

# ONE

Only Natural Energy



## Divide and Conquer



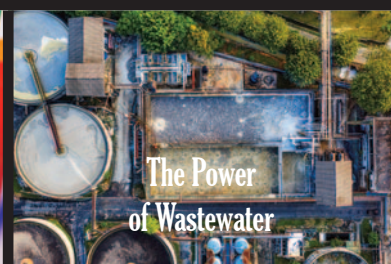
What Does 'Recyclable' Really Mean?



The role of BRI and Energy between China and Turkmenistan



Grasping at Straws



The Power of Wastewater





CO2 Technology  
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# SARDINIA Technology & Nature



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Wind turbine in Siurgus Donigala (Sardinia, Italy).  
Photo credit: ONE





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# Divide and Conquer

GIANNI SERRA  
ONE

It happens in Italy. "Areas that are not included in the list of suitable areas may not be declared unsuitable for the installation of renewable energy production plants, either in spatial planning or in individual proceedings, simply because they are not included in the list of suitable areas." A legalese bureaucratic contortion to say, 'Whatever you decide, the final word will not be yours.'

This Italian law is not exactly a model of clarity, and it will not be a blueprint for citizen participation—quite the opposite. Without proper and shared planning, it is a perfect recipe for energy unsustainability and social unrest. How can an energy transition be successfully carried out by letting individuals (private companies and private landowners) decide how and where to put blades and panels according to their economic convenience?

Solar panels here and there windmills next to Romanesque cathedrals or those ancient megalithic towers called "Nuraghi". The case of Sardinia illustrates how these issues manifest in a specific context. This Italian Island in the middle of the Mediterranean Sea is a microcosm of Europe's energy and social transition, starkly different from the idealized versions depicted in the EU Commission leaflets.

Far from being "just," this transition often perpetuates existing inequalities and creates new ones. Some local communities are called upon to bear more significant burdens in favour of others, with greater damage in terms of scarred land in exchange for minimal, derisory, and sometimes nonexistent compensation. For those communities, it's injustice in a nutshell.

The carbon-free economy goal gets unconditional support everywhere. However, things change when the carbon-free slogan becomes tangible and visual; suddenly, support turns into opposition.

Sardinia is no exception. The Island's planned transformation into a green energy reservoir, driven by speculative interests and central authorities' apathy, has raised many concerns and doubts among the local population.

In Sardinia, permit applications for wind and solar projects have been filed for installations capable of producing nearly eleven times more energy than necessary. Nobody is reassured by the fact that there are no Samaritans in sight in the long queue of permit seekers. The initial fear of the Sardinian population towards a speculative onslaught allowed by the central authorities in the name of a long overdue transition has turned into disbelief and a solid general widespread opposition towards the whole wind-and-solar-all-in package.

The lack of transparency and accountability in the regulatory frameworks governing these projects exacerbates this feeling of injustice, allowing for the continued exploitation of vulnerable communities. The main feature of this new gold rush - to collect public incentives - is not a platform for social justice but a deliberately vague regulatory framework, where projects can be presented as isolated, failing to recognize their cumulative impacts.

This intentional vagueness is the actual damage to local populations: if measured in square meters, the percentage impact of wind or solar farms is minimal, but in the affected areas, it can be disruptive, as it is massive and often leaves no room for any other business.

Such heavy-handed impact and one-sided policy fostered the formation of a solid and unified opposition that aligns farmers, hoteliers, and suppliers from all sectors. The lack of a comprehensive, long-term strategy in the public interest made this mess possible. And those who should solve it are the same ones who created it—circular power. **ONE**



Set of reusable straws.  
Photo credit: Sarah Chai (Pexels)







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# Grasping at Straws

LENORE HITCHLER

ONE

When quenching your thirst, do you grab a straw? If so, are you aware of the many damaging repercussions for the environment? Natural resources are used when manufacturing all types of drinking straws. Fossil fuel energy is used at every stage of a straw's life cycle. Fossil fuels are used to extract raw materials, transport them to factories, and ship the final product to stores. Also, using fossil fuels produces greenhouse gases leading to climate change. After they are discarded, straws generate pollution when incinerated, sent to landfills, or eventually end up in the ocean. Since straws harm the environment, the best choice is to eliminate them. However, an exception must be made for the small group of the disabled who need to drink liquids through straws.

Most people drink their coffee, tea, milk, and juice from glasses and cups without using straws. When properly motivated, many will be willing to eliminate straws to benefit the planet, their descendants, and themselves. However, if people are unwilling to do so, then they should be informed about which drinking straws cause the least harm.

It is difficult to find thorough and up-to-date data about straws that is published in scientific journals. Much of the available information comes from websites that are frequently biased in favor of one type of straw over another. Another difficulty is that since some types of straws are so new, there is not enough data about them. Therefore, any analysis of drinking straws will seem like a puzzle that is incomplete with some puzzle pieces broken and only tiny fragments remaining.

Plastic straws are the most complete puzzle piece. They appear to be the most harmful type of straw in existence. They contribute to climate change when the raw materials used to produce them are extracted, manufactured, and transported to factories where they are manufactured. The finished straws are shipped to customers who use them





A bunch of colorful plastic straws. Photo credit: Horia Varlan (Wikimedia)

Kingdom reported that when plastics are incinerated, they release 1,343 kilograms (around 2,960 pounds) of CO<sub>2</sub> equivalent per tonne of plastic straws. A large quantity of plastic straws ends up in landfills where they eventually migrate to the seaside. Two Australian researchers, Denise Hardesty and Chris Wilcox, analyzed data from trash collected on US coastlines. They estimated that there are nearly 7.5 million plastic straws on the country's coasts and 437 million to 8.3 billion plastic straws on the planet's coasts. Statistics vary on how long it takes for plastic to decompose, but the minimum figure given is several centuries.

only once before they are discarded. The vast number of discarded straws causes environmental degradation.

The *Journal of Cleaner Production* published an article about plastic straws. The authors reported that worldwide, one billion plastic straws are used per day. This results in a massive amount of waste. The authors stated "Plastic straws and stirrers contribute 7% to total plastic trash and up to 4% of single-use straws end up in the oceans. ... Plastic straws contribute about 1.53 x 10<sup>5</sup> tons of plastic waste into the environment every year. ... The ubiquity, buoyancy, and size of these items (e.g. straws and stirrers) have severe implications for wildlife since they often are mistaken for feed and ingested. The persistence of intact plastics or their fragments (microplastics) in the water bodies is hazardous to aquatic life, also affecting human health, ecosystems, and environmental sustainability."

When the waste disposal industry processes plastic straws, additional carbon dioxide (CO<sub>2</sub>) is released leading to climate change. The Department for Environment, Food and Rural Affairs (DEFRA) of the United

A website that sells straws made from sugar cane stated that "exposure to sunlight, salt water, and extreme temperatures can break plastic straws into microplastics." An article in *One Health Advances* reported that when microplastics end up in oceans, they absorb sunlight and thus increase the water's temperature.

Another difficulty with plastic straws is that they contain PFAS. PFAS are poly and perfluoroalkyl compounds that are called "forever chemicals" because they last a long time before decomposing. They are used to make straws water-repellent. PFAS also frequently contaminates the raw materials used for various types of straws. An article in *Food Additives & Contaminants* reported on the presence of PFAS in 39 brands of straws. They found that 90% of paper straws, 80% of bamboo straws, 75% of plastic straws, and 40% of glass straws contained PFAS, whereas steel straws contained none.

Unfortunately, PFAS are widespread throughout the



globe. An article in USA Today reported that according to the United States Environmental Protection Agency (EPA), PFAS are found in food, air, soil, water, and globally in animal and human blood. The EPA found a link between PFAS and the following threats to human health. “Reproductive effects such as decreased fertility or increased high blood pressure in pregnant women. Developmental effects or delays in children, including low birth weight, accelerated puberty, bone variations, or behavioral changes. Increased risk of some cancers, including prostate, kidney, and testicular cancers. Reduced ability of the body’s immune system to fight infections, including reduced vaccine response. Interference with the body’s natural hormones. Increased cholesterol levels and/or risk of obesity.”

Bioplastic straws are another puzzle piece. They were originally considered a better alternative to regular plastic straws. PLA (polylactic acid) straws are manufactured from the sugars found in corn, cassava, beet sugar, and sugar cane. Unfortunately, because of their chemical composition, PLA straws can only be composted in an industrial composting facility. Also, according to an article in *Energy Procedia*, the carbon footprint of PLA straws is higher than that of plastic straws. Thus, bioplastic straws are not good alternatives to plastic straws. Like bioplastic straws, paper straws are considered a more ecological alternative to plastic straws.

However, paper straws are also bad for the environment. Logging trees for paper contributes to deforestation leading to climate change. When forests are clear-cut, the result is less biodiversity. Fossil fuel energy is used when trees are chopped down and transported to factories where the wood is turned into pulp, and then are formed into straws, and shipped to stores. Additionally, other resources are expended when making paper straws. According to a website that sells straws made from sugar cane, “Paper production uses more water per product than any other industry. It’s the fifth-largest consumer of energy in the world.” Also, paper straws are toxic because water-resistant polymers are added to them so that they do not become soggy and fall apart as soon as they are put in liquids. The PFAS found in paper straws are just as harmful to the environment as the PFAS in plastic straws. Therefore, paper straws cannot be composted because of their toxic plastic ingredients.

All types of straws are packaged in either plastic or paper. This damages the environment during fossil fuel extraction to obtain petroleum products to manufacture plastics or deforestation to provide wood to manufacture paper. When discarded, packaging causes more pollution when it is either incinerated or placed in landfills. Incineration can produce toxic pollution. Methane, an extremely potent greenhouse gas, and CO<sub>2</sub> are produced when garbage decomposes in landfills.

Glass straws represent another puzzle piece. They are attractive, recyclable, non-toxic, and dishwasher safe. Some glass straws are shatter-proof. Like other types of straws, the raw materials for glass straws must be extracted, transported to factories, and the finished products shipped to stores. This process also uses energy and thus increases greenhouse gases leading to climate change.

Still another incomplete puzzle piece represents silicone straws. As silicone is a relatively new product, there is not enough data to determine if it is nontoxic to the environment. Silicone is a form of synthetic rubber and is produced by extracting silicon from silica. The silicon is then processed with hydrocarbons to create silicone polymers. Gosili is a company that sells products made of silicone. An article on their website states that silicone lasts an extremely long time, is non-toxic and when made with food-grade silicone is safe, flexible, stain resistant, odorless, hypoallergenic, and dishwasher safe.

Another large puzzle piece represents stainless steel straws. At first glance, steel straws appear to be a good alternative to drinking straws since they can be reused hundreds of times. However, producing them harms the environment. According to an article in the *Journal of Environmental Chemical Engineering*, the main components of stainless steel are iron, chromium, and nickel. Mining these elements uses large amounts of energy and pollutes the environment. The authors reported that for each plastic straw manufactured, 140 grams [4.93 ounces] of CO<sub>2</sub> equivalent are produced. In contrast, for each stainless steel straw manufactured, 520 grams [18.34 ounces] of CO<sub>2</sub> equivalent are produced. Statistics regarding the precise amount of energy used to manufacture various straws vary from report to report. However, all studies find that the pro-

duction of individual steel straws expends more energy and produces more CO<sub>2</sub> than the production of plastic straws. A study conducted by the sustainability office, along with an engineering class from California State Polytechnic University, Humboldt, compared the carbon footprint of various types of straws.

The researchers found that manufacturing one stainless steel straw used 0.672 kilowatt hours (kWh) of energy and 217 grams (around 7.65 ounces) of CO<sub>2</sub> were released. The figures for one plastic straw were 0.007 kWh of energy and 1.46 grams (around 0.051 ounces) of CO<sub>2</sub>. The figures for one paper straw were around 0.004 kWh of energy and 1.38 grams (around 4.86 ounces) of CO<sub>2</sub>. The figures for one glass straw were around 0.306 kWh of energy and 65.2 grams (around 2.29 ounces) of CO<sub>2</sub>. The figures for one bamboo straw were around 0,209 kWh of energy and 38.8 grams (around 1.368 ounces) of CO<sub>2</sub>. Unfortunately, plastic straws are only used once before being discarded. In contrast, one individual steel straw can be reused for many years and then can be recycled.

However, the amount of energy used is not the only factor that has to be evaluated when comparing various types of straws. For example, the quantity of raw materials used is also important when evaluating various straws.


