twin crises of climate and biodiversity breakdown is an existential threat to humanity. A 'whole of government' and 'whole of economy' approach is needed if we are to avert climate collapse. This will require addressing the cow in the room and facing up to the large industrial meat and dairy sectors who are driving the destruction of our planet.

The UK and other governments must go beyond PR pledges and translate climate-friendly farming commitments into real policy. For example, as the UK designs its new, post-Brexit agricultural policy, the government must look at overhauling the farm payment scheme to reward farmers who protect wildlife on their farms.

Nature must be a part of the climate mitigation solution. Governments must commit to the 30x30 conservation and restoration plan, including 30% of the ocean, with a long-term goal towards conserving 50% of the planet in partnership with local communities, traditional rights holders and Indigenous peoples.



INSIGHTS.TRASE.EARTH
COMMODITY TRADERS
AND MARKETS

OP-ED

WE ARE EATING

OUR PLANET

WRITTEN BY STEVE TRENT



ABOUT THE AUTHOR

Steve Trent is CEO and founder of the Environmental Justice Foundation and has more than 30 years of experience in environmental and human rights campaigning. He also cofounded WildAid, serving as president for over a decade and leading WildAid's work in China and India.



It is critical that these conservation targets do not simply become more 'paper parks' or drive further human rights abuses: governments must put in place real protective measures and dedicate sufficient resources to managing protected areas, collaborating closely with local communities and Indigenous peoples. To successfully protect nature, we must look to partner with and empower Indigenous communities, who, while representing only around 5% of the world's population, are already safeguarding **80% of the planet's remaining biodiversity** ↙.

Finally, we must take a long look at our consumption patterns and make changes for a more sustainable future. Government policies are critical to this behaviour change, for example by using labelling and carbon taxes to reflect the true cost of unsustainable food choices. Another key part of the puzzle must be robust human rights and environmental due diligence requirements for corporations' supply chains, to ensure that abuse and destruction is not making its way onto people's plates.

This pledge might plant the seed towards recognising the urgent need to transform our food systems to protect people and the planet. But we need much, much greater action still.



NATIONALGEOGRAPHIC.COM
INDIGENOUS PEOPLES DEFEND
EARTH'S BIODIVERSITY—BUT
THEY'RE IN DANGER

DUTCH START-UP ECOCLIPPER IS BRINGING TRADITIONAL SAIL CARGO SHIPS BACK TO THE INTERNATIONAL COMMERCIAL STAGE IN AN ATTEMPT TO CREATE AN EMISSION-FREE FUTURE FOR TRANSPORT AND TRAVEL.

About 90% of world trade is conducted via shipping. That's a big share, and so is its ecological footprint. The shipping industry is set to change, but will it happen in time to prevent the most catastrophic implications of climate change?

Alternative systems of propulsion are being tested, and the International Maritime

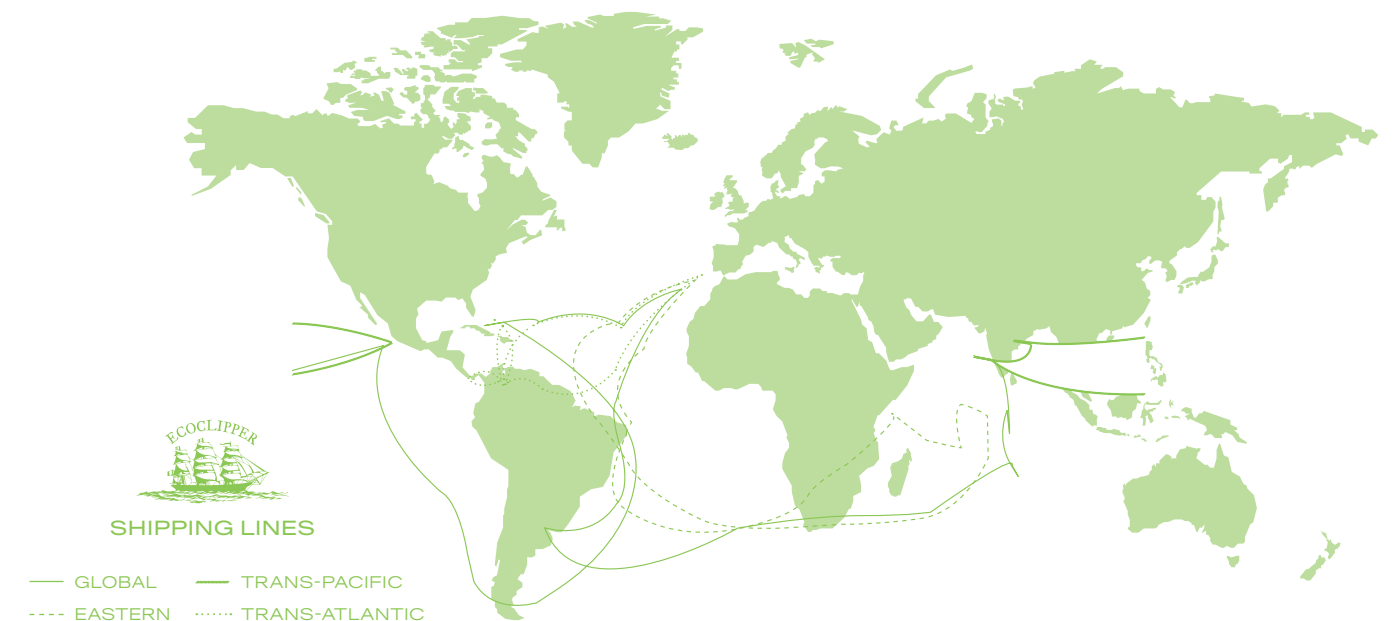
Organisation's (IMO) latest amendment to its regulatory framework, IMO 2020, has just been entered into force, limiting sulphur content of marine fuel to 0.5% instead of 3.5%. Yet, the path to achieving climate neutral transport remains long, or at least so it seems.

