# ONE
Only Natural Energy


## A star in a galaxy of young climate activists


Lost in transition

A cold reminder

Green ammonia, what else?

Cagliari waterfront silo

YEAR VII - NUMBER 2 - APRIL-JUNE 2021


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Only Natural Energy

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A green Eiffel Tower to celebrate COP 21, Paris (France).
Photo credit: Yann Caradec

# Lost in transition

GIANNI SERRA
ONE

Green new deal, just transition fund, circular economy, carbon free, biofuels, eco-friendly, fair trade, organic, recycling, renewable, resilience, sustainability, zero-whatever (from emission to waste).

The lexicon of the environmental-consciousness keeps growing. And for a tangible reason. The commercial fate of a specific product or technology or industry is increasingly related to the feeling words can generate. Pick and associate the most evocative concept or colour, and you can turn opposition into support without changing anything substantial about your business or policy.

But people are getting tired of this blatant travesty. Two years ago in France, four environmental groups launched a lawsuit against the government for its failure to fulfil self-imposed obligations to reduce greenhouse gas emissions, despite all the good words carefully picked to emphasise their commitment to tackling the climate issue.

In February, a Paris administrative court sanctioned the government to pay a symbolic amount - only one euro each - to the four groups and to take action within two months. The ruling was clear - no more empty words. Just. True. Facts. S'il vous plait. ONE

# A cold reminder

## The deep freeze dealt a heavy blow to an industry accustomed to more mild winters

TOBY LOCKWOOD
ONE

As February's bout of extreme cold weather left millions of Texans without power for days, it seemed all the more jarring in a state famed for its abundance of energy resources. Once synonymous with oil, Texas now leads the country's booms in both shale gas and wind power, so few can have anticipated privation on this scale. But the deep freeze dealt a heavy blow to an industry accustomed to more mild winters, causing dozens of the state's power generators to disconnect just as demand for electricity soared. In the aftermath of the crisis, the search for answers has lent an unusual amount of media attention to the intricacies of power market design.

Texas is unique in the US for adopting a system in which price signals from the wholesale energy market alone are expected to drive investment in new power generation capacity; periods of scarcity are allowed to drive prices very high and, in theory, secure a decent profit for generators. This is in contrast to the use of capacity markets in many other parts of the country, where wholesale prices are more controlled and generators are paid for being able to guarantee capacity in advance. On top of this, in order to avoid federal regulation, Texas has opted to remain relatively isolated from the rest of the US grid, so has much less ability to draw on power from the surrounding region in times of need. Many have been quick to lay the blame for the blackouts on this – perhaps characteristically Texan – independent and free-market approach to electricity supply.

Usually, Texans are more concerned about power shortages during hot summers, when demand for air conditioning is at its highest. Summer 2019 saw the state fly particularly close to the wind, with reserve margins falling below 9% and some energy shortages experienced in August. Since then, the summer reserve margin has climbed to much safer levels, but largely due to huge additions of wind and (to a lesser extent) solar power. Determining the extent to which these intermittent sources can provide reliable generation is obviously challenging – both summer heat waves and winter cold snaps can


Ice and snow Feb. 15, 2021 in Odessa, Texas (USA).
Photo credit: Jacob Ford/Odessa American

be associated with little wind and, in the case of winter, very little sun. Texas has increasingly relied on natural gas for more dependable capacity, reaching over 45% of generation in 2020, while coal has fallen to 18% and wind climbed to 23%. But investment in new gas capacity is thought to have been inadequate in recent years, even as demand in the state has grown.

Nevertheless, the state should have had enough conventional power plants on the grid to deal with demand during the cold snap. Worst-case scenario forecasting by the grid operator 'ERCOT' naturally assumes minimal contribution from wind. However, around 30 GW of generators – mainly gas, but also wind, coal, and nuclear – went offline due to a combination of cold-induced technical failures at plants (such as freezing pipes or instrumentation) and a shortage of gas supply.

There was also a sizeable portion of plants undergoing scheduled maintenance over what is normally expected to be a quiet period. This dramatic loss of available generators left the operator with no option but to drop consumers from the grid.
The issue of gas shortages in cold weather has become a hot topic in the US over the last decade, particularly following another famous 'polar vortex' cold snap in 2014, which mostly affected north-eastern states. Unlike summer demand peaks, cold weather brings high demand for gas for both power and heating and, when combined with freeze-ups at production wells and pipelines, can lead to astronomical gas prices and supply shortages for generators. Following the 2014 event, several north-eastern grids beefed up their existing capacity markets by requiring generators to prove their resilience to cold weather through steps such as securing alternative fuel supplies or long-term gas contracts.