An article in the *Journal of Cleaner Production* compared the amount of raw materials used to produce different types of straws. Starting from the least amount of raw materials used to the most amount of raw materials were straws made from steel, bamboo, glass, plastic, paper, and wheat. Thus, manufacturing steel straws used the least quantity of raw materials. Also, steel drinking straws can be recycled in contrast to plastics, bioplastics, and most paper straws. When recycled, steel drinking straws do not take up space in landfills and energy is not expended during incineration. If recycled, they also do not contribute to soil, air, and water pollution or add harmful toxins to the environment. The puzzle pieces of straws made from agricultural wastes and food crops are the smallest and most incomplete fragments of all the puzzle pieces. These types of straws are so new that scientists have not yet produced much research on them. However, the ferti-

zers, pesticides, and fossil fuels used to grow, irrigate, and harvest these crops add to pollution and climate change. In addition, the fossil fuel energy used to manufacture and transport them in all stages of their life cycle also produces greenhouse gases that lead to climate change.

Nevertheless, straws produced from agricultural wastes and various crops are less toxic to the environment than plastic straws. Additionally, bamboo and wood straws are reusable and compostable. Avocado, agave, coconut, hay, and sugar cane straws are used once, and can be composted. However, just because they are compostable does not mean that they are composted.

Many people are not able to compost them. For example, most urban residents do not have access to a space where they can compost their organic garbage. This would be especially true for apartment dwellers. 80% of the US population lives in urban areas and globally 56% of the world's population lives in cities. Worldwide, this adds up to 4.4 billion people who may not be able to compost their garbage. Thus, many plant-based straws will end up being incinerated or put in landfills where the methane that is produced from their decay will increase climate change.

A small puzzle piece represents edible straws. They come in such flavors as lemon, lime, strawberry, and chocolate. Edible straws are not discarded so therefore do not cause additional pollution. A potential puzzle piece represents straws made from hemp. Hemp does not require fertilizers, pesticides, or irrigation, and it grows exceedingly fast. Another puzzle piece represents the brushes used for cleaning reusable straws. The production of them requires the use of natural resources and energy. Also, when they are discarded, if incinerated they produce pollution or else take up space in landfills for many years before they eventually decompose.

Thus, manufacturing drinking straws uses nonrenewable raw materials. In addition, the fossil fuels required for the energy used to manufacture them, transport them, and discard them contribute to pollution including the production of greenhouse gases leading to climate change. Also, when discarded, straws increase soil and water pollution. 



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# The role of BRI and Energy in China-Turkmenistan relations

FARZAD RAMEZANI BONESH  
ONE



Chinese President Xi Jinping holds a welcoming ceremony for visiting Turkmen President Serdar Berdimuhamedov prior to their talks at the Great Hall of the People in Beijing, capital of China, on January 6, 2023. Photo credit: Xinhua



Turkmenistan is located in the southeast of the Caspian region. China and Turkmenistan established diplomatic relations in January 1992.

## **Past relationships**

China was the first country to establish diplomatic relations with Turkmenistan. The relationship between Turkmenistan and China witnessed the signing of several bilateral agreements and treaties such as the Bilateral Investment Treaty in 1992 and the Double Taxation Agreement in 2009 and numerous official visits.

In the last decade, two countries have expanded their diplomatic presence in the opposite country. In 2013, intergovernmental relations between Beijing and Ashgabat became strategic. Their relationship was upgraded to a strategic partnership in 2014.

In 2023, officials and leaders of China and Turkmenistan met at a summit, The official visit of the President of Turkmenistan Berdimuhamedov to China in January 2023) was announced as the development of comprehensive strategic cooperation between Turkmenistan and China. Also, several memorandums of understanding were signed in the digital economy, green development, revitalization of the Great Silk Road, and BRI, energy, education, tourism, etc."

On October 16, 2023, the heads of the two countries jointly announced the promotion of China-Turkmenistan relations to a comprehensive strategic partnership. Turkmenistan appreciated China's leading role in international governance and announced that it participates in China's important global initiatives and steps alongside the country.

In 2023, Xi Jinping met with the national leader of Turkmenistan, Gurbanguly Berdimuhamedov at the third high-level forum of the "One Belt, One Road" initiative in Beijing. The signing of Important agreements and documents in this meeting led to the intensification of interregional relations with China's Xinjiang Autonomous Region, and the further development of bilateral, and multilateral relations in the framework of United Nations and also in the format of 'Central Asia-China'.

In addition, China supported Turkmenistan in protecting its national sovereignty, security, and inte-

rests and pursuing the development path of deepening cooperation and relations, paying attention to the synergy of the "One Belt, One Road" initiative and Turkmenistan's strategy for revitalizing Great Silk Road, implementing the results of the China Summit and Central Asia.

China-Turkmenistan comprehensive strategic partnership in 2024 has been slowly developed. Supporting each other in development, promoting cooperation in the "One Belt, One Road" initiative, strengthening people-to-people relations, and deepening cooperation in fields such as politics, economy and trade, energy, transportation, and culture are considered by both sides.

## **The role of BRI and energy**

China is expanding and relatively deepening BRI cooperation in Turkmenistan. In the China-Central Asia-West Asia BRI corridor, two of the BRI routes pass through Turkmenistan.

China by using BRI, seeks to expand transportation and logistic infrastructure, trade links, prosperity, new opportunities for stability and growth, investment, technology and new markets, industries, industrial promotion, green and digital economy, reducing electricity shortage etc.,

Turkmenistan is getting closer to China with the signing of the memorandum of cooperation on railway routes with China, the "2024-2025 roadmap" of Turkmenistan, Kazakhstan, Iran, and Russia (upgrading the North-South international transport corridor) and expanding the middle corridor. After May 2023, progress is being made on the construction of the China-Kyrgyzstan-Uzbekistan-Turkmenistan railway. In the first meeting of the heads of C+C5 countries, China also asked Turkmenistan to increase investment and win-win cooperation in BRI and sectors such as energy.

In the sixth meeting of the bilateral cooperation committee in November 2023 in Ashgabat, the two sides emphasized strengthening strategic communication, promoting comprehensive strategic partnership, increasing economic, commercial, and investment cooperation, deepening natural gas cooperation, and consultations on the alignment of priority economic projects, and the early implementation of Luban workshops in Turkmenistan.

A list of agreements on the role of expanding the BRI in the economy of Turkmenistan, infrastructure projects, and other economic sectors is also considered by Beijing. China's approach is based on the country's national goals in Turkmenistan and South-South cooperation and is also seen in the service of strengthening BRI.

China's BRI is under the National Plan of Turkmenistan in 2022-2052 and the Plan in 2022-2028", "Foreign Trade Strategy 2021-2030", and attracting large capital to Turkmenistan. Six sub-committees in the fields of trade, energy, humanitarian exchange, security, transportation, and logistics, as well as scientific technology play a coordinated role in the comprehensive implementation of the cooperation program for 5 years (2021-2025).

Turkmenistan has the 4-6 largest natural gas reserves in the world. As China became the world's largest energy consumer, Turkmenistan can help to diversify energy supply sources for China, reduce coal consumption, energy security, and reduce dependence on the Straits of Malacca.

Turkmenistan exports its natural gas to China through the Central Asia-China gas pipeline or three pipelines from the Turkmenistan-Uzbekistan-Kazakhstan route.

BRI has paid attention to this country by speeding up the implementation of the development of the Galkinish field and the construction of Line D of the Turkmenistan-China gas pipeline. Line D from the Tajikistan-Kyrgyzstan route to China is shorter and more in China's possession and increases the total annual capacity of the network to 85 billion cubic meters and maintains Turkmenistan's rank in gas exports to China.

In this regard, China has been able to contract and implement mainly in the fields of exploration and development of natural gas and technical services and has access to the Galkinish gas field located in the south of Turkmenistan. Beijing attaches great importance to the planning of CNPC gas trade with Turkmenistan, bioenergy, transport electrification, hydrogen energy, and training of local experts in Turkmenistan.

Ashgabat also needs China to increase gas production in the sea and on the coast, attracting foreign investment, increasing oil production, as well as

newly discovered areas in the Caspian region. China is the largest trade partner of Turkmenistan. The balance in bilateral trade is completely in favor of Turkmenistan. The trade turnover of the first quarter of 2024 between Ashgabat and China was approximately 2.6 billion dollars. Turkmenistan accounts for almost 92% of this figure through the sale of natural gas to Beijing.


## **Obstacles and prospects**

Challenges such as the legal status of the Caspian Sea, the policy of strict neutrality and the severe isolation of Ashgabat, the dominance of government institutions over the economy, logistical risks and limitations in infrastructure, and the cost of the \$6.7 billion line D, paying gas prices "according to Global pricing are important.

In addition, China denies any ulterior motives in the BRI, but critics of "debt trap diplomacy" rule out imposing harsh conditions on borrowers, the terms of Chinese loans, confidential or unusual clauses, obscurity in details, low-priced gas sales, increased dependence on Beijing considers gas export and provision of foreign exchange resources. Turkmenistan sees China as the most important partner and priority of its foreign policy. With Turkmenistan's neutral policy, Ashgabat supports the principle of one China, and Beijing's interests.

However, the bilateral opportunities for both countries are higher than the threats. Special bilateral cooperation and the cooperation of two countries in the energy sector have become the basis of cooperation. Both countries continue to improve trade structure, expand investment, economic and technical cooperation, and strengthen cooperation in emerging fields.

China's economic growth and Turkmenistan's abundant reserves complement each other. But Ashgabat's reliance has increased on China.

The increase in the volume of China-Turkmenistan railway transport, the construction of the China "China-Turkmenistan-Iran" railway corridor, and the expansion of Turkmenistan's transit trade volume will open more opportunities. Gas cooperation will be the cornerstone of the China-Turkmenistan BRI, and investment in strategic fields such as the chemical industry, transportation, and communication will be expanded and deepened. 



View of Ashgabat from Arch of Neutrality.  
Photo credit: John Pavelka





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# New forms of steel for stronger, lighter cars

Stainless details of a car engine. Photo credit: Erik Mclean (Pexels)

**Automakers are tweaking production processes to create a slew of new steels with just the right properties, allowing them to build cars that are both safer and more fuel-efficient**

JOHN JOHNSON JR.  
Knowable Magazine

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Like many useful innovations, it seems, the creation of high-quality steel by Indian metallurgists more than two thousand years ago may have been a happy confluence of clever workmanship and dumb luck.

Firing chunks of iron with charcoal in a special clay container produced something completely new, which the Indians called wootz. Roman armies were soon wielding wootz steel swords to terrify and subdue the wild, hairy tribes of ancient Europe.

Twenty-four centuries later, automakers are relying on electric arc furnaces, hot stamping machines and quenching and partitioning processes that the ancients could never have imagined. These approaches are yielding new ways to tune steel to protect soft human bodies when vehicles crash into each other, as they inevitably do – while curbing car weights to

reduce their deleterious impact on the planet.

“It is a revolution,” says Alan Taub, a University of Michigan engineering professor with many years in the industry. The new steels, dozens of varieties and counting, combined with lightweight polymers and carbon fiber-spun interiors and underbodies, hark back to the heady days at the start of the last century when, he says, “Detroit was Silicon Valley.”

Such materials can reduce the weight of a vehicle by hundreds of pounds – and every pound of excess weight that is shed saves roughly \$3 in fuel costs over the lifetime of the car, so the economics are hard to deny. The new maxim, Taub says, is “the right material in the right place.”

The transition to battery-powered vehicles underscores the importance of these new materials. Elec-



tric vehicles may not belch pollution, but they are heavy – the Volvo XC40 Recharge, for example, is 33 percent heavier than the gas version (and would be heavier still if the steel surrounding passengers were as bulky as it used to be). Heavy can be dangerous.

“Safety, especially when it comes to new transportation policies and new technologies, cannot be overlooked,” Jennifer Homendy, chief of the National Transportation Safety Board, told the Transportation Research Board in 2023. Plus, reducing the weight of an electric vehicle by 10 percent delivers roughly 14 percent improvement in range.

As recently as the 1960s, the steel cage around passengers was made of what automakers call soft steel. The armor from Detroit’s Jurassic period was not much different from what Henry Ford had introduced decades earlier. It was heavy and there was a lot of it.