There are ways to conduct maritime freight

transport completely emissions-free, however, and there is a record spanning thousands of years to prove it: sailboats. Now, old freight vessels are being restored and refitted to carry out transport in the traditional way once again. But those are small-scale projects run by sail enthusiasts in their spare time.

Dutch entrepreneur Jorne Langelaan takes on the task of sail cargo transport in a more professional way. Langelaan doesn't want to refit the old boat; he's up to building new boats, including computer designed hulls and rigging, using the latest navigation technology.

His prototype is called Ecoclipper, and while the ship is yet to be built, Langelaan is confident that it will set sail within a few years.



SETTING SAILS TOWARDS A GREEN FUTURE OF TRANSPORT

FRANK ODENTHAL FROM THE BEAM IN CONVERSATION WITH JORNE LANGELAAN, ECOCLIPPER'S FOUNDER & CEO

“Goods should only be transported over such distances if they can’t be produced locally.”

THE BEAM Magazine spoke to Lange-
laan about Ecoclipper and the project’s
goal of reshaping the shipping, transpor-
tation and travel markets.

THE BEAM: what is the idea behind Ecoclipper?

Jorne Langelaan: Ecoclipper is a company
which is established to bring sustainable
travel and transport to the public by way
of sailing vessels.

How did you come up with this idea?

I was working on motor cargo ships before,
and then I started sailing on traditional
sailing vessels in the 90’s on board the
Avontuur under Captain Paul Wahlen. In
those days, nobody was really interested
in sustainability or emissions-free travel or
emissions-free transport, so it was really
a niche thing. But it really got me. And
at a certain point I wanted to start using
wind power to distribute cargo. I was 19
years old back then, so I decided to start
my own sail cargo business. It felt like a
dream was coming true.

These were, of course, times when people
didn’t talk about climate change so much,
it wasn’t a mainstream thing. It was in 2000
when I met two of my partners in later years
who I would work together with later on
and start Fairtransport; that was in 2006.
We then purchased a hull in Delft, the town
where I was born. I knew that old hull before.

I actually played on it as a child, and always
thought about sailing with it. We purchased
that hull and refitted it into what can be said
as the first engineless sail-cargo ship in the
21st century, the Tres Hombres.

But that was way before Ecoclipper. The
Tres Hombres was really pioneering at
that time, as an ambassador for sail cargo
from 2009 on. Then quite-fast other
companies started to do it in a similar
way, like Timbercoast with the Avontuur
that I was sailing on in the 90’s.

The company Ecoclipper was launched in
2018, basically to scale up the successes
of the then-existing sail cargo companies.
Today, we’re in a situation where even
traditional passenger sailing ships are
looking for sail-cargo opportunities,
because it is becoming more and more
clear that sail-cargo will be the next big
thing in logistics.

Basically, sail-cargo is the only way to
distribute cargos and travel passengers
emission-free on a possibly large scale
without having to set up a huge industrial
background system.

Currently it’s just a niche market with about
10 sailing ships carrying cargo. Today, a
lot of shipping companies are looking
for sustainable alternatives, but that’s all
based on a large industrial system, which
has to be built and financed. But the wind
is there, and it can be used by everybody!
So, that’s what we do with Ecoclipper.

So the idea of Ecoclipper is not to refit old boats, but to build new boats?

Originally, we intended to design a ship
that would be very flexible to be used
on all different routes around the world,
and we’ve actually done that. We went
through a couple of design cycles, we
have a couple of naval engineer teams
who work on it and did a really good job.
Three years ago we contacted about 25
European shipyards, and now we think
we found a fitting partner shipyard in the
Netherlands for our design ideas.

With this new boat strategy, it is really
important to be able to scale up, to
build more identical ships, if needed,
and to offer a certain quality on differ-
ent shipping lines.

But it takes time, and it’s a costly affair, as
well. From 2018 on we’ve been working as
a start-up to design this prototype. It all
depends now on how successful we are
with the financing campaign that we’re
preparing right now.

Currently, you are a ship company without a ship. What are your short-term plans?

Recently we realised that it takes up to 18
months to build that new ship. So, in the
meantime, we’re keeping our eyes open
for existing ships as well, which could be
put into service sooner.