Texas may not have a capacity market, but state regulators have made some efforts to improve mandatory winter-proofing of power plants and gas infrastructure following a near-miss cold-weather event in 2011. Much of the fall-out around the February blackouts has centred on why more regulation was not imposed, or why industry has resisted it.

Northern regions prove that it is perfectly possible to make this infrastructure more resilient to extreme weather, but it will come at a cost, and perhaps one that is harder for generators to justify in an ERCOT-style market. After all, scarcity events represent a vital pay day for generators in Texas (pro-


Woodlands, north of Houston (USA).
Photo credit: Brett Coomer/Houston Chronicle

vided they remain online), so the market arguably tends towards such close calls.

Inevitably, backers of various energy sources have been quick to use the crisis to highlight the weakness of competitors – wind turbines can freeze, gas is vulnerable to shortages, even coal and nuclear were affected.

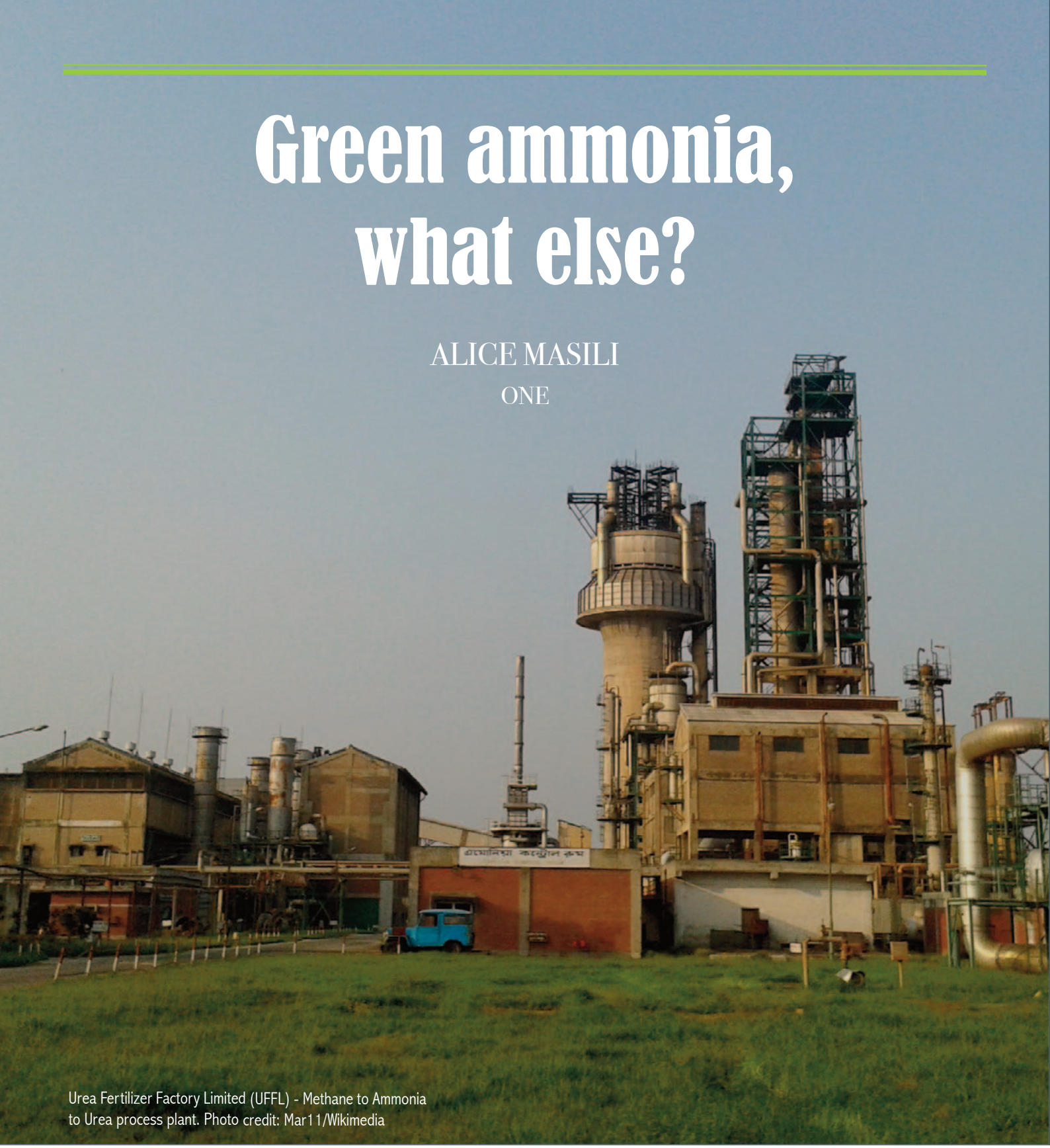
However, there is more to take from this than a simple acceptance of the fallibility of all types of energy. Thermal plant can clearly be vulnerable to cold, but adequate regulation and technical measures offer a ready solution. On the other hand, there is no question of relying on wind and solar to ride out such a storm. The grid still needs to ensure that there is always sufficient 'firm' capacity to meet almost all the peak demand if necessary and this is highly challenging – particularly without recourse to a capacity market.