With the 1965 publication of Ralph Nader’s *Unsafe at Any Speed: The Designed-In Dangers of the American Automobile*, big automakers realized they could no longer pursue speed and performance exclusively. The oil embargos of the 1970s only hastened the pace of change: Auto steel now had to be both stronger and lighter, requiring less fuel to push around.

In response, over the past 60 years, like chefs operating a sous vide machine to produce the perfect bite, steelmakers – their cookers are furnaces reaching thousands of degrees Fahrenheit, with robots doing the cooking – have created a vast variety of steels to match every need. There are high-strength, hardened steels for the chassis; corrosion-resistant stainless steels for side panels and roofs; and highly

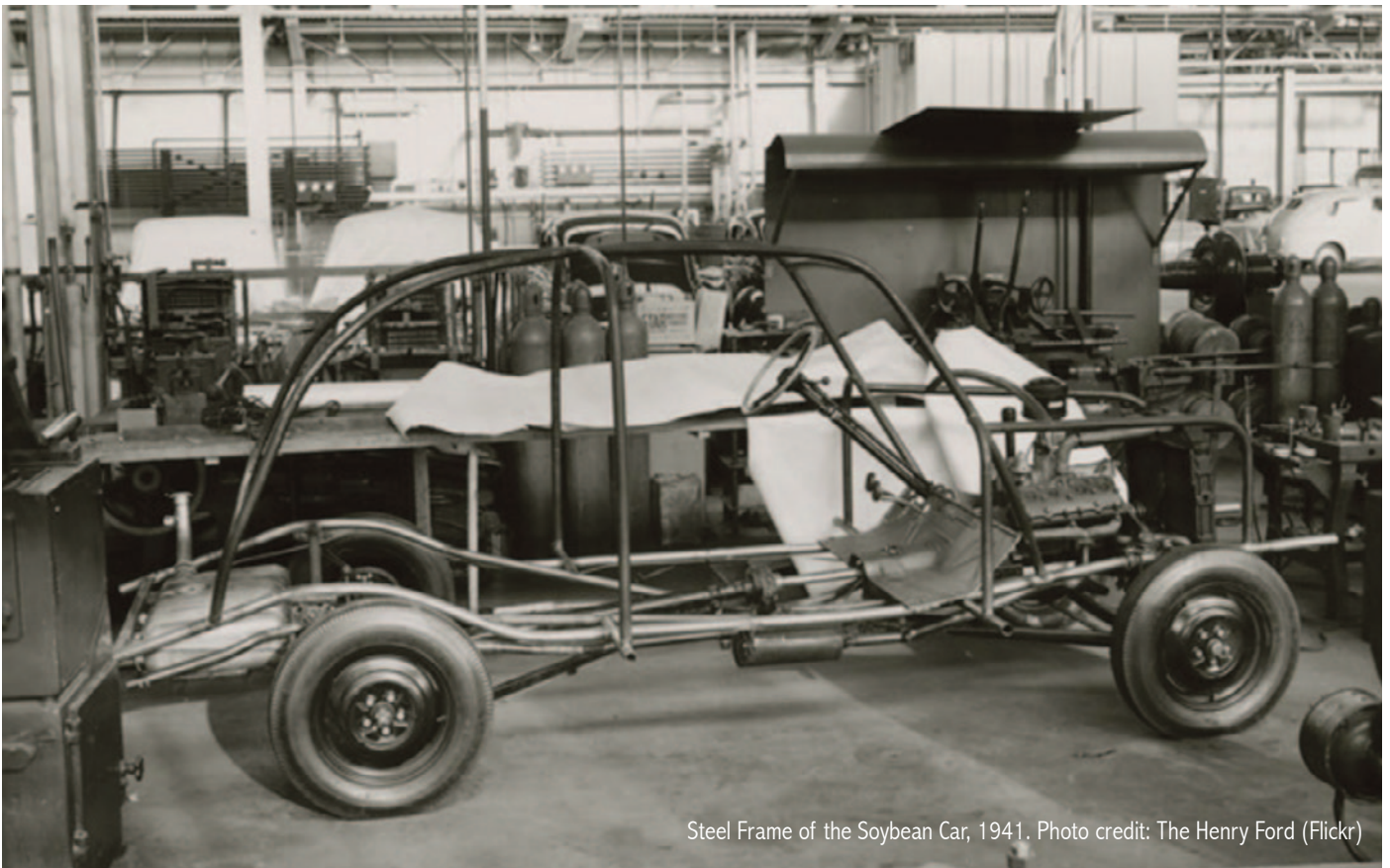
stretchable metals in bumpers to absorb impacts without crumpling.

## Tricks with the steel

Most steel is more than 98 percent iron. It is the other couple of percent – sometimes only hundredths of a single percent, in the case of metals added to confer desired properties – that make the difference. Just as important are treatment methods: the heating, cooling and processing, such as rolling the sheets prior to forming parts. Modifying each, sometimes by only seconds, changes the metal’s structure to yield different properties. “It’s all about playing tricks with the steel,” says John Speer, director of the Advanced Steel Processing and Products Research Center at the Colorado School of Mines.

At the most basic level, the properties of steel are about microstructure: the arrangement of different types, or phases, of steel in the metal. Some phases are harder, while others confer ductility, a measure of how much the metal can be bent and twisted out of shape without shearing and creating jagged edges that penetrate and tear squishy human bodies. At the atomic level, there are principally four phases of auto steel, including the hardest yet most brittle, called martensite, and the more ductile austenite. Carmakers can vary these by manipulating the times and temperatures of the heating process to produce the properties they want.

Academic researchers and steelmakers, working closely with automakers, have developed three generations of what is now called advanced high-strength steel. The first, adopted in the 1990s and still widely employed, had a good combination of strength and ductility. A second generation used more exotic alloys to achieve even greater ductility, but those ste-



Steel Frame of the Soybean Car, 1941. Photo credit: The Henry Ford (Flickr)

els proved expensive and challenging to manufacture. The third generation, which Speer says is beginning to make its way onto the factory floor, uses heating and cooling techniques to produce steels that are stronger and more formable than the first generation; nearly ten times as strong as common steels of the past; and much cheaper (though less ductile) than second-generation steels.

Steelmakers have learned that cooling time is a critical factor in creating the final arrangements of atoms and therefore the properties of the steel. The most rapid cooling, known as quenching, freezes and stabilizes the internal structure before it undergoes further change during the hours or days it could otherwise take to reach room temperature.

One of the strongest types of modern auto steel — used in the most critical structural components, such as side panels and pillars — is made by superheating the metal with boron and manganese to a tempera-

ture above 850 degrees Celsius. After becoming malleable, the steel is transferred within 10 seconds to a die, or form, where the part is shaped and rapidly cooled.

In one version of what is known as transformation-induced plasticity, the steel is heated to a high temperature, cooled to a lower temperature and held there for a time and then rapidly quenched. This produces islands of austenite surrounded by a matrix of softer ferrite, with regions of harder bainite and martensite. This steel can absorb a large amount of energy without fracturing, making it useful in bumpers and pillars.

Recipes can be further tweaked by the use of various alloys. Henry Ford was employing alloys of steel and vanadium more than a century ago to improve the performance of steel in his Model T, and alloy recipes continue to improve today. One modern example of the use of lighter metals in combination with



steel is the Ford Motor Company's aluminum-intensive F-150 truck, the 2015 version weighing nearly 700 pounds less than the previous model.

A process used in conjunction with new materials is tube hydroforming, in which a metal is bent into complex shapes by the high-pressure injection of water or other fluids into a tube, expanding it into the shape of a surrounding die. This allows parts to be made without welding two halves together, saving time and money. A Corvette aluminum frame rail, the largest hydroformed part in the world, saved 20 percent in mass from the steel rail it replaced, according to Taub, who coauthored a 2019 article on automotive lightweighting in the *Annual Review of Materials Research*.

### **New alloys**

More recent introductions are alloys such as those using titanium and particularly niobium, which increase strength by stabilizing a metal's microstructure. In a 2022 paper, Speer called the introduction of niobium "one of the most important physical metallurgy developments of the 20th century."

One tool now shortening the distance between trial and error is the computer. "The idea is to use the computer to develop materials faster than through experimentation," Speer says. New ideas can now be tested down to the atomic level without workmen bending over a bench or firing up a furnace.

The ever-continuing search for better materials and processes led engineer Raymond Boeman and colleagues to found the Institute for Advanced Composites Manufacturing Innovation (IACMI) in 2015, with a \$70 million federal grant. Also known as the Composites Institute, it is a place where industry can develop, test and scale up new processes and products.

"The field is evolving in a lot of ways," says Boeman, who now directs the institute's research on upscaling these processes. IACMI has been working on finding more climate-friendly replacements for conventional plastics such as the widely used polypropylene.

In 1960, less than 100 pounds of plastic were incorporated into the typical vehicle. By 2017, the figure had risen to nearly 350 pounds, because plastic is cheap to make and has a high strength-to-weight ratio, making it ideal for automakers trying to save on weight.

By 2019, according to Taub, 10-15 percent of a typical vehicle was made of polymers and composites, everything from seat components to trunks, door parts and dashboards. And when those cars reach the end of their lives, their plastic and other difficult-to-recycle materials known as automotive shredder residue, 5 million tons of it, ends up in landfills – or, worse, in the wider environment. Researchers are working hard to develop stronger, lighter and more environmentally friendly plastics. At the same time, new carbon fiber products are enabling these lightweight materials to be used even in load-bearing places such as structural underbody parts, further reducing the amount of heavy metal used in auto bodies.

Clearly, work remains to make autos less of a threat, both to human bodies and the planet those bodies travel over every day, to work and play. But Taub says he is optimistic about Detroit's future and the industry's ability to solve the problems that came with the end of the horse-and-buggy days. "I tell students they will have job security for a long time."

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August 5, 2024*

# Romania's big bet on fossil gas proves a reckless gamble

Romania has hit the EU funds jackpot, securing significant amounts for fossil gas projects. However, implementation has been sluggish. More concerningly, these projects could delay Europe's energy transition and deepen Romania's dependence on fossil fuels.

RALUCA PETCU  
Bankwatch Network

The country's newly published energy strategy argues for increased gas consumption based on plans for new power plants and distribution systems.

According to both the national energy strategy and the national energy and climate plan, due to be released this month, Romania will add 2 gigawatts to its gas-fired power production capacity by 2030. However, the number of projects in the works is actually much higher.

Romania is currently actively building and planning a number of gas-fired power plants with a combined capacity of over 3 gigawatts. New pro-

jects slated for Turceni, Isalnita and Mintia are being pursued to replace the country's ageing coal infrastructure and 'secure' the national energy system.

But while most EU countries are trying to reduce their reliance on gas after Russia's full-scale invasion of Ukraine, the Romanian government seems oblivious, pressing ahead with plans to open the Neptun Deep gas field in the Black Sea.

Starting in 2027, OMV-Petrom expects to extract around 100 billion cubic metres of fossil gas over a period of at least 20 years, well beyond the time Europe's energy system aims to be free of fossil



fuels. According to the country's energy strategy, this would position Romania as a major regional fossil gas exporter starting in 2027. But Romania needs energy now. Soaring temperatures this summer have led to a surge in the use of cooling devices, with the national power system unable to meet increased demand, resulting in record-high imports. The government has even warned of possible local power outages.

The planned gas power plants will take at least three more years to become operational and have already encountered considerable delays. The 850-megawatt Isalnita power plant is still in the permitting stage, while the Turceni plant (475 megawatts) is only now undergoing tender preparations. Though the initial plan was to start operations in 2026, officials have now suggested the end of 2027 as a more realistic target.

Meanwhile, the Mintia mega power plant, with a capacity of 1700 megawatts, appears to be on track. The project has obtained an environmental permit, secured a construction contract, and already received the delivery of its first turbine. The power plant is expected to be completed by mid-2026. However, its sources of financing remain a mystery.

In theory, renewable energy projects should be faster to build, as the permitting process is typically shorter than that for a huge concrete carbon emitter. Solar farms, for example, generally take 8 to 18 months to complete from planning to implementation, compared to a minimum of 24 months only for constructing a gas plant. In Romania, solar farms with a total capacity of 2000 megawatts are

expected to come online in 2024 and 2025. If these deadlines are met, solar energy, coupled with energy storage solutions, could meet Romania's energy demand as early as next summer.

## The hydrogen mirage

The companies behind these new gas projects claim their power plants are 'hydrogen-ready', touting their capacity to burn a blend of fossil gas and hydrogen, usually at around 20 per cent. While they claim to eventually transition to 100 per cent renewable hydrogen, the economic realities point to a far less appealing future.