We’ve been in contact with a number of
companies that would be interested in the
service we’re going to offer, and it’s getting
harder and harder to tell them that it takes
another 18 months for the ship to be ready.
So, that is actually a new strategy, because
we’ve gathered so many letters of intent
from companies that are interested to
ship with us. There are huge opportunities



EcoClipper vessels range from retrofit projects to new, purpose-built ships © Tanner Mardis

for cargo ships at the moment. So, for us, it's just a matter of bringing ships into the water and to start operating.

What is the intended load of the Eco-clipper? Is it comparable to container-carrying vessels?

The Ecoclipper 500 is designed to [carry] just below 500 gross tonnage. Gross tonnage is a measurement of volume, it doesn't say so much about the weight of the cargo. But, coincidentally, we will be able to take on 500 tons as well.

There is an advantage in terms of legislation and registration costs to have a ship below 500 gross tonnage. The largest unit we will be taking is a pallet. Usually containers are filled with pallets. So, instead of stacking containers, the Ecoclipper will load about 300 pallets. And we will not only be serving the transport market of goods, but also servicing the market of travel. Nowadays, many people don't want to fly anymore or want to fly less, but still want to travel. And what a wonderful way of travelling it is to use a sailing ship! And we'll accept trainees on board as well, which is a very adventurous way of travelling.

It takes a lot more time, of course, but it ultimately results in fewer emissions. We did this life cycle analysis; we calculated the carbon footprint of the Ecoclipper ships. And compared to container vessels, Ecoclippers are about 5 times cleaner, and compared to flying they are about 10 times cleaner.

On each Ecoclipper we'll have accommodation for twelve passengers and a maximum of 36 trainees. These trainees are actually helping to run the ship, and are being trained by the professional crew to become seamen. But they are at the same time passengers, too. I was a trainee myself, and I can really recommend it to everybody.

There are currently only about 50 projects around the world for shipping cargo by wind power. Why are there still so few of them? Shouldn't this market be accelerating much faster, considering how hard we're being hit by the climate crisis?

Well, let's not forget that about 20 years ago there was only one ship, the Avontuur, doing it this way again. We actually did a market research last year, and the outcome was that there's really exponential

growth in that industry of projects doing sail-cargo. But we should also not forget that these transitions are huge. Shipping is an industry with very high investments, so things do take time. A lot of today's shipowners invested in their motorships, and they last for at least 20 or 30 years. So for them it's very hard to make a change, because they would end up with stranded assets.

But at the same time it's good for large investments in alternative ways of transport. If someone is looking today for investment opportunities, I would definitely recommend looking into sail-cargo projects, because this is the next big thing. But it takes time.

What we've seen in the 19th century with the industrial revolution, that was of course an enormous transition, too, just the other way around: from sailing ships to steam ships. It took about 150 years for that transition. So, it really takes time, and we're actually still at the beginning.

What is the financing strategy behind Ecoclippers?

We were preparing a crowdfunding campaign last year, but it was meant to hire naval engineers and to move on the design process. But instead of the crowdfunding campaign we met some bigger investors, and that was a second financing round, which funded the whole design process. Currently, preparations are being done for a way larger crowdfunding campaign. People will be able to invest into the company, not into single ships. And as a company, I expect that we will be growing really fast.



For the next five years, our company strategy is to finance 10 or more newly-built vessels and a few retrofit projects. For a start-up, that's of course a big investment; it might turn out to be around tens of millions of euros. But in comparison to the large shipping operators this is still just peanuts.

We are now about one and a half years into a pandemic. Did the Coronavirus have any impact on your business?

Yes, definitely. Back then we had an office in Alkmaar with a few people working there. When Corona hit, we started working at home and shut down that office. We had an international team, and they lived in an apartment here in Alkmaar. Now they all went back home to their

countries, and started to work online.

In that office in Alkmaar we were looking locally for our specialists. Now, it doesn't matter anymore where they're from. We have our naval engineering team in Portugal, our systems engineering team is based in Switzerland and the Netherlands, our interior design team is from the Netherlands and Germany, our head of communication is in the UK, other communication team members are in Mexico and Portugal. So that works fine.

But all these events like maritime fairs, where we could have presented Ecoclipper to a larger

public or to potential new investors, they all got cancelled.

What kind of goods do you expect to transport?

Mainly goods that need to be transported due to their meteorological circumstances. For example, you cannot grow tea or coffee in Europe, so we need to import it. There are, however, many goods that are being imported, just because it is cheaper to produce them in China or anywhere else around the globe.

If the cargo prices would become more fair, more realistic, which means taking into account the environmental and social impact of it, that wouldn't pay off anymore. The container prices have already been doubling last year due to congestion caused by Corona lockdowns and because of a rise in the trade in consumer goods. You can already find producers of textiles moving their production closer to Europe because of that. So, we at Ecoclipper are looking at first-class goods that really have a necessity to be transported over long distances.

We think transporting goods just because of less strict environmental rules or lower wages is not a good reason. Transporting goods is such an energy-intensive thing to do, so we think goods should only be transported over such distances if they can't be produced locally.

That sounds like stepping back from globalisation to localisation.