Advocates for both renewables and the 'energy-only' market model often point to greater use of smarter energy grids with more opportunity for demand response, in which users can offer to reduce consumption for a fee. While this must surely form part of the future of electricity, it may have more limited use during winter shortages, when reducing consumption has more serious implications than simply turning down the air con. The other rapidly emerging option is the development of large-scale energy storage technologies, but again, the Texas event represents a formidable task for this approach. Delivering several days of unusually high demand would require an enormous quantity of stored energy – potentially in a long-term form such as hydrogen – as well as enough excess generation beforehand to build up supplies.

So, the Texas crisis is perhaps a warning that we are a long way from being able to entirely dispense with conventional power plants. It has also raised some fundamental questions over how much risk we are willing to accept with our electricity supply, how much we are willing to pay to minimise that risk, and whether we trust existing markets to deliver the best compromise. On paper, the 'one day of blackout in ten years' level of assurance used by many grid operators sounds manageable, but a serious system failure in the depths of a cold winter may have consequences which society deems unacceptable at any price. As power grids undergo a rapid evolution to more dynamic, less predictable systems with much more weather-dependent generation, these questions will only become harder to address. ONE

# Green ammonia, what else?

ALICE MASILI
ONE



Urea Fertilizer Factory Limited (UFFL) - Methane to Ammonia to Urea process plant. Photo credit: Mar11/Wikimedia

Everyone looks to green hydrogen as the new frontier of fuels. But its storage and long-distance transport are still open challenges. Ammonia is an emerging alternative as an indirect storage medium for hydrogen.

So-called "green ammonia" provides a path to decarbonize various applications that still depend on fossil fuels. Ambitious zero-carbon energy targets rely heavily on renewables. But to ensure energy security from these intermittent sources, it is necessary to resort to energy carriers, with "green" hydrogen", synthesized using renewable energy sources, usually the first to be considered.

Green hydrogen, made from water electrolysis using renewable energy, is the ideal candidate for clean energy generation. But there are several hurdles to overcome. Two of the main challenges are related to storage and transport. The lack of adequate infrastructure for the effective transportation of hydrogen requi-

res expensive dedicated networks.

Large-scale storage of the gas, so necessary for the progression towards a hydrogen economy, also has severe limitations — the need for specially insulated cryogenic tanks and refrigeration units greatly increases weight and cost. The chemical conversion of hydrogen into another energy carrier can provide a solution.

Ammonia has a high hydrogen content and does not contain carbon. Obtained by the reaction of atmospheric nitrogen with hydrogen, it can be easily stored as a liquid at moderate pressures (10-15 bar) or refrigerated at -33°C. It can be conveyed around the world through the existing distribution network of pipelines, tankers and ships.

Furthermore, it could offer numerous other advantages, even as a zero-carbon fuel, because it can burn in vehicle engines or in power plants to generate electricity. When ammonia is produced from green hydrogen – making it "green ammonia" - these benefits have a significant impact.

However, ammonia has its limitations too. It is a toxic gas that produces nitrogen oxides. When burned at high temperatures, ammonia produces nitrogen dioxide, contributing to air pollution which causes acid rain and can damage respiratory systems.