**Recent reports indicate that the price of renewable hydrogen in Europe will not drop below EUR 5 per kilogramme by 2030 and EUR 3 per kilogramme by 2050. In contrast, the equivalent energy content of gas (3 cubic metres) currently costs around 1 EUR in the EU.**

Given that fossil gas is already one of the most expensive fuels for electricity production in the EU, rising fuel prices could further jeopardise the economic viability of these power plants. As a result, there's a strong likelihood that these plants will continue to primarily run on fossil gas, derailing Romania's trajectory towards an economy free of fossil fuels.

The documentation for these projects also suggests that hydrogen may just be a fig leaf for continued fossil fuel dependence. The technical details for Isalnita and Turceni make zero mention of 'hydrogen-ready' components. Only the Mintia project refers to hydrogen generators and storage

capacity. In any case, these projects will need additional investments to increase hydrogen usage. The truth is, the Romanian government's megalomaniacal pursuit of gas needs a reality check. It must increase its support for electrification by investing in networks and energy storage, while simplifying bureaucratic procedures for renewable energy projects, such as land acquisition.

**The country already has an installed gas capacity of around 3 gigawatts, with plans to increase this to 5.3 gigawatts by 2030 according to the national energy and climate plan.**

However, the actual projects in development indicate a significantly higher capacity.

New modelling published by the Regional Centre for Energy Policy Research (REKK), a Budapest-based think tank, shows that new gas capacity in Romania could be reduced to as little as 600 megawatts in total.

On the other hand, a shift to hydrogen could risk turning these planned power plants into stranded assets. Even 600 megawatts is excessive given the present climate chaos, highlighting the urgent need for Romania to find viable alternatives, including demand response strategies.

## **Communities focus on sustainability**

Though Romania's government and utility companies continue to heavily promote gas as a solution for regions in transition, local communities are increasingly looking towards sustainable alternatives.

While they accept gas as a short-term measure, they don't see it as a viable long-term fuel. Instead, some communities have chosen to focus on energy efficiency and sustainable energy to support local residents.

For example, the small town of Turceni in the Gorj coal region is implementing multiple EU-funded green projects, while other towns are taking the opportunity to install municipal solar farms and support prosumers.

RenewAcad, the largest network of renewable energy training centres in southeastern Europe, is helping to skill local residents to operate solar and wind farms and manage power systems. This proves that where there's a willing market, there's a way.

Accelerating the development of both distributed and large-scale solar production capacities is key to enhancing energy security and ensuring a sustainable transition. Alongside other regeneration initiatives, this approach can help productively utilise brownfield sites and boost electricity generation capacity at the quickest rate.

For instance, there's huge potential to harness the abundant sunshine on offer in the southwestern coal region of Gorj as a way of attracting new business, reducing pollution and engaging communities. By embracing renewable sources of energy in this way, Romania can secure a cleaner, more sustainable future for its citizens.

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# 12th ISWA BEACON CONFERENCE 2024 ON WASTE TO ENERGY STOCKHOLM, SWEDEN

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Green fabric bag. Photo credit: PickPik



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# What Does 'Recyclable' Really Mean?

A trade group has proposed a new definition, pressuring regulators to make plastic appear more environmentally friendly.

LISA SONG

Undark

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Most of the products in the typical kitchen use plastics that are virtually impossible to recycle.

The film that acts as a lid on Dole Sunshine fruit bowls, the rings securing jars of McCormick dried herbs, the straws attached to Juicy Juice boxes, the bags that hold Cheez-Its and Cheerios — they're all destined for the dumpster.

Now a trade group representing those brands and hundreds more is pressuring regulators to make plastic appear more environmentally friendly, a proposal experts say could worsen a crisis that is flooding the planet and our bodies with the toxic material.

The Consumer Brands Association believes companies should be able to stamp "recyclable" on products that are technically "capable" of being recycled, even if they're all but guaranteed to end up in a landfill. As ProPublica previously reported, the group argued for a looser definition of "recyclable" in written comments to the Federal Trade Commission as the agency

revises the Green Guides — guidelines for advertising products with sustainable attributes.

The association's board of directors includes officials from some of the world's richest companies, such as PepsiCo, Procter & Gamble, Coca-Cola, Land O'Lakes, Keurig Dr Pepper, Hormel Foods Corporation, Molson Coors Beverage Company, Campbell Soup, Kellanova, Mondelez International, Conagra Brands, J.M. Smucker and Clorox.

Some of the companies own brands that project health, wellness, and sustainability. That includes General Mills, owner of Annie's macaroni and cheese; The Honest Co., whose soaps and baby wipes line the shelves at Whole Foods; and Colgate-Palmolive, which owns the natural deodorant Tom's of Maine.

*ProPublica* contacted the 51 companies on the association's board of directors to ask if they agreed with the trade group's definition of "recyclable." Most did not respond. None said they disagreed with the definition. Nine com-

**The reality is, only 5 percent of Americans' discarded plastic gets recycled. And while soda bottles and milk jugs can be turned into new products, other common forms of plastic, like flimsy candy wrappers and chip bags, are destined for trash heaps and oceans, where they can linger for centuries without breaking down.**

panies referred ProPublica back to the association.

“The makers of America’s household brands are committed to creating a more circular economy which is why the industry has set sustainability goals and invested in consumer education tools” with “detailed recycling instructions,” Joseph Aquilina, the association’s vice president and deputy general counsel, wrote in an email.

The Green Guides are meant to increase consumer trust in sustainable products. Though these guidelines are not laws, they serve as a national reference for companies and other government agencies for how to define terms like “compostable,” “nontoxic,” and “recyclable.” The Federal Trade Commission is revising the guides for the first time since 2012.

Most of the plastic we encounter is functionally not recyclable. It’s too expensive or technically difficult to deal with the health risks posed by the dyes and flame retardants found in many products. Collecting, sorting, storing, and shipping the plastic for reprocessing often costs much more than plowing it into a landfill.

Though some newer technologies have pushed the boundaries of what’s possible, these plastic-recycling techniques are inefficient and exist in such limited quantities that experts say they can’t be relied upon.

The reality is, only 5 percent of Americans’ discarded plastic gets recycled. And while soda bottles and milk jugs can be turned into new products, other common forms of plastic, like

flimsy candy wrappers and chip bags, are destined for trash heaps and oceans, where they can linger for centuries without breaking down.

The current Green Guides allow companies to label products and packaging as “recyclable” if at least 60 percent of Americans have access to facilities that will take the material.

As written, the guidelines don’t specify whether it’s enough for the facilities to simply collect and sort the items or if there needs to be a reasonable expectation that the material will be made into something new.

“The Green Guides have long set forth that items labeled as ‘recyclable’ are those which are capable of being recycled,” Aquilina, the association vice president, told ProPublica. “Any characterization suggesting Consumer Brands is pushing for a ‘looser definition’ is false.”

But the association seemed to disregard what the FTC said in a separate document released alongside the guides, which states that a truthful recyclable claim means that “a substantial majority of consumers or communities have access to facilities that will actually recycle, not accept and ultimately discard, the product.”

In its comments to the FTC, the association pushed back on that idea. The U.S. recycling system is decentralized, and manufacturers have no control over economic factors that might lead a recycler to change its mind about how it handles a certain type of plastic, the association wrote, adding that it was unrealistic to force brands to predict which products will be



“ultimately recycled.”

The association represents sellers and will naturally seek more flexibility in its positions, Jef Richards, a professor of advertising and public relations at Michigan State University, said in an email. The “problem with defining ‘recyclable’ as anything that MIGHT be recycled is that I seriously doubt that’s how consumers define it.”

When consumer expectations fail to match what the advertiser is saying, “consumers are being deceived,” he added.

That deception has concrete impacts: Plastic bags that mistakenly end up at recycling centers can gum up machinery, start fires, and contaminate bales of paper, which then can’t be recycled. The problem could get worse if the FTC listens to the Consumer Brands Association and allows companies to market plastic bags as “recyclable.”

Annie’s mac and cheese is one of the brands under the association’s umbrella that has a reputation for health and sustainability. Unlike most pasta companies, Annie’s avoids using plastic film to create windows in its pasta boxes. The brand also sells cheese crackers packaged in plastic that is clearly labeled as nonrecyclable, with a diagonal slash through the triangular “chasing arrows” symbol.

Its parent company, General Mills, however, has promoted store drop-off recycling programs for one of its granola bar brands, Nature Valley. A *Bloomberg News* investigation found these programs have a spotty record, with much of the plastic ending up at landfills.

The CEO of General Mills is a member of the association’s executive committee. Earlier this year, the investment firm Green Century filed a shareholder resolution asking General Mills to investigate how it could reduce its use of plastic packaging. The resolution also suggested that the company assess the effectiveness of drop-off recycling programs.

The Honest Co. similarly cultivates a sustainable reputation, including by avoiding two parti-

cularly problematic types of plastic in its packaging. Its website provides instructions on how to dispose of plastic packaging; product pages tell consumers to disassemble and rinse out containers and to “check with your local municipality for recyclability acceptance.”

Tom’s of Maine uses similar language in fine print on its “first-of-its-kind recyclable toothpaste tube.” The tubes show the familiar chasing arrows recycling symbol accompanied by the words, “Once empty, replace cap and recycle.” Small letters on the edge of the tube read, “Your community may not yet accept tubes for recycling. Check locally.”

But regulators have warned that “check locally” caveats are vague. The Environmental Protection Agency told the FTC last year that the warning “has little value in assessing recyclability” and said companies should use clearer instructions to reduce “wishcycling” — tossing things into a curbside bin with the faint hope that they will get recycled.

A group of state attorneys general suggested using more aggressive language: “NOT ROUTINELY RECYCLED — Please check with your local jurisdiction.”

“We’re proud of the leading role we’ve played in transforming tube packaging,” Rob Robinson, a marketing executive at Tom’s of Maine, said in an email. A “check locally” caveat appears on the toothpaste tube, the outer carton, and the company website, he said.

Miriam Holsinger, co-president of Minnesota-based Eureka Recycling, said not every sorting center has the right equipment or staff training to recycle these tubes. “Until all toothpaste tubes are recyclable, it’s just not something that you can easily do.”

General Mills, The Honest Co., and Colgate-Palmolive didn’t return requests for comment.

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# Anthrax in Zimbabwe: Caused by Oppression, Worsened by Climate Change

**First used as a bioweapon four decades ago, anthrax outbreaks continue to worsen as the country gets warmer and wetter.**

ANDREW MAMBONDIYANI

The Revelator

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A herd of emaciated cows crowd for water at a small dam in the Zimunya area about 50 kilometres (31 miles) south of Zimbabwe's eastern border city of Mutare.

On the other side of the small dam, a group of children excitedly fetch water, mostly for nondrinking or cooking uses. In this part of the country, water became scarce this year as an El Niño-induced drought — the worst in more than 40 years — ravaged the region. The drought has left nearly 10 million people food insecure. Livestock and people now compete for limited water in many rural areas of Zimbabwe.

At the same time, livestock diseases are killing the few cattle that have survived the current and previous droughts. The mix of severe droughts and devastating diseases are making both livestock and rain-fed crop farming in Zimbabwe increasingly untenable. And farmers are worried; summer seasons

are becoming shorter — in some cases accompanied by violent storms and heavy flooding.

“We don't even know how to save our cattle,” says Leonard Madanhire, a small-scale livestock and crop farmer in Zimunya. “The cattle might survive the drought, but we are not sure whether they will survive the diseases like anthrax and theileriosis. Most of our livestock are now too frail to fight diseases.”

Anthrax, a disease that affects wild animals, livestock, and humans, is caused by spore-forming bacteria called *Bacillus anthracis*. Theileriosis, also known as January disease, is a cattle disease transmitted by ticks.

Anthrax is of particular worry. Early this year several districts in Zimbabwe were hit by an anthrax outbreak that caused a documented 513 human infections, countless livestock infections, and 36 livestock deaths.





To contain this year’s outbreak, the Zimbabwe government imported 426,000 anthrax vaccine doses — 25% of what it initially said it needed — from Botswana. The medicines were deployed in hot-spots like Chipinge, Gokwe North and South, Mazowe, Makonde, and Hurungwe.

The government also said it carried out public-awareness campaigns about anthrax risks “to ensure that people are well-protected,” according to statements in *The Herald*, a state-owned newspaper.