I would call it a step forward, though.



Jorne Langelaan was one of the co-founders, captains, and is still a shareholder of Fairtransport who has two ships (Tres Hombres and Nordlys) currently running. For more than 20 years he has been involved with several sail cargo operations. In the late 90s with the cargo schooner Avontuur. In 2018 he founded Eco-Clippers based in Alkmaar, Netherlands.

→ [ECOCLIPPER.ORG](https://ecoclipper.org)

HOW YOUTH BRINGS CLEAN POWER
TO THOUSANDS IN SIERRA LEONE
A FIRST-HAND EXPERIENCE OF POWER
POVERTY INSPIRED AN AFRICAN
TEENAGE BOY TO INVENT A DEVICE THAT
USES KINETIC ENERGY FROM VIBRATION
TO GENERATE CLEAN POWER.

THE FUTURE IS GREEN

WRITTEN BY CYRIL ZENDA

A single mother battling terminal breast cancer while struggling to raise two boys in a slum on the outskirts of Freetown, Sierra Leone's capital, in the aftermath of a bloody civil war had taught her children a profound lesson: 'If you don't like your situation, only you can change your destiny.'

It was a piece of advice that deeply resonated with one of her sons. As the family eked out an impoverished existence in the West African nation, which suffers from severe energy poverty (estimated at 90%), Jeremiah Thoronka did exactly what his now late mother had instructed and sought to end this energy crisis. He went on to invent a device that uses kinetic energy from vehicular and pedestrian traffic to generate clean power.

It is for this invention that the name Jeremiah Thoronka has not only become an international news item, but also brought rewards and global recognition to the 21-year-old who was born during a civil war.



GENERATING POWER FROM VIBRATIONS

At 17, when he was studying at the African Leadership University in Rwanda, Thoronka invented piezoelectric devices that, when placed under roads, soccer pitches and other surfaces, convert kinetic energy in the form of vibrations and movement into electric current without need for battery storage. He went on to launch a start-up called Optim Energy, through which he has been able to take his invention to the ground.

"I used my skills in science to develop Optim Energy, an innovative piezoelectric device that harnesses energy from heat, vibrations and weather, all of which naturally occur in the environment, to create affordable, accessible and clean power," Thoronka said of his invention. "Since 2017, I have grown Optim Energy into a larger initiative aiming to build a sustainable energy sector in Sierra Leone, diminish greenhouse gas emissions and educate citizens on climate change."

Optim Energy ran a successful pilot programme in the young inventor's neighbourhoods of Makawo in the northern part of Sierra Leone and Kuntoluh, east of Freetown. With only two devices, the start-up provided free electricity to 150 households comprising around 1,500 people, as well as to 15 schools attended by over 9,000 students.

INSPIRED BY PAST HARDSHIPS

Thoronka's first-hand experience of the harsh reality of fuel poverty in his country became his inspiration and sparked the idea for this invention.

"I grew up not knowing the importance of energy. The lack of electricity in my town meant that we could only prepare food using firewood or charcoal," Thoronka said as

he introduced himself at the 2019 United Nations Academic Impact and Millennium Campus Network Fellowship, where he was recognised.

"The process of getting firewood made all of us children very sad. As a child, it was my first duty to help my mother gather firewood and bring it home from the bush. I grew up in a country where over 89% of the population is suffering from energy deficiency."

Thoronka, who is also one of the World Wildlife Fund's top 100 Young African Conservation Leaders, is a passionate renewable energy and climate change advocate.

According to him, energy and environmental problems

are closely related since it is nearly impossible to produce energy without it having a significant environmental impact. He maintains that the ecological issues directly related to energy production include air, thermal and water pollution, and solid waste disposal. Emissions from fossil fuel combustion are the primary cause of urban air pollution and global warming.

"The sun is not always shining, water is drying up, fossil fuels are on the way out, but people are always

moving," Thoronka said about the advantages of his invention. "The future is green if we start realising and financing Africa's energy revolution," he added.

GLOBAL STUDENT PRIZE WINNER

On 10 November, Thoronka was announced 2021 winner of the Chegg.org Global Student Prize, making him the inaugural taker of the new \$100,000 sister award to the \$1 million Global Teacher Prize. The prize is given to one exceptional student who has made a real impact on learning, the lives of their peers and on society beyond.

"You've made an enormous difference to your community and far beyond," said Hollywood star and humanitarian Hugh Jackman who announced Thoronka as the winner during a virtual ceremony, broadcast from UNESCO's headquarters in Paris.

While Thoronka was surprised to have emerged as a runaway winner in a field of 3,500 nominations and applications from 94 countries around the world, to those who have known him it did not come as a shock at all.

"I am not surprised that he won the global prize because he has been consistent in everything he does, including his innovations," Dr Victor Moinina, one of Thoronka's mentors, told FairPlanet. "He has been working smart and hard," Dr Moinina of the Institute of Public Administration and Management at the University of Sierra Leone added.

Another of Thoronka's mentors, Samuel B. Miles, a researcher, writer and explorer on decarbonised solutions for a changing world, expressed similar sentiments.