Combustion also produces small amounts of nitrous oxide, a more harmful greenhouse gas than carbon dioxide and methane. It is therefore preferable to use fuel cells rather than an internal combustion engine; a fuel cell converts chemical energy into electrical energy without burning fuel, thus preventing the release of dangerous gases or particles into the air.

Different types of fuel cells have been studied, and their performance varies according to specific applications. Solid oxide fuel cells (SOFC) are considered the most efficient power generation method. This type of fuel cell shows high energy conversion efficiency and a high degree of fuel flexibility.

A 2-megawatt system, fueled with ammonia, is installed on the Viking Energy supply ship in Norway and will be tested in 2024. There are several challenges to address before the technology can be fully exploited, such as increasing power density and reducing costs.

Several projects for the production of electricity from green ammonia are underway. Some are on a pilot scale. The EU HiPowAR (Highly Efficient Power Production By Green Ammonia Total Oxidation In A Membrane Reactor) project is testing an innovative technology for direct energy conversion of renewable ammonia fuel into electricity through a membrane reactor.
Compared to combustion engines and steam power plants, the new membrane reactor should provide greater energy conversion efficiency. It should also enable a breakthrough in the direct conversion of ammonia as an easily storable, carbon-free hydrogen carrier into usable energy.

Leading fertilizer companies are also actively involved. Fertiberia and Iberdrola have announced their intention to produce green ammonia for emission-free fertilizers. Spain could become one of the most important producers and exporters of green ammonia in Europe.

The initial investment of 150 million euros involves constructing a 100 MW photovoltaic solar field, a lithium-ion battery system with a storage capacity of 20 MWh, and an electrolyzer capable of producing about 360 kg/hour of hydrogen (20 MWel in). The green hydrogen produced will be used in the Puertollano Fertiberia ammonia plant to produce green fertilizers.

The latest fertilizer company to announce a massive green ammonia project is the Norwegian Yara International. To electrify and decarbonize its ammonia plant in Porsgrunn, they will replace the hydrogen from hydrocarbons with water electrolysis powered by renewable energy.

In partnership with Statkraft and Aker Horizons, Yara aims to produce emission-free fuel for shipping, carbon-free fertilizers and ammonia for industrial applications.

It plans to install electrolyzer capacity for 20,000 tons of ammonia per year by 2023. The company also has two other exciting pilot projects in store: one in Pilbara, Australia, with 3,500 tons of ammonia capacity from solar energy; another in Sluiskil, the Netherlands, with 70,000 tons of green ammonia capacity from wind energy.

The futuristic city of Neom in Saudi Arabia will host the largest and most ambitious project. Developed by a joint venture between Neom Town Hall, the Saudi company ACWA Power and the US Company Air Products, the facility will produce 1.2 million tons of green ammonia per year.

Green ammonia is not only a valid alternative to hydrogen as a carbon-free fuel. It can also help hydrogen's cause. With the correct subsidies, there is a real potential to develop a renewable energy export market to kick-start the hydrogen economy. ONE

# How waste CO2 is helping to turn renewable energy into liquid fuel

**Coordination between industry players could ensure waste products or byproducts from one process – such as CO2 – can be used as a raw material for another.**

REX MERRIFIELD
Horizon magazine

Storing power generated by strong winds or bright sunshine by turning it into liquid fuel such as methanol can help to ensure green energy does not go to waste, without having to rely on batteries. Methanol can be made from CO2 captured from industrial sources, combined with hydrogen split out of water using surplus renewable energy. And the resulting fuel can be used in cars or ships, reducing the use of fossil fuels as well as emissions of greenhouse gases.

'We are … transforming renewable energy into a liquid fuel that can be used in standard internal combustion engines,' said David Cuesta, of the Spanish energy consultancy i-deals.

'In the end you are taking a standard vehicle, and somehow, you are "electrifying" it,' he added.

Cuesta coordinated the MefCO2 project, which showed how industry can play a role in conserving renewable energy as it is produced and help to absorb some of the fluctuations inherent in sustainable energy production.

The project used carbon capture technology at a coal-fired power plant in Germany to demonstrate the process, storing some of the emissions as methanol. Reproducing the process at scale could also help to reduce EU imports of methanol, which is easily stored and transported but currently produced from fossil raw materials. In addition to its use as fuel, methanol is a feedstock with widespread use in the chemical industry.