Education on the risks is important: People can be infected by anthrax through breathing in spores, eating food and drinking water contaminated with spores, or getting spores in a cut in the skin. Flu-like symptoms such as sore throat, mild fever, fatigue,

and muscle aches are common. Other symptoms include mild chest discomfort, shortness of breath, nausea, coughing up blood, painful swallowing, high fever, and trouble breathing. Animals infected by anthrax may stagger, have difficulty breathing, tremble, and finally collapse and die within a few hours, according to experts.

Eddie Cross, a livestock expert in Zimbabwe, says anthrax poses a serious threat to humans and livestock in Africa.

“Anthrax ‘can survive in the ground for many years and then be activated by appropriate conditions,’” says Cross, who is also a former legislator and advisor to the Reserve Bank of Zimbabwe. “People eating meat from an infected animal run a risk of catching the infection themselves.”

## Modern Problems, Historic Cause

Though some experts say the current anthrax outbreaks in Zimbabwe have been exacerbated by climate change, outbreaks can be traced back to the time of Zimbabwe's protracted war of liberation that ended in 1979. At the height of the war, when the country was still known as Rhodesia, the brutal colonial regime of the late Prime Minister Ian Smith reportedly used anthrax as a biological weapon.

Experts say this resulted in the largest global human anthrax outbreak, which occurred in Zimbabwe between 1978 and 1980. More than 10,700 cases of human anthrax and 200 deaths were recorded during that time.

Since the late 1970s and early 1980s, the disease has become endemic in Zimbabwe. Victor Matemadanda — a veteran of the 1970s liberation war and secretary general of the Zimbabwe National Liberation War Association — confirmed to me that many of his colleagues died from suspected anthrax infections.

The association is a grouping of former freedom fighters, also known as guerrillas or comrades, who served during the country's war of liberation (also known as the Rhodesian Bush War). The war culminated in the end of minority white rule and Zimbabwe attaining independence in 1980.

"Many freedom fighters died, I can confirm that," says Matemadanda, who is also Zimbabwe's ambassador to Mozambique. "But back then we were not sure whether it was anthrax or not because there was no scientific research to confirm that. But the signs and symptoms showed it was anthrax."

Unfortunately, due to a lack of knowledge back then, many cases could not be confirmed as anthrax infections. Even some medical doctors were

not familiar with anthrax symptoms in humans during that time. Little has changed. One 2016 study revealed that grossly unusual epidemiological features of the anthrax outbreaks in the late 1970s and early 1980s still have not been definitively explained. However, the authors, from the University of Nevada–Reno, widely agree with a hypothesis proposed by Meryl Nass, an American physician living in Zimbabwe at the time of the outbreaks who suggested that the anthrax epidemic was propagated intentionally.

"Nass emphasized the unusual features of the epidemic: large numbers of cases, geographic extent and involvement of areas that had never reported anthrax before, lack of involvement of neighbouring countries, specific involvement of the Tribal Trust Lands versus European-owned agricultural land, and coincidence with an ongoing civil war," the study notes.

Witness testimony from some people who lived on Tribal Trust Land — areas reserved for Indigenous Black people during the colonial era — revealed a belief that "poisoning" by anthrax occurred during the war, according to the study. The researchers cited other authors who provided testimony of deliberate anthrax releases during the war by Rhodesian soldiers with support from South African forces. And they say that these activities were part of apartheid South Africa's biological weapons program, code-named Project Coast.

During the war Rhodesia was under United Nations economic sanctions and was isolated from the rest of the world, although it maintained a close relationship with apartheid South Africa. Through South Africa, Rhodesia Prime Minister Smith managed to bust the U.N. sanctions to fund the war, which lasted for more than a decade.

## A New Threat Rises

Today experts fear that anthrax outbreaks in Zimbabwe will become worse due to climate change,



which is making some parts of the country warmer and wetter. Les Baillie, a professor of microbiology at Cardiff University's School of Pharmacy and Pharmaceutical Sciences in the United Kingdom, tells me that outbreaks of anthrax regularly occur in Zimbabwe and that there have been several outbreaks across Africa since last year.

Baillie shared a report on anthrax he recently wrote with Alexandra Cusmano, another expert from the school, which suggests that climate change may have worsened the anthrax problem in Africa.

Oddly enough, the evidence for their hypothesis comes from a 2016 anthrax outbreak in reindeer in northern Russia. There, anthrax killed thousands of animals and affected dozens of humans on the Yamal peninsula, in Northwest Siberia.

Experts, the report adds, identified two primary factors as contributing to this outbreak: a summer heat wave that caused the permafrost to melt, releasing "trapped spores," and the cancellation of the reindeer vaccination program in 2007, which led to an increase in population susceptibility.

Baillie and Cusmano conclude that:

**“Outbreaks of anthrax in endemic regions of the world are not unusual. We are likely to see more cases due to a combination of climate change and socio-economic factors, such as food poverty and lack of access to effective veterinary services.”**

Another study, published in the journal BMC Public Health this year, modeled the future of anthrax outbreaks in Zimbabwe under climate change. The researchers found that the country's eastern and western districts will face the greatest threats.

These districts are home to thousands of small-scale

farmers who depend mostly on livestock and crop farming. The study calls for disease surveillance systems, public-awareness campaigns, and targeted vaccinations, among other control measures.

Cross, the Zimbabwe livestock expert, agrees, and says the government should make sure that farmers are aware of the dangers of coming across the carcass of a cow who has died from unrecognized causes. Anthrax infections in humans are mostly by exposure to contaminated animals or their meat.

“[Farmers] should be extremely careful in the way they approach the carcass and, if possible, they should arrange it to be burned, which is the only real way of ending the infections,” Cross says.

Meanwhile, the government says plans are underway to produce enough anthrax vaccines locally starting next year, which could help to eradicate the disease.

But the collapse of Zimbabwe's economy may complicate the fight against livestock and human diseases.

Political and economic crises that unfolded following the country's controversial land-reform program — which started in 2000 — resulted in negative growth rates, skyrocketing inflation, decline in the rule of law, and a disintegration of markets, according to experts. At the same time, the country has become isolated on the international stage due to its frequent human-rights violations.

Time will tell whether Zimbabwe can succeed in eradicating anthrax. But for now the legacy of this wartime bioweapon continues to haunt the country, more than four decades after it was unleashed.

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# The power of wastewater

ALICE MASILI  
ONE

The generation of clean and renewable energy is a topical issue, particularly regarding the principle of large-scale recycling to avoid using or extracting new materials. One example of this is wastewater.

Wastewater originates from human activities and contains organic and inorganic impurities that can harm health and the environment. The purification of this water is essential to remove the contaminations present before it is released into the environment. During these treatments, toxic substances are removed from the liquid waste, and everything turns into sludge. The latter, which is not yet completely free of pollutants, is in turn subjected to other unique treatments until it is either disposed of in special landfills, used in agriculture, collected in composting plants or finally used to produce biogas and biomethane.

Especially in the industrial sector, companies seek more sustainable solutions linked to a circular economy and a flexible energy transition to be virtuous and innovative. Wastewater treatment plants, civil or industrial, can become real energy generators. Renewable, of course. But how? Beneath our cities, another watercourse flows, made up of kilometres of sewers that collect wastewater from buildings. Did you know that it is not only an important water reserve but also a potential source of energy? The Schönerlinde sewage treatment pilot plant in Germany has been converting sewage sludge into methane,

which is then used as an energy source, for some time now. Recently, however, it began developing a new and innovative "power-to-gas" process with the aim of producing green hydrogen from the electrolysis of pre-treated wastewater. The project, funded by the federal government with 3.2 million euros, aims to use the surplus wind energy from Berliner Wasserbetriebe's turbines. Berliner Wasserbetriebe, among other things, treats wastewater in the capital.

The hydrogen will be combined with the CO<sub>2</sub>-rich sewage gas to produce methane gas, which can be fed into the existing gas distribution networks. In addition to producing hydrogen, which can be used as an energy carrier to compensate for the fluctuating and erratic availability of wind energy, the project offers the significant advantage of avoiding the use of drinkable water, an increasingly precious and limited resource.

The pilot project intends to demonstrate by 2027 whether the conversion of wastewater into hydrogen is economically and technically feasible on a large scale. However, there are other ways to reuse and convert wastewater.

Energy can also be recovered by taking advantage of the fact that the temperature of the wastewater is relatively constant, thanks to geothermal energy. Heat can be recovered from the wastewater by installing heat exchangers





Conventional municipal wastewater treatment plant in Rąbczyn, Ostrów Wielkopolski (Poland).  
Photo credit: Stioipa (Wikimedia)

connected to heat pumps in the sewage system, which flows for kilometres under the surface of our cities' streets. The water discharged from households is relatively constant throughout the year, as the heating water produced in the household is discharged into the wastewater collectors while still hot. The heat exchanger then recovers the heat energy contained in the water before the temperature is brought to the desired level via the heat pump. This way, wastewater can be used as a heat source in winter and for room cooling in summer.

Belgium, where the temperature is between 10° and 14°C, is focusing on the potential, technical constraints and possible profitability of this type of system. In the meantime, the first concrete applications are already making it possible to analyze the advantages of this form of energy recovery.

The first large-scale installation is that of Uccle. As part of the sewer renovation, heat exchangers were installed that can be used to air-condition the five municipal administration buildings by reheating them.

The water supply company Vivaqua, which has patented this technology, has installed a system in the Brussels city council's sewerage plant that generates 120 kW of electricity with an eco-efficiency of almost 5. This means that the energy extracted and the energy returned are the same. Recent studies on recovering thermal energy from wastewater in Italy measured temperatures between 15°C and

25°C. The potential of this innovative technology for wastewater was examined by Enea, which activated a case study in a wastewater section of the city of Bologna. The study showed that "the recovery of thermal energy from wastewater can significantly contribute to achieving energy neutrality in the water supply sector.

The application of recovery technologies is an interesting solution to promote the transition to new energy systems and meet the challenges of climate change".

However, the system has several critical points. Not too much heat must be removed from the water, as this could weaken the purification process. In addition, a large and relatively constant flow of water must be guaranteed, and the possibility of incrustations in the heat exchangers due to wastewater must be taken into account.

Considering the impact of inflation, rising energy prices, and climate change, it is essential to embark on a path of change. Thanks to a mix of technological and renewable innovations, optimizing energy consumption by making production processes as circular as possible is now conceivable.

As these technologies consolidate, the synergistic integration between the energy and wastewater treatment sectors could lead to tangible economic benefits for citizens and contribute to the development of a more sustainable and resilient energy market. **ONE**

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# The Rights of Nature Prevail Again in Ecuador



Dracula morleyi from Reserva Los Cedros. Photo credit: Andreas Kay (Flickr)

**The beguiling, mist-covered forest of Los Cedros provides a vision of a future where the rights of the natural world are actively and effectively protected.**

PETER YEUNG

YES! Media

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Jose Martín Ovando suddenly halts in his tracks and crouches down along the steep forest path shrouded in mist, pulling out a magnifying glass from his small backpack to inspect a clump of deep green moss.

Among the greenery, he has spotted an orchid: *Dracula morleyi*. Blotted in black with a flash of white at the center, it's barely bigger than a fingernail. "This place is full of so much biodiversity," he grins. "Scientists don't even know about most of it."

Ovando is a guide at Los Cedros Protective Forest, a 4,800-hectare (11,860-acre) reserve of cloud forest in the northwest Ecuadorian Andes, one of the world's most biodiverse areas.

This tropical haven—home to a wealth of wildlife, including the critically endangered black-and-chestnut eagle and brown-headed spider monkey, jaguars, endemic frogs, more than 300 species of birds, 600 kinds of moths, and 200 varieties of orchids—is at the forefront of

a global movement to recognize the legal rights of the natural world.

The movement is rooted in the common Indigenous belief that nature—from the Andean mountains to Amazonian rivers right down to a single soldier ant—is a system to which human beings belong and with which they must harmoniously coexist. The legal theory argues that these ecosystems and species have intrinsic rights that should be protected in the same way as those of humans.

"The idea that rocks, rivers, and animals are alive and so should be granted a legal status is a core aspect of Indigenous worldviews," says César Rodríguez-Garavito, professor of clinical law and director of NYU School of Law's More Than Human Rights Project, an initiative attempting to further nonhuman rights and the larger web of life. "Indigenous peoples have turned that belief into practices of reciprocity with nature, through ceremonies, use of medicinal plants, and more."