"Jeremiah is emerging as a bright young leader passionate about advancing African leadership and playing a role in the energy transition of his home country of Sierra Leone," said Miles, who is based at the University of California in the United States. "He is proactive, respectful and tenacious in the pursuit of his ambitions. I expect him to go far."

STRIVING TO TOUCH LIVES

"My journey and experiences have challenged me to always reflect and know I am a new breed of leader who has a lot to offer to my country, continent and the world. I will continue to aspire and refuse to succumb or settle for

anything less," Thoronka said on his Facebook page in March upon his graduation with a First Class Honours/Distinction degree in Global Challenges (with focuses in Energy and Environment) from the African Leadership University. "[I] am heading out there to touch lives, create impact and deliver on the missions I have spent so much time working on. Much is expected of me and much I have within to give back to society."

"The sun is not always shining, water is drying up, fossil fuels are on the way out, but people are always moving,"

Currently studying for a Master's degree in Sustainable Energy and Development in the United Kingdom, Thoronka plans to use the \$100,000 windfall to increase the impact of his invention in his country and beyond.



SHINING A SPOTLIGHT ON

WRITTEN BY BOB KOIGI

In the last two decades, the world has been on a clean energy overdrive as governments, private players and development agencies sell the renewable energy gospel as a sustainable alternative to the environmentally unfriendly fossil fuels.

Solar has become a front runner in this space, with both developed and low income nations tapping into solar panels to capture and convert the sun's rays into electricity. It has become somewhat of a spectacle with innovative projects world over demonstrating how the sun can redefine our daily lives if well tapped.

From the floating farm in the Maldives, the Solar Bike Path in the Netherlands, the solar powered train tunnel in Belgium and airports that run entirely on solar power, there is no end in sight for what solar energy promises. In fact, in the tiny island nation of Tokelau, located in the South Pacific Ocean, the country runs entirely on solar energy. So entrenched has solar energy become that it is poised to be the dominant source of energy in almost all continents in about three decades to come.

But as we get excited and glamourise the wonders of sun-generated energy, a catastrophe is brewing, and one that parallels the plastic waste menace.

THE NOT-SO-BRIGHT SIDE OF SOLAR ENERGY

Most of the solar panels, the heart of the solar energy innovation, were installed about two decades ago. The average lifespan of these panels is estimated to be about 20 to 30 years. As the world warmed up to the solar energy and technologies, it never quite paid attention to how to dispose them, or manage the waste. And now we are staring at a disaster. Picture this, in 2016, there were about 250,000 tonnes of solar panel waste globally and this figure will hit 78 million tonnes in 2050, according to a report by the International Renewable Energy Agency (IRENA) and International Energy Agency Photovoltaic Power Systems Programme (IEA-PVPS).

These panels contain chemicals and heavy metals that if wrongly discarded would be harmful to our environment and human health.

Almost all solar panel modules are made up of glass and that glass cannot be recycled without breaking the entire panel due to the impurities that include lead, antimony, cadmium and plastics known to cause cancer, death and air pollution.

The best practice therefore has been to invest in recycling the panels. But with recycling costs being higher than the value of the materials being recovered, solar companies have opted for re-use, repurposing, dumping into landfills or selling them to secondary markets.

This has been captured by a report from the National Renewable Energy Laboratory (NREL) and the Electric Power Research Institute: "Current technology, infrastructure, and processes associated with recycling PV modules are not optimized for cost-effective recovery of high value materials. As a result, the cost of recycling is often outweighed by cheaper more accessible disposal options."

MANAGING THE SOLAR PANEL WASTE

Jude Mutua, a renewable energy expert concurs: "Recycling of solar panels poses similar challenges associated with the old TVs due to the exorbitant cost of recycling them, the diminished value after recycling and the high concentration of toxic metals. And as technology evolves, these

TVs fail to excite the markets and buyers are usually not keen on their reuse. That is why it is imperative to explore sustainable models to handle used solar panel and the wastes associated with them."

One of the contributing factors to the growing solar panel waste is the dumping to secondary markets, among them poor countries. With weak legislation and a pent-up demand for low-cost panels, there has been a proliferation of second-hand panels with low quality control that operate for a few years before reaching the end of their life. This dumping of solar junk in countries with a scarcity of solar panel recycling facilities only exacerbates the global e-waste menace.

The explosion of solar home systems in Africa for example, where the majority of rural households are not connected to the national grid, has equally fanned e-waste.



IRENA.ORG
END-OF-LIFE MANAGEMENT:
SOLAR PHOTOVOLTAIC
PANELS



THE SOLAR POWER MENACE



These miniature systems, containing a battery, solar panel, a charge controller, LED bulbs and mobile charger are enough to cater for the basic energy needs of households with some even powering television sets. Aggressive marketing by solar panel companies, through an innovative model christened Pay as you go, that allow households to pay for these systems in installments, coupled with governments incentives for solar products in a bid to address the energy poverty, has lit up Africa, but at a cost.