## Electrifying

Hydrogen made from renewables has long been recognised as a clean fuel, but taking the extra step to make methanol provides a higher energy density product, without the technical demands of high-pressure storage and transport, or the need to provide new infrastructure for use by retail consumers. One hurdle to using renewable energy to split off the hydrogen from oxygen in water was the demand by some electrolysis systems for constant supplies of power. But using innovations such as polymer electrolyte membrane (PEM) technology allows flexibility in adjusting to natural fluctuations in conditions.

MefCO2 also paved the way for renewables to be harnessed by other carbon-emitting industries, such as steelmaking, where i-deals is coordinating the FReSMe project to produce methanol as a fuel for ocean-going ferries. Large-scale battery-powered engines may not be viable for such ships, but methanol may be accommodated readily.

## Renewable

By meeting various standards, such as CO2 footprint reduction, methanol can be considered a renewable fuel, which can command a premium from businesses working to reduce their carbon emissions. That additional income for the producer can cover the cost of the infrastructure and provide an additional economic incentive.

'We're helping certain industries to decarbonise and they can even make a profit out of this, so that decarbonisation is not as much of a burden,' Cuesta said.

Coordination between industry players to provide raw materials for renewable energy, as well as careful management of production and storage, can help to smooth out fluctuations in supply and demand for green power, stabilising the grid as well as making carbon capture and use more economically viable.

That kind of coordination is an essential element of industrial symbiosis – where different industries share resources, data, and materials to make the whole ecosystem more sustaina-

Coal-fired Power Plant Eon, Port of Rotterdam (The Netherlands).
Photo credit: Frans Berkelaar/Wikimedia

ble. Working in this way could help industry play a greater role in renewable energy production and use. Such coordination could ensure waste products or byproducts from one process – such as CO2 – can be used as a raw material for another, such as in the MefCO2 project.

'If I am a company and I am acting alone, I tend to satisfy what I think is … best (for me),' said Andrea Ballarino, of Italy's Institute of Intelligent Industrial Technologies and Systems for Advanced Manufacturing (Stiima-Cnr).

'But if I can combine my action with the action of other companies, I can achieve symbiosis and I can achieve a global optimum – as well as my (own) optimum,' he added.

**Collaborate**

Ballarino coordinated the Symbioptima project, which showed that one company could tailor a byproduct to meet the needs of another user, turning it into extra income as well as lowering costs for the buyer who could avoid purchasing some primary raw material.

Embracing that approach brings industry together to play a pivotal role in reducing waste of all kinds. Symbioptima also focused on making savings in energy use at the level of individual factories, while smoothing out collective demand for power from the grid, including renewables, and being able to plan ahead more accurately.

Symbioptima used close monitoring of industrial processes and cooperation between companies to demonstrate they could make energy cost-savings of the order of 10%-15%.

By building up and adjusting a detailed profile of the energy demand in one factory, software tools were able to both govern its production in an energy-aware way and calculate its expected power purchases.

Those could then be aggregated with the profile of another factory, and a software system that preserved their anonymity would mesh their purchases together, matching peak demand from one with an energy dip from the other.

By staggering the industrial processes, the software ensured factories were not having to pay peak prices by demanding maximum power at the same time. The result was to cut costs for both factories as well as help the grid manager to balance demand, and to plan for what backup power may be needed to support renewable inputs.

**Attractive**

In addition to energy planning, industries could tune the characteristics of their byproducts and time their availability to make them more attractive to other industrial users. 'At the end of the day and at the end of the month, it provides an economic advantage – money in the pocket,' Ballarino said.

One of the Symbioptima aims was to uncover economic opportunities in value chains of companies and even industries that may not have obvious links – and where the players are clearly not competitors. Those included a four-way collaboration between a foundry, a cement factory, a paper mill and a brickmaker.

The Symby-Net software developed during the project showed how slag and waste sand from a foundry could be used by a cement factory and a brick factory. And the brick factory could also reuse sludge left over from paper manufacturing, reducing its need for raw clay.

Ballarino pointed out that the incentives to cooperate range from financial benefits to ensuring the long-term security of scarce resources or compliance with regulations, such as those encouraging environmental sustainability or renewable energy production.

'We have a number of companies for which resources are scarce, energy efficiency is a problem, (and) sustainability is a must,' Ballarino said.
'And the only way to achieve all these goals is to collaborate, so we need the tools to collaborate,' he added.