The planet faces a human-led sixth mass extinction that has already wiped out entire species and risks destroying whole ecosystems. This destruction would accelerate under authoritarian regimes and right-wing agendas around the globe, including Project 2025 in the United States. Los Cedros is the world's leading example of how non-anthropocentric laws can be used to effectively defend the planet.

“By putting ourselves [humans] outside of nature, we’re hurting ourselves,” says Bitty Roy, an ecologist at the University of Oregon who first visited Los Cedros in 1998 and has since returned many times. “We live within the system of nature, we rely on it, and it’s part of us. The rights of nature recognizes this in a way that old laws haven’t.”

So-called “rights of nature” arguments, a novel conservation strategy dating back to the 1990s, have been lodged in 397 cases across 34 countries and even the United Nations, according to the Eco Jurisprudence Monitor. These cases have been brought from Bolivia to Brazil to Uganda, as well as Canada, Mexico, and the U.S.

Some cases have broadly recognized the rights of rivers, watersheds, mountains, and even the entirety of Mother Earth, whereas others have focused on species like seals in the North Sea, sea turtles in Panama, or a specific animal, such as Tommy the chimpanzee, who was living in a cage in New York. In one particularly creative case this year, campaigners succeeded in getting music streaming platforms to allow nature to be credited for sounds used in songs.

In Ecuador, the groundwork was set in 2008 when, thanks to lobbying from Indigenous groups, the country adopted a new constitution that included the rights of Pacha Mama, in essence stating that Mother Nature has the same rights as people.

But Los Cedros’ story began much earlier. Today, the reserve is owned by the state, but in 1988, the land was pur-

chased by Josef DeCoux, an American environmentalist who managed a scientific station at the heart of the reserve until his death in May 2024. Photo by Bitty Roy

Bit by bit, with the help of friends and nonprofits including Friends of the Earth Sweden and Australia’s Rainforest Information Center, DeCoux bought land in the area in order to preserve it. For many years, he lived in a shack deep in the forest.

“I fell in love with the unique beauty of the place,” said DeCoux, during a visit to the monitoring station in Los Cedros shortly before his death following a years-long battle with cancer. “I immediately knew that I wanted to dedicate my life to this forest. And that’s what I’ve done.”

DeCoux worked with Indigenous communities in the surrounding Manduriacos Valley to build local support for the effort, resulting in Los Cedros securing state conservation status in 1994. “People stopped shooting all the monkeys,” he added.

### **“They appreciated the reserve and its value, and how it protects the watershed.”**

As a result, Los Cedros—which ranges from 3,000 to 9,000 feet in altitude and is crossed by four rivers—thrived, in contrast to the mass deforestation suffered by the surrounding, highly endangered Andean cloud forest.

Under an open-door policy aimed at raising the profile of the reserve, scientists came from across the world to study its wealth of biodiversity, with more than 140 scientific papers now published.

“I could spend time studying a single square meter of Los Cedros and still not understand everything there,” Roy says. “Western Ecuador is head and shoulders above the rest of the world in terms of amphibian, bird, and plant biodiversity.”



Josef DeCoux, an American environmentalist, purchased the land on which Los Cedros sits in 1988, and managed a scientific station in the reserve until his death in May 2024. Photo credit: Bitty Roy

However, conservation efforts hit a major stumbling block in 2017 when the government granted the state-owned mining company ENAMI EP rights to mining concessions for copper and gold in more than two-thirds of Los Cedros' landmass.

This is where the rights of nature legislation came into play. Before extraction could begin, a legal challenge was tabled at the Provincial Court by the local government of Cotacachi, a region home to 43 Indigenous communities. After an appeal, the case was then taken to Ecuador's Constitutional Court. The claimants argued that if mining was to proceed in Los Cedros, it would violate the forest's constitutional rights, and they demanded the protection of its "right to exist, survive, and regenerate."

After a years-long legal battle, in December 2021, judges at the Constitutional Court finally annulled the concession that had been granted to the mining company, in effect turning a theoretical constitutional text into a tangible, real-world policy.

The unprecedented verdict was one of the first times that

any court in the world had ever recognized the rights of nonhuman organisms—and the judges went as far as to state that the law not only applied to Los Cedros and to other protected areas, but, under the terms of the constitution, to any kind of nature within the country of Ecuador.

"There was no case before this, there was no precedent," added DeCoux. "It was a case of science winning over extractive industries."

In Los Cedros, the miners were forced to remove their machinery immediately and the court banned all future mining and other extractive activities.

Now, 24 hours a day, the reserve thrums with activity, from the early-morning roars of howler monkeys among the dense canopy to the afternoon squawks of toucans and the buzzes of nocturnal bats swooping after the many critters that fill the night sky.

"It is a great pleasure to observe the greatness of the animal kingdom here every day," says Ovando, as he watches a pair of yellow-beaked toucans in the distance. "Life is calmer here now. The wildlife is more at ease."

Follow-up monitoring has also confirmed the early impact of the ruling. As part of a report published by the More Than Human Rights Project in June 2024, Rodríguez-Garavito visited Los Cedros twice and found that mining equipment and staff had been removed from the reserve, which remained a "sanctuary" for biodiversity thanks to the ruling. The report concluded that the enforcement of the rights of nature and rulings like Los Cedros "can be effective tools to protect endangered ecosystems."

"I was positively surprised," Rodríguez-Garavito says. "Especially because Los Cedros is in the midst of the region with many active mining projects. It should not be taken for granted that these rulings will be properly implemented."

Proponents argue that the successful use of those rights



to defend an ecosystem like Los Cedros has set a powerful precedent, and it is already influencing rulings in Ecuador and beyond. In July, the Indigenous Kitu Kara people won a case claiming pollution violated the rights of the Machángara River, which runs through Ecuador's capital, Quito. In March, Peru recognized the rights of the Marañón River to be free of pollution after a lawsuit was brought by the Kukama Indigenous Women's organization against the oil company Petroperú. A recent claim relating to Ecuador's Fierro Urco wetlands even referenced the Los Cedros precedent in court filings.

"It's a phenomenon that's catching fire and that's spreading very rapidly around the world," Rodríguez-Garavito says. "Because the Los Cedros case is a sophisticated and detailed judicial decision, it's being referenced by other courts."

Nicola Peel, an environmentalist who first visited Los Cedros in 1999 and testified during the Constitutional Court case, argues that the ruling marks a turning point in global conservation. "I absolutely believe that the time has come for the rights of nature," she says. "This feels like the natural progression for a new era."

However, plenty of concerns remain over the long-term success of the ruling in Los Cedros, and rights of nature cases more generally, in the face of powerful extractive industries and limited resources to monitor and enforce legal protections.

"The courts move on to new cases," Rodríguez-Garavito says. "But the argument behind my study is that researchers, policymakers, and advocates must continue paying attention to implementation. We need to follow what happens after."

The Ganges River, for example, which is considered sacred by more than a billion Indians, was recognized by the highest court in the Indian state of Uttarakhand, which is home to part of the river, as a "living entity" in 2017, but sewage and industrial waste has continued to

pollute the river since then and it mostly remains undrinkable.

Rodríguez-Garavito's findings also highlighted other threats to Los Cedros: mining activities in nearby areas that risk a "spillover effect," a growing problem with organized crime in Ecuador that could hinder efforts, "grossly insufficient" resources for park rangers, and the passing of DeCoux, who led the movement.

An ongoing challenge is also maintaining the support of locals, some of whom—in situations of poverty, without alternative sources of income, and barely any support from the state—have been tempted by the pay offered by mining. "Companies always offer them good jobs," Ovando says.

Others are concerned that the ruling could simply boost illegal hunting, logging, and mining outside of the reserve's borders, which could result in mass biodiversity loss.

**"My worry is that Los Cedros will become an island surrounded by private lands that get degraded," Peel says. "How can we ensure the protection of other areas too?"**

But few disagree that the case of Los Cedros, with its beguiling, mist-covered forest, has provided a vision of a future where the rights of the natural world are actively and effectively protected.

"Mining isn't going to happen here again," said DeCoux, in a typically direct tone that has driven the conservation success in Los Cedros. "People need to get that into their heads."

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# How are the EU's coal giants decarbonising?

Can Germany and Poland, the EU's two largest coal consumers, sustain their emissions cuts?

NIU YUHAN  
Dialogue Earth

Renewable Energy Island. Photo credit: Mholtsmeier/DeviantArt

In the EU, coal consumption rebounded in 2021 and 2022 as the economy recovered from the Covid-19 pandemic and an energy crisis escalated by Russia's invasion of Ukraine prompted some countries to fire up coal power plants. In China, the media and public began to question Europe's climate commitments.

But gas and coal use across the EU fell significantly in the second half of 2022, a Dialogue Earth analysis showed. Coal burning continued to decline in 2023, with coal-power generation hitting new lows, dropping 26% in a year to account for only 12% of the bloc's electricity mix, according to energy think-tank Ember.

The EU has long been a leader in global climate governance. Its European Green Deal, published in late 2019, aimed to bring about "climate neutrality" by 2050, meaning net zero emissions of all greenhouse gases, not just CO<sub>2</sub>. In February of this year, the European Commission set an intermediate goal on that pathway – to reduce emissions by at least 90% by 2040, against a 1990 baseline.

This would mean coal being "almost completely phased out" by 2040, according to an impact assessment report. Pieter de Pous, who leads the Coal to Clean Programme at UK-based think-tank E3G, said

Germany and Poland's continued efforts are particularly important when it comes to the EU targets because despite falls in coal power generation in both countries in 2023, the two still account for 71% of the bloc's coal generation.

Experts interviewed by Dialogue Earth believe Europe's two largest coal consumers are accelerating the deployment of renewables to reduce their reliance on coal, but still face challenges around economic development and ensuring a just transition.

## Could Germany phase out coal by 2030 rather than 2038?

Germany's carbon emissions have been in general decline since 1979. Last year, they reached their lowest levels since the 1950s, with coal-power generation dropping by a quarter compared to 2022, from 180 gigawatts to 135 gigawatts, and coal's share of the energy mix down to 26.8%, Ember found.

In January 2020, Germany passed a law requiring coal-fired power stations to be completely phased out by 2038, and published a detailed timetable. The government also committed to ending nuclear-power generation within two years, leading to concerns over power shortages.



When the 2022 energy crisis led to shortages of natural gas, the shutdown of the last three nuclear power plants had to be delayed; they were finally wound down in April last year. But fears that coal generation would pick up the slack proved unfounded, with fossil-fuel generation falling at the same time.

So Germany was able to cut coal generation while shutting down nuclear power and weathering natural gas shortages. This achievement was, at least in part, thanks to a rapid expansion of renewables.

Reforms designed to speed up the energy transition were announced in 2022. These included faster planning and approvals processes for renewables, and a requirement for 2% of all land to be reserved for wind power by 2032.

In 2023, Germany for the first time generated more than half of its power from renewable sources (excluding nuclear), Ember data shows. Last year also saw wind power overtake coal as the country's largest single source of power, at 27.2% of the mix. The data also shows that together, wind and solar power accounted for 39% of all power generated, three times the global average of 13%.

However, a fall in electricity demand from industry, which saw reduced output last year, also helped cut emissions. Some are therefore worried about the relationship between economic performance and emissions. Agora Energiewende, a German think-tank, calculated that only 15% of Germany's 2023 carbon cuts were permanent in nature, that is, achieved by adding new renewable energy, boosting energy efficiency or switching to lower-carbon fuels.

Half of the cuts came from falling power demand and other short-term impacts; Reuters has reported a 5.3% drop in load on public power networks in 2023, reflecting that drop in demand. Germany's economic slowdown has a range of causes including the war in Ukraine, high interest rates and deficits in skilled labour. When the expected recovery from these issues occurs, some emissions reductions gains are likely to be lost, Agora warns.

De Pous says the German government has set ambitious targets related to renewables, such as for at least 15 million electric vehicles to be on the roads by 2030. The associated growth in power demand has been factored into planning for renewable-energy construction, he adds. The question is, can

Germany keep on expanding renewables to meet post-coal power demand? The government seems confident. In fact, action at the state level indicates that the coal power shutdown may indeed come earlier. In late 2022, North Rhine-Westphalia – a centre for coal mining and heavy industry in the west of Germany – announced that coal generation would be phased out by 2030. States in the east of the country are making similar noises.