Waste management companies like Kenyan-based startup SolarSap that collects discarded solar panels say that the faulty home solar systems have become an eyesore as users discard them anywhere. “We have been working with community groups to encourage them to sell us the faulty systems, some which we dismantle and send the parts to countries like South Africa or China that have the capacity to recycle. There hasn’t been enough education and awareness on the dangers of discarding these panels among small scale users, and that is an environmental time bomb,” said Timothy Khisa, the founder of SolarSap.

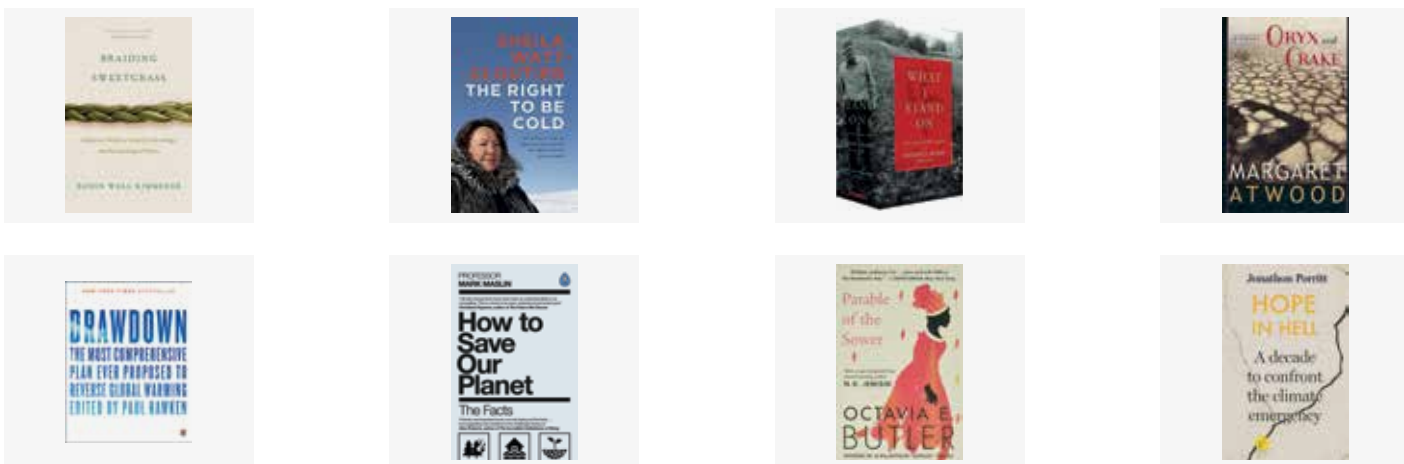
Waste regulation has been touted as the silver bullet to the e-waste menace and various countries, alive to the growing threat to the environment and human health, are acting.

Europe under the EU for example has entrenched laws that compel solar panel producers to fund collection and recycling of their products.

Washington in 2017 made history by becoming the first state to introduce a bill introducing an extended producer responsibility (EPR) program for solar panels. From 2023 all manufacturers will be required to finance collection and recycling of panels according to the law.

Last year, the California Department of Toxic Substances Control (DTSC) gave nod to regulations that categorise solar panels as universal waste and not hazardous waste which relaxed regulatory hiccups around collection and shipping them. However, they are still classified as hazardous should tests show they exceed harmful metals concentration limits in federal law or California and waste handlers are expected to carry out tests when they are discarding the panels.

“The most crucial aspect in managing solar panel waste and arresting a situation that is threatening to spiral out of control is for countries to enact strong e-waste legislation, build an ecosystem that supports and encourages waste management and recycling companies and pass the responsibility of managing solar products that have reached the end of their life to the manufactures rather than the users,” said Jude.



BOOKS

BRAIDING SWEETGRASS ROBIN WALL KIMMERER (2013)

Applauded as a 'quietly revolutionary book', Kimmerer poetically weaves together ancient indigenous practices and wisdom with the modern scientific approach to the climate crisis. It presents a re-evaluation of western socio-economic structures in light of the currency of gratitude and reciprocity, notions fundamental to humanity's relationship with the earth and all of the 'gifts' it willingly provides. Through a beautiful and heart-warming narrative, Kimmerer gradually teaches us to recognise the extraordinary in the ordinary. How the everyday behaviour of the natural world operates with intense complexity and beauty, something we should understand as an intrinsic part of ourselves.

THE RIGHT TO BE COLD: ONE WOMAN'S STORY OF PROTECTING HER CULTURE, THE ARCTIC, AND THE WHOLE PLANET SHEILA WATT-CLOUTIER (2015)

Raised in a Northern Quebec Inuit community, Sheila Watt-Cloutier utilises her own story of resilience and survival to put a human face on the environmental crisis in the Arctic. Through the authentic voice of an individual living on the frontline of the global climate crisis, the world is brought together in communal obligation to action.

WHAT I STAND ON: THE COLLECTED ESSAYS OF WENDELL BERRY WENDELL BERRY (2019)

Famous for his deep understanding of people, communities and the environment, Wendell Berry's work has always

been orientated towards the 'life and health of the earth'. By sharing his experiences as a small-scale farmer and ecological philosopher, the essays in this two-volume collection contain one continuous theme that Berry articulated himself, 'The soil is the great connector of lives, the source and destination of all... without proper care for it we can have no life.' The books and extracts included within the collection dive into the heart of the current ecological crisis, inspiring one to further explore the role of sustainable, small-scale farming in preserving the planet.