*Originally published by Horizon Magazine September 20, 2020*


# We need to radically reimagine the way we travel and commute

**It's eminently possible to want a carbon-neutral, quiet, clean-air future but still have questions that haven't yet been answered.**

DAVIDE SETTE
Diem25.org

Let's start with a fact: electric vehicles (EVs) are better for the environment than internal combustion engine (ICE) vehicles. We should focus on promoting electric vehicles and not waste time trying to delay the inevitable. However, this is a difficult goal, especially when there's a lot of false and misleading information being pushed out, whether by Toyota's president or fake PR firms.

The oil and (some) automotive industries' increasingly crude attempts to spread misinformation about electric vehicles is a bid to protect a business model increasingly recognized each day as harmful to the planet and to each and every one of us. Even recently, Aston Martin has found itself at the centre of a storm for not coming clean over its role in authoring a widely-debunked study that claimed electric vehicles are a more polluting option than ICE vehicles.

## Let's talk inequality

So all good? Well, it's eminently possible to want a carbon-neutral, quiet, clean-air future but still have questions that haven't yet been answered.

How do we avoid giving low-income drivers — reliant on landlords or councils to provide domestic charging — the choice of sticking in an old internal combustion engine car or being forced to use expensive rapid chargers if they get an EV? Will the fuel of a tenant parking on the street with no choice of energy provider cost more than that of a senior manager who can plug into their solar-panelled house each night? In embracing a zero-emissions future, we need to make sure that nobody is treated unfairly or gets left behind.

The development in battery prices is rapidly creating the conditions that could give electric vehicles a significantly lower total cost of ownership. This means that at least one conviction of policy makers needs to be reexamined: the idea that more stringent fuel efficiency norms will determine the speed of electric vehicles adoption.

However, charging infrastructure needs to be available for potential owners that cannot charge the car on their own driveway and fast chargers need to become abundant and cheap.

How does battery production impact human rights? In considering the net impact of a transition from fossil fuels to electric vehicles, however, it is important to note that fossil fuel exploration and extraction has been associated with some of the most severe problems of human rights abuse, conflict and corruption in the world.

American electric bus manufacturer Proterra's high-power charging solutions.
Photo credit: Proterra

The average scores on the Resource Governance Index for oil-producing countries (47 out of 100) and mineral-producing countries (48 out of 100) are virtually identical, signaling that mis-governance remains a challenge in both sectors.

A recent Organization for Economic Co-operation and Development (OECD) survey of officials from state-owned enterprises identified mining as the industry with the second-highest incidence of corruption, with 50 percent of respondents saying they had observed corrupt acts. The sector with the highest incidence of corruption was oil and gas, at 63 percent.

The urgency in getting a lithium supply has unleashed a mining boom, and the race for "white oil" threatens to cause damage to the natural environment wherever it is found. But because they are helping to drive down emissions, the mining companies have EU environmental policy on their side.

Everyone having an electric vehicle means an enormous amount of mining, refining and all the polluting activities that come with it. In the so-called Lithium Triangle of South America vast quantities of water are pumped from underground sources to help extract lithium from ores, and this has been linked to the lowering of groundwater levels and the spread of deserts.

Similarly in Tibet, a toxic chemical leak from the Ganzizhou Rongda Lithium mine poisoned the local Lichu river in 2016 and triggered widespread protests in the region. Europe will need to scale up its battery recycling capacity: even in a scenario projecting only moderate uptake of electric vehicles by 2030, the current Li-ion recycling capacity will not be able to cope with projected demand from exhausted electric vehicle batteries.

In the case of cobalt (also used for cleaning fossil fuel), 60% of the world's supply comes from the Democratic Republic of the Congo where large numbers of unregulated mines use children as young as seven as miners.

There they breathe in cobalt-laden dust that can cause fatal lung ailments while working tunnels that are liable to collapse. However, electric vehicle manufacturers are transitioning away from cobalt: Tesla's current vehicle batteries contain less than three per-

A Smart ED.
Photo credit: David Villarreal Fernández

cent cobalt and the company has announced that their next generation of batteries will be cobalt-free.

The negative human and environmental consequences of cobalt mining are indeed real and well-documented. However, a serious solution to the exploitation of mine workers involves a comprehensive national trade policy and an economy-wide effort to curtail the use of cobalt.