“Of course, Germany still has a lot of work to do,” said de Pous. “As in most countries rolling out renewable energy, the big task is construction and digitalisation of the power grid. Alongside that, Germany is also developing flexible energy tech, such as hydrogen power. I'm cautiously optimistic that Germany is on the right track with its energy transition. If the government's renewable-energy plans come to fruition, a 2030 coal phase-out is feasible.”

## Poland, an emerging decarbonisation 'leader'?

Last year was a record-breaking one for Poland too. The country increased its wind and solar power generation by 7 terawatt hours, with their share of the energy mix up from 16% to 21%. Coal generation, meanwhile, fell by 22 terawatt hours, with its share of the energy mix dropping from 70% to 61%.

But unlike Germany, Poland's annual emissions have remained steady over the last 25 years or so. However, a Polish politician speaking off the record told Dialogue Earth that while Poland's emissions look high, the economy grew 2.5 times between 2000 and 2020, while emissions held steady. In other words, carbon intensity – meaning emissions per unit of GDP – more than halved. “That means that Poland, one of the world's fastest growing economies, is already undergoing a sustained transition and has, for 25 years, been a leader on decarbonisation,” he said.

Poland's journey away from coal can be traced back three decades. Between 1990 and 2020, output of hard coal, or anthracite, dropped 63%, while mining sector jobs fell 80%, from 390,000 to 80,000. However, this was an inevitable outcome of economic trends and the switch from a planned to a market economy, rather than a deliberate energy transition strategy by government, according to Resources for the Future, a US-based research institute.

## «Sometimes, Poland's energy transition seems like a silent revolution»

Aleksander Śniegocki,  
*CEO of the Reform Institute*

Poland is now making plans for decarbonisation, but it is more reliant on coal than Germany and so faces bigger challenges. In 2020, the government and union representatives agreed on an end to coal mining by 2049. The deal gave miners the right to transfer from closed mines to those still operating, or to get an early retirement package of 80% of their salaries.

The government also sought EU permission to provide state aid “for financing the current production, in order to ensure the stability of the hard-coal mining companies”. The EU regulates state aid provided by its member states, and experts think it unlikely that Poland will be allowed to keep funding coal mining.

Aleksander Śniegocki, CEO of the Reform Institute, a Polish think-tank, told Dialogue Earth that it remains to be seen how the new administration, which came to power in December, will manage that commitment, but it's clear that the government cannot keep supporting loss-making mines. Western Europe once had many coal mines too, but at a certain point, the mining stops making economic sense, Śniegocki said.

Seeking to secure power supply security following the energy crisis, in October 2023 the EU suspended until the end of 2028 a requirement for power stations to stay within certain CO<sub>2</sub> emissions limits in order to qualify for state aid. That effectively allowed member states to subsidise coal- and gas-power generation. In March this year, Poland's top energy-security official told Reuters the country would need the suspension extended beyond 2028, until its first nuclear power plant comes online next decade.

Under the EU's Emissions Trading System (ETS), certain industries must keep their CO<sub>2</sub> emissions within a quota or buy additional allowances. De Pous said that, like Germany, Poland will speed up its coal

phase-out in response to the tightening of ETS quotas as well as to the economic attractiveness of renewables. But unlike Germany, Poland is putting its hopes in new nuclear power stations. This is risky as nuclear power construction can be slow and expensive. In such a scenario the country may be left no choice but to burn coal and natural gas to bridge the gap, which would inevitably slow the energy transition, de Pous added.

### Justice and efficiency

In 2021, Poland approved an energy policy framework running up to 2040. Known as PEP2040, the framework was roundly criticised for its lack of ambition. For example, its target to install 10-16 gigawatts of solar power by 2040 was met just two years later. And last year, renewables accounted for 27% of Poland's energy mix – already approaching the 2030 target of 32%.

Śniegocki points out that, unlike Germany, Poland has no energy-transition roadmap or methodical top-down planning and implementation. The government's thinking seems to be that an active approach, with forward planning and targets for an ambitious roll-out of renewables, would be a clear signal that demand for coal is going to fall. Such a communication would make the government unpopular with the mining unions. “Sometimes, Poland's energy transition seems like a silent revolution,” he said.

After all, Poland is one of the EU's fastest growing markets for solar power. In 2018, heat pumps had 10% of the heating installation market. By 2023 that share had risen to 40%. And the country is set to become a major player in offshore wind, with a target of at least 3.4 gigawatts of generating capacity by 2030.

The Polish politician Dialogue Earth spoke to said the new administration is expected to boost ambition for both offshore wind and nuclear power. The closure of mines, he stressed, won't just result in miners losing their jobs. There will also be grave consequences for their families and communities. Just transition policies need to be in place for them, he said, as well as solutions to ensure energy security. “It's a sustained process, and we aren't going to give



## Germany and Poland's changing CO<sub>2</sub> emissions from coal

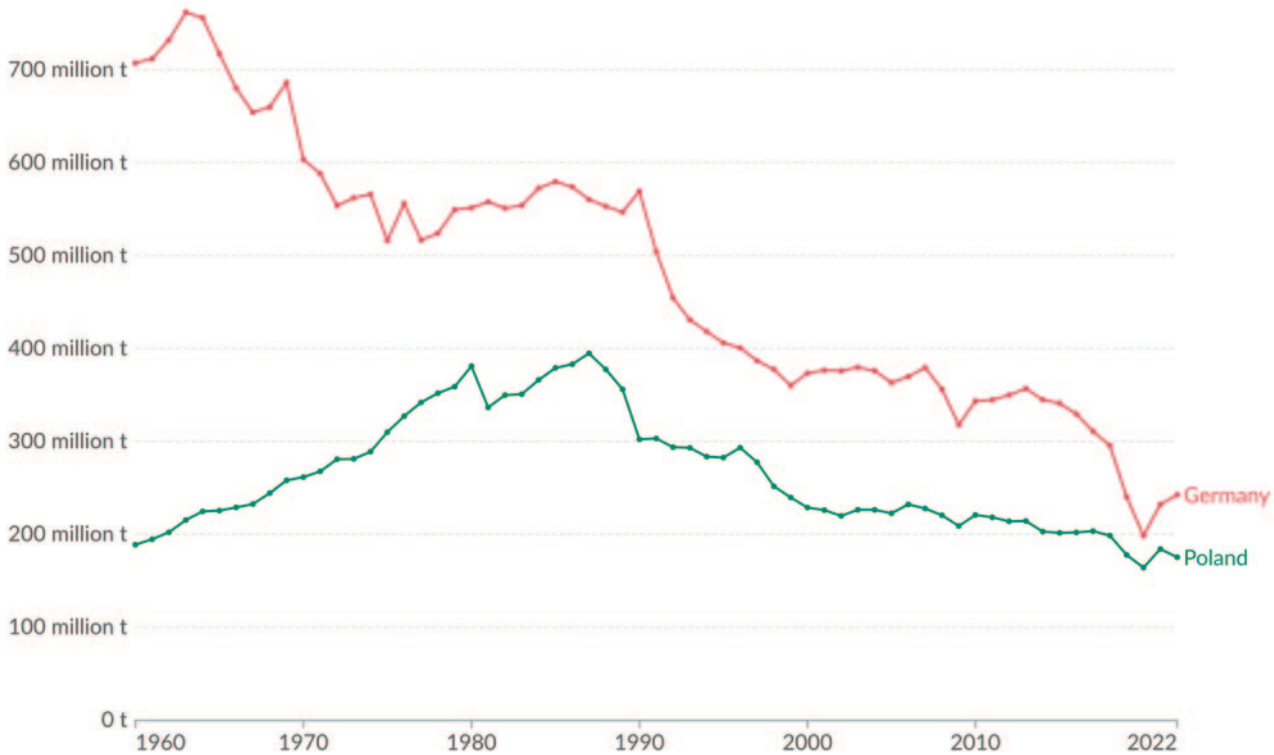
Annual emissions 1960-2022, in million tonnes

Data source: Our World in Data • Graphic: Dialogue Earth

### Annual CO<sub>2</sub> emissions from coal

Annual emissions of carbon dioxide (CO<sub>2</sub>) from coal, measured in tonnes.

Our World  
in Data



Data source: Global Carbon Budget (2023)

OurWorldinData.org/co2-and-greenhouse-gas-emissions | CC BY

up,” he said. Ensuring a just transition for workers and communities reliant on the coal industry, while keeping the lights on in homes and factories, is a challenge for all decarbonising countries, not just Germany and Poland, he said.

In Germany, the far-right Alternative for Deutschland (AfD) party, which is opposed to a coal phase-out, garnered strong support in the east of the country in recent European elections. Some worry its influence will reduce the government’s climate ambition. In 2020, EUR 40 billion was promised in structural funding to reduce the impact of job losses, but eastern state leaders have again warned that ensuring a just transition will be key in keeping voters away from extremist parties.

In three eastern state elections in early September, the AfD received the most votes in Thuringia and came a close second in neighbouring Saxony. Reflecting on these results, de Pous told Dialogue Earth:

“An earlier coal phase out in eastern Germany is just as likely to happen following these election results as before,” but with state government intervention less likely to play a part. The earlier phase out is now more likely to be “entirely driven by market forces,” he said.

De Pous believes that a just transition and industrial competitiveness will in fact be best achieved by speeding up renewable-energy development, and that this process should not be slowed by a minority seeking to keep their jobs a little longer. “In Europe, the debate about a just transition has often become instrumentalised,” he said. “We’ve already wasted a lot of time, which is preventing more people from enjoying the social and economic benefits of a transition to sustainable energy.”

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# Cities Are Depaving for a Cooler Future

Asphalt contributes to the urban heat island effect and makes places more prone to flooding. Planners are rethinking its place in cities.

LUCY SHERRIFF  
Nexus Media News

It all started because a man named Arif Khan wanted a garden.

In 2007, he had recently moved into a house in Portland, Ore., whose backyard was covered in asphalt. Some friends helped him tear up the impervious surface, and soon after, they won a small grant to carry out a similar project in front of a local cafe.

“It was a one-off,” said Ted Labbe, co-founder of Depave, an urban greening movement. “But it was so successful that the next year we got solicited to do three projects, and then five the year after that. It just kept escalating.” In the 15 years since breaking ground on Khan’s backyard, Depave has completed 75 projects in schoolyards, churches and other community spaces across Portland.

The Depave movement has spread across the United States and Canada in recent years as climate-related extreme heat and flooding have made some cities rethink the wisdom of all that heat-absorbing, impervious surface area.

Depave’s newest chapter is in Chicago, where about half of the population lives in areas where temperatures are at least eight degrees higher than the city’s base

temperature, a disparity that can prove deadly in heatwaves. More than 60% of the city is covered in impervious surfaces, and when record rains fell in early July, more than 12,000 residents reported flooding in their basements.

“Environmental justice communities are suffering from a lot of pavement-related issues,” said Mary Pat McGuire, a professor of architecture at the University of Illinois, and the founder of Depave Chicago. “We’re trying to bring attention to it so that the city will start treating this as a critical part of climate adaptation and social justice.”

Since launching in 2022, McGuire and a group of volunteers have been holding listening sessions across the city to identify local needs. She and her cohort recently finished drawing up plans for their pilot project: greening a public schoolyard in West Englewood, a low-income neighborhood in southwest Chicago.

“They teach the Montessori method which is very hands-on,” McGuire said. Depave consulted with sixth, seventh and eighth graders, along with teachers, parents and school board members to draw up a blueprint for the new schoolyard. It includes pollinator gardens, an outdoor classroom, log structures, bioswales and shady trees. “Green infrastructure isn’t clean,



neat and tidy,” McGuire said. “We’re going to get messy.”

Paved roads and parking lots take up about 30% of urban areas in the United States. (In some cities, like New York, that figure is closer to 61%.) Parking lots alone cover more than 5% of developed land in the lower 48 states, according to the U.S. Geological Survey.

“We’ve had a love affair with paving things for several generations,” said Brendan Shane, climate director at the nonprofit Trust for Public Land (TPL). “We have too many unnatural paved surfaces and not enough natural surfaces, and that’s creating these urban heat islands [and] rapidly flooding neighborhoods.”

Extreme heat and flooding are particularly acute in low-income communities of color, which typically have less green space than wealthy, white neighborhoods, a legacy of redlining practices.