ORYX AND CRAKE MARGARET ATWOOD (2003)

Set in a world of increasing ecological destruction, human pursuit of genetic perfection and mass-extinction, Atwood presents an eerie dystopian exploration of science pushed too far in the wake of the climate emergency. The inevitable consequence of a consumer-driven society is presented through the manipulation of nature. Here, ethics can no longer protect the world from the selfishness of human desire to interfere with nature for our own needs.

DRAWDOWN: THE MOST COMPREHENSIVE PLAN EVER PROPOSED TO REVERSE GLOBAL WARMING PAUL HAWKEN (2017)

As bold and exciting as its title, Drawdown (the point when greenhouse gases in the atmosphere peak and begin to decline) addresses climate change by synthesising thousands of studies to rank the most innovative and realistic solutions. The collective effort of researchers, scientists and professionals, it presents a clear and persuasive guide for policymakers on how to engineer effective change.

The 80 solutions listed range from walkable cities to educating women, yet all are highly interconnected and offer benefits beyond carbon sequestration.

HOW TO SAVE OUR PLANET: THE FACTS MARK MASLIN (2021)

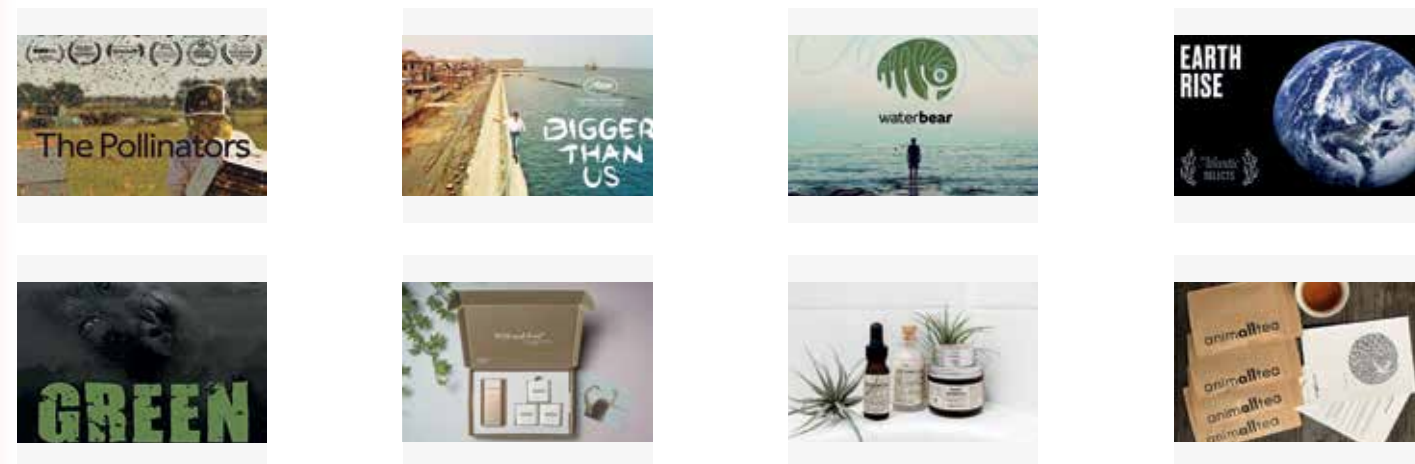
Aiming to bring together everyone 'from pub to parliament', Mark Maslin has produced a no-nonsense, user-friendly guide to climate change that is full of facts! He breaks down what we need to deal with, why we need to deal with it and how we should deal with it. A refreshingly energetic call to action, Maslin uses clarity to cut to the heart of the climate crisis and exposes the obscured resources of government, technology, scientists, and innovators.

PARABLE OF THE SOWER OCTAVIA BUTLER (1993)

Addressing social inequality, poverty and global warming, Butler's 'Prescient vision' of a world set just two years from now rings unnervingly true. Seen by many as a 'cautionary tale', the scientific fiction presents a world in a chaos of its own making, where the fight for survival appears all that is left. Throughout this enduring struggle, Lauren Olamina, who is suffering with 'hyperempathy', may have the salvation for all mankind.

HOPE IN HELL: A DECADE TO CONFRONT THE CLIMATE EMERGENCY JONATHON PORRITT (2020)

This book is an unflinching description of the cliff-edge situation we seem to be in today, whilst maintaining an optimistic commitment to hope. However, action is required urgently. Porritt exposes the direct consequences of inaction and lack of political will that is leading us over the chasm into irreversible damage.



PODCASTS

OUTRAGE + OPTIMISM

Outraged at the years of climate warnings falling on deaf ears, these charismatic hosts, with the help of expert guests, music, and humour, plunge into fascinating discussions on the latest news concerning the planet. A lively and entertaining listen, the podcast equips listeners with the tools and information to process headlines and face the climate crisis head on. Co-hosted by former UN Chief Christiania Figueres, Tom Rivett-Carnac who oversaw the Paris Climate Accords, and CPD founder, Paul Dickinson, there is no topic left unturned.