Replacing asphalt with greenery has benefits beyond lowering temperatures and reducing flood risk. It’s also associated with lower stress levels, a reduction in noise, fewer traffic-related injuries and even restoration of local biodiversity. It can also improve air quality: asphalt releases hazardous air pollutants into communities, especially in extreme heat and direct sunlight.

“We want to bring it to the city’s attention that this is a critical part of climate adaptation and solving social inequity,” McGuire said.

Amid climate-fueled heatwaves and floods, cities around the country are rethinking the streetscape. In Phoenix, Arizona, where asphalt can get so hot during heatwaves it can give third-degree burns, officials are painting surfaces with reflective grey paint. Nashville, which experienced deadly floods back in 2010, has transformed alleyways into blooming bee-filled rain gardens.

More than a decade ago, Chicago invested \$14 million in building what it dubbed the “greenest street in America.” The two-mile stretch of Blue Island Avenue and

Cermak Road in the Pilsen neighborhood sports rain gardens, permeable pavements and solar-powered street lights.

“There are a lot of great strategies and plans out there,” says Vincent Lee, a principal at Arup, an engineering and architecture firm. Last year, Arup released a study examining the “sponginess” – or ability to absorb rainfall – of several cities and making the case for cities to invest in nature-based solutions to prevent flooding. “But implementation is a major challenge due to lack of funding, outdated policies and codes and minimal cross-sector collaboration.”

Many advocates say schoolyards are ideal sites for greening projects because they represent an opportunity to educate students about climate resilience. Space to Grow, another Chicago organization, has overhauled 34 schoolyards over the last decade, replacing asphalt with permeable sports fields, rain gardens and other porous surfaces.

“Our schools are the center of the community, and we want to make sure kids are excited to be in those spaces,” said Meg Kelly, Space to Grow’s director.

According to the organization’s data, replacing asphalt with permeable sport fields, rain gardens and other porous surfaces has reduced ground temperatures by up to 54 F and captured more than 3.5 million gallons of stormwater, alleviating neighborhood flooding.

McGuire said she wants Depave Chicago to help neighbors avoid the next flood or find respite from the next heat wave, but she also wants to help Chicagoans envision a different future for their city.

“It’s about changing attitudes towards concrete,” she said. “We’ve been missing an opportunity to embrace nature in the city, and I’m just trying to get people to look at the world around them and dream of something different.”

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# A huge park outside of Mexico City serves as a climate-adaptation model

The park aims to restore the hydrological basin of the Valley of Mexico, provide greenspace for residents and combat climate change. Can it be an example for other projects?

PAUL BIASCO

Ensia

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*Editor's note: Paul Biasco first wrote about the Lake Texcoco Ecological Park for Ensia in early 2020. Here, the author revisits the park as it's set to open to provide an update on the progress.*

It's unusually dry in this former lake bed in the Valley of Mexico. It hasn't rained in weeks, and typically temperate Mexico City is in the midst of a heat wave. Residents are planning for a "day zero" situation, with water shortages impacting nearly every part of the city.

Iñaki Echeverria points toward the edges of the horizon where the plateau of the Valley of Mexico is surrounded by two volcanoes and mountains that create a barrier around the city based 7,350 feet (2,240 meters) above sea level.

"I remember as a child, snow almost up to the skirts [of the mountains] in normal times," says Echeverria, an architect and landscape designer who has been tapped to lead the formation of the Lake Texcoco Ecological Park, an ecological restoration project in the valley that could end up being the largest urban park in the world. "[The

lack of snow] is a very clear example of climate change, which is the context in which the project is being developed."

Today birds fill one of the lakes, bobbing on top of the blueish-green water and peering out through the brush. Scientists hope more than 150 species will inhabit the area once the park is complete.

The wetlands are a sliver of an oasis that had been drained in one form or another over hundreds of years, starting with the founding of Tenochtitlan, the once-capital of the Aztec Empire, in the middle of a swampy lake bed. The city grew as a series of islands, and Spanish conquistadores later drained most of the lake system. As of 2015, Lake Texcoco had lost more than 95% of its surface.

That same year, the lake was set to be drained completely as the site was chosen for a US\$13 billion airport. But when Andrés Manuel López Obrador became president in 2018, he canceled the airport despite the fact it was already one-third complete and appointed Echeverria to restore the ecosystem with the creation of the park spanning



Lake Texcoco (Mexico City) in 2013. Photo credit: Haakon S. Krohn



more than 14,000 hectares (34,500 acres). “This project is a project of social and environmental justice in favor of all the people of the valley of Mexico, particularly the most vulnerable in the context of global climate change,” Echeverria says. “And it allows us to aspire to a broader project of restoration of the entire hydrological basin. The project of the lake alone cannot restore all of this, but it is a key and central piece for a broader process.”

### **Example for the World**

Echeverria, who says he has been obsessed with the area for nearly three decades, isn’t seeking to restore it to the exact state it was before humans settled 700 years ago, but instead is implementing what he calls “soft infrastructure,” which lets nature act as builder with the right pieces in place. “We try to understand what things can be, what things are, what things were, and by playing with that, we start working from there,” he says. “It’s a more open system where uncertainty and change

in time are allowed.”

Instead of trying to construct the wetlands piece by piece, Echeverria’s revitalization experiment is repurposing parts left over from the airport construction, previous ecological ventures over the past 100 years and hydraulic projects that have sought to regulate water flowing into and out of the megacity for decades. Echeverria sees the park as part of a broader awakening of sorts around the world where people are “going against the current,” saying, “a consciousness is beginning to emerge that clearly something is going wrong and that we all have to start looking for alternatives.”

Kevin Grecksch, a director in water science, policy and management at the School of Geography and the Environment at the University of Oxford, sees the wetland restoration project as a global example that could fill a gap in urban ecological planning. “There’s a lot of writing of how adaptation should be done, but we don’t have enough literature of, ‘Is it actually successful?’” Grecksch





Architect Iñaki Echeverría has completed the first phases of the Lake Texcoco Ecological Park, using some of the infrastructure of the cancelled airport. Photo courtesy of Iñaki Echeverría

says. “We want to see the projects that have been adapted to see if they are actually working. For big cities, seeing such a project like this can be a very valuable sign to go ahead with these projects. ... It could send a strong signal to other big cities in the world.”

## Specifics of the Park

The park, located just northeast of Mexico City’s current international airport and less than 15 miles (24 kilometers) by car from the city’s historic center, is surrounded by roughly 4.5 million residents in some of the region’s more economically disadvantaged areas. The multifaceted design aims to achieve multiple goals.

A big one is to reintroduce the natural water and vegetation system of the valley, which the team behind the park hopes can spark other water restoration projects in the valley and metropolitan area. “It allows us to aspire to a broader project of restoration of the entire hydrological basin of the valley,” Echeverría said. “The project of the lake alone cannot restore all of this, but it is a key and central piece for a broader process. Above all, and this is the ethos of the project, an expression of health.”

Jose Alfredo Ramirez, an architect and co-director of Groundlab, a climate change-focused design lab, says he views the project as the first step to a bigger solution.

“Cities like Mexico City require these types of

projects and even more ambitious ones. If you know the story of Mexico City in terms of water management, it’s disastrous,” Ramirez says. “There needs to be a thinking away from controlling water and moving toward working with water. This project is one step in that direction, but it requires a lot more effort to make these things more ambitious.”

The second goal is to help regulate global temperatures by reducing the heat island that has formed because of draining bodies of water and paving over a vast region of the valley during the city’s expansion into a metro-

polis of more than 22 million people.

“Ironically, all this process caused the lake, which regulated the temperature and provided humidity to the environment, to [contribute to] the most terrible heat island in the whole valley,” Echeverría says.

The third is to provide green space and a connection to nature for residents surrounding the park. For the park’s opening, there is only one main entrance, but entrances to connect the neighborhoods adjacent to the sprawling park are planned in the near future, according to Echeverría.

Ramirez, who previously lived in the Valle de Aragón near the park, says that connecting to the neighboring communities will be vital for the park’s future. This will ensure that whatever happens politically, neighbors and the park’s primary users will strongly support it. “Before, there was nothing. No one was allowed to enter. It was just full of dust. ...It was a no-man’s-land,” he says.

“This project might have had a specific political spurt that allowed the project to happen, but the politics are always changing. You never know how much that support might shift in the future. You need something that makes the communities feel this project is part of their lives, something they can defend and maintain in the future. I think it needs to work more on how to incorporate the support and work of the communities that surround the area.”



The park includes a massive sports complex near its main entrance, bike and walking trails throughout, and a visitor center with a restaurant, museum and event hall. “I think the key, with climate change, and especially climate change adaptation, is you need to have these local or regional solutions,” Grecksch says. “The problem is a worldwide one, but we also know it differs depending on the geography. ... You create a wetland, so there’s water that should have a natural cooling effect. This is what we’re talking about when redesigning cities.”

The government expects the site to capture 1.5 million metric tons (1.7 million tons) of carbon emissions per year due to expanded green and wetland areas and to improve air quality by reducing exposure of bare soil, which causes dust storms and PM1 pollution in the region.

## How It Happened

Pulling off an environmental project of this size required the costly cancellation of the airport and major political “risks,” given that the environmental results and permanent impact would not be seen for years.

Echeverria’s advice to planners around the world on achieving success on projects of similar scale boils down to four points.

First, according to Echeverria, the construction and planning among scientists, politicians, engineers and designers have been based more on a strategy than a concrete plan. “The problem that we humans have is that we love recipes and recipes don’t exist,” he says. The plan would have been more complicated and would have had a greater chance of failure if the team wasn’t able to be flexible, he says. “I think it applies to all works of art. This is not a work of art, but it works in other areas as well.”

The second is that narrative matters. In some cases, creating the narrative for a project is more important than the specifics, especially when selling it to not only the public but also to decision-makers. “The narrative is critical,” Echeverria says. “You have to have the capacity to transmit

the possibility of other worlds, to invent a universe. ... This capacity to create worlds to imagine and give an image to these worlds so that others can get excited and generate interest and become part of this — I think it’s one of the most important things you can do in a project, especially in this nature.”

The third point is to have an ambitious and clear leader — not always easy with projects of this scale. “It needs someone who has vision and enthusiasm and the dedication to enthuse others, and the delivery to excite others,” Echeverria says. “More than 11,000 people have participated in this project. You need someone to create that narrative, to build it, to make others excited, so that they can make it happen. That’s the job of that leader.”

The fourth point is political leadership, which wasn’t lacking in this case. The president’s decision to cancel the airport ignited the restoration project. Echeverria points to Chinese landscape architect and urbanist Kongjian Yu, whose book *Letters to the Leaders of China: Kongjian Yu and the Future of the Chinese City* sparked a national movement to take climate change solutions seriously at local planning levels. “Something like [Lake Texcoco Ecological Park] — due to the investment it requires — requires an important political leadership,” he says. “That’s very clear. For example, Kongjian Yu in China, what he has been able to do is because he knew how to talk to politicians.”

According to Echeverria, the most difficult part of the yearslong process has been getting multiple agencies and types of experts to work together and agree on concepts involving scientists, engineers, designers and politicians.

At the end of the day, though, Echeverria says it has all been worth it.

“I hope it shocks people,” he says. “The size. The scope.”

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# LAST STAND

Photo credit: AbandonedPorn (Reddit)

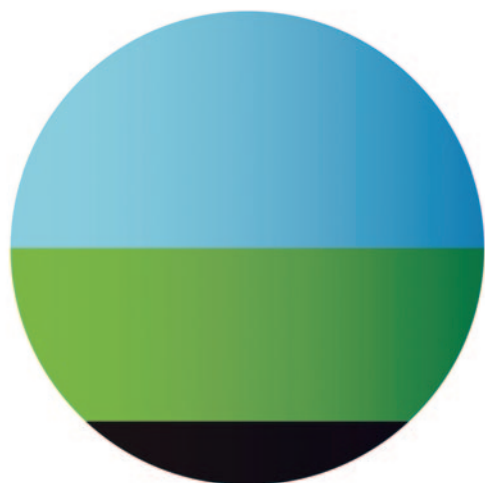


The remains are still there in Hinckley, Utah. The Delta Solar R&D Project started as a technological avant-garde experiment and became a scheme fraud. In 2018, the company that produced those "futuristic" plastic lenses was fined 50 million dollars, the company's revenue despite zero results.

The image of abandoned poles and lenses has become a sort of monument to the environmental damage that even clean energy sources could create if related to badly conceived projects. **ONE**



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