FOR WHAT IT'S EARTH

A podcast that 'has a look at all things' concerning climate change within the framework of a light, easy discussion. If you are looking to ease yourself into the world of climate discussion yet hoping to avoid the familiar feeling of complete overload, this is the podcast for you. Making big issues bite-sized, For What It's Earth does the hard work so we can enjoy an easy listen.

FILMS

THE POLLINATORS

PETER NELSON (2019)
An investigation into the role of the honeybee and the grave consequences of American agriculture without them. Every year an extraordinary and precarious event takes place; trucks of millions upon millions of bees make their way to California's almond farms. This agricultural practice is not uncommon, nor is it easy. Exploring the impacts of agrochemicals as well as the future of sustainable farming, this honest and buzzing documentary is a must-see.

BIGGER THAN US FLORE VASSUER (2021)

Accompanying 18-year-old Indonesian campaigner, Malati Wijisen, across the

globe, the fight of the younger generation against the clock is powerful and inspiring. Bigger Than Us delves into the lives and adventures of seven youth activists from Indonesia, Greece, Malawi, Uganda, Brazil, Lebanon and the USA to demonstrate the power of the combined voice. It exposes the sheer scale of the challenge faced by the younger generation in their response to human rights, climate, freedom of expression, social justice, access to education and food. However, the film subtly inspires great confidence and hope in the progress and achievements that are being witnessed.

WATER BEAR STREAMING SITE

A free streaming service where you can binge over 1000 documentaries, shorts and films all focussed on the future of the planet. With the general themes of "biodiversity, climate change, circularity and community" all content to educate and inspire is found on one platform.

EARTH RISE EMMANUEL VAUGHAN-LEE (2018)

A short documentary narrated by the Apollo 8 astronauts shares the initial thoughts of beauty, awe and philosophy that struck the first men to see the Earth from lunar orbit. Behind the first image captured of the Earth from space is a deep message that transcends national, political and religious boundaries. The film reminds us of what it means to live on the planet we do, and the importance of caring for our shared home.

GREEN: DEATH OF THE FORESTS MOEZ MOEZ AND PATRICK ROUXEL (2009)

A feature-length documentary follows the unique point of view of Green, an orangutan

in her final days due to deforestation and exploitation. No human commentary is needed to relay the scale of destruction caused by consumerism. As an emotional bond is formed with Green and the tranquility of her world before deforestation, resentment is drawn against the irony of trivial consumer demand in the face of its real cost.

PRODUCTS

WILD DEODORANT

A new, sustainable natural deodorant that is proven to provide 24 hours of protection from body odour. With natural ingredients from coconuts, cassava plants and sunflowers, switch from using harsh parabens and phthalates to a kinder product that is healthier for you and the planet. The average lifespan of a plastic deodorant stick is roughly 400 years, the solution to this is simple and offered by Wild.

ANATO LIFE

As Earth is becoming engulfed by a disposable economy, and neglect is causing exponential food-related diseases, consideration of the amount of harmful chemicals we are applying to our bodies is overlooked. It can be immensely overwhelming when trying to navigate the clean beauty world, but it is not impossible. Anato Life's work is grounded in Regenerative Design, using systems that go beyond organic such as ingredients from regenerative crops. The company offers a wide range of products that nurture the body and cultivate care for the planet.

ANIMALLTEA

Animaltea is about devoting all its energy to protecting wildlife, using 100% of its net profit to fund conservation. All products are pesticide-free, organic or biodynamic, protecting both consumers and the animals that share our planet.

There are about three trillion trees on the planet and they play a major role in producing the oxygen we all breathe. But twice as many existed before the start of human civilisation.

Forests are a vital and rich habitat for wildlife – unfortunately the razing of forests is a major contributor to biodiversity losses.

Trees are important in controlling regional rainfall, as they evaporate water from their leaves.

As trees grow, they absorb and store the carbon dioxide (CO₂) emissions that are driving global heating.

CO₂ stored in trees is released into the atmosphere when they are destroyed via logging or burning.

Many Western medicines, including anti-cancer drugs are derived from plants found in rainforests.

In urban areas, the shade from trees has been shown to both cool city streets and reduce levels of air pollution.

The world's rainforests could be extinct in 100 years should we continue with the current rate of deforestation.

Today, 10 billion more trees are cut down than are planted every year. This destruction is a significant contributor to the carbon emissions that are driving the climate crisis.

A living tree draws in and stores twice as much carbon dioxide than a fallen tree releases.

Tree roots anchor the soil and prevent soil erosion.

Tropical rainforests host 50% of known terrestrial species on only 6% of the world's land.



12 CLIMATE FACTS

ABOUT TREES

SOURCE: SAPP

WATER

Water is life.

More than ever, it is threatened
by climate change and pollution.
How are innovators finding solutions
to protect one of our planet's
most essential resources
and make it equitably accessible?



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READ, DEBATE: ENGAGE.

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