## Debunking myths

We should face these challenges in order to make mining more environmentally sustainable. Existing problems should not serve as excuses for pearl clutching and renewables bashing before taking a ride back in a far worse fossil fueled car.

Misleading reports about electric vehicles generally rest on six faulty assumptions: Overestimating battery manufacturing; Underestimating battery lifetime; Assuming an unchanged electricity mix over the lifetime of the BEV; Using unrealistic tests for energy use; Excluding fuel production emissions; Lack of system thinking.

Professional debunkers have already explained the flaws of these 'studies' and that proper calculations show electric vehicles already emit less than half the greenhouse gasses of their fossil fueled counterparts. If we speculate about a future in which production and driving are done on renewable energy this results in at least ten times less emissions than what is achievable with combustion engines using fossil fuels.

A study recently published in Nature found that current models of electric vehicles have lower life-cycle emission intensities than current new petrol cars in 53 of 59 world regions, accounting for 95% of the global road transport demand. Relative differences range from electric vehicles being around 70% less emission intensive per vehicle-kilometre in Iceland, Switzerland and Sweden, to being 40% more emission intensive in oil-shale-dependent Estonia.

In 2030, under the current technological trajectory and the end-use without power policies scenario, the resulting average emission intensities of EVs do not exceed those of fossil-fuel based alternatives in any of the ten countries with the highest transport and heating demands, even without additional decarbonization policies in the power sector. This implies that in the medium term, in almost all cases, the more effective policy strategy for reducing transport emissions is to push electric vehicles instead of supporting the uptake of more efficient fossil-fuel based technologies.

## Laws are too timid: the case of Italy

Despite these evidences, the Italian Parliament gave the green light to a package of incentives which is targeting so-called "Euro 6" thermally efficient vehicles, as

electric and hybrid cars still have little foothold in Italy. The incentives, strongly pushed by car dealers in order to empty their forecourts of unsold vehicles, encourage the purchase of Euro 6 cars that emit up to 110 grams of CO2 per km (the EU target of 95g/km entered into force in 2020 and European car manufacturers must comply with it or face high fines).

In 2019 the FCA group, which owns Fiat, had to resort to forming a pool with Tesla — costing it €1.8 billion — in order to avoid more substantial fines for not producing and selling zero and low-emission cars. On the eve of the launch of the Fiat500e, FCA's first fully-electric mode, the Italian government should have allocated funds to new technologies only. A smart, forward-looking industrial strategy would ensure that the state loan guarantee for FCA comes with green strings attached and that the scrapping mechanism would be for zero-emission cars only.

## A silver bullet?

The electrification of private transport is not a silver bullet — local and national policies need to reduce car ownership and use, and promote active travel and shared mobility. But electric vehicles could certainly replace conventional cars and largely eliminate GHG emissions in the process. To support the transition towards electrified transport we should create institutions that will coordinate the various works and redistribute the benefits from the Global North and the Global South.

As Yanis Varoufakis pointed out, a credible International Green New Deal should use transnational bond instruments and revenue-neutral carbon taxes — so that the money raised from taxing diesel can be returned to the poorest of citizens relying on diesel cars, in order to strengthen them generally and also allow them to buy an electric car.

The efficiency of a hybrid vehicle could theoretically become almost 50% higher than in today's cars, but that would require a range of breakthroughs that are currently not on the horizon (we're talking about plug-in hybrid, not "self charging hybrid", which Michael Liebreich brilliantly described as "fossil-fueled car being marketed to people without knowledge by people without ethics").

Furthermore, the consumer interest in large SUVs with powerful motors outstrips the modest advances in efficiency, and if we take road testing as our benchmark there has been basically no improvement of CO2 emissions per kilometre in the last 20 years. If we aim for a world with billions of SUVs, we will still ruin our natural habitat and make living on this planet much harder.

## Green New Deal for transport

There is no time left for new polluting vehicles to be rolling out of our factories. Our Green New Deal for Europe must amend the Vehicle Emissions Regulation to introduce a new 'Euro 7' standard that is consistent with zero-exhaust pipe emissions on all passenger vehicles. This will require that all new vehicles are fully electric, or powered by any other green technology. Buses or light vans should be included.

All heavier goods vehicles must also be zero emissions, subject to specific exemptions made by the Commission on a temporary basis, to the extent enabled by technology. In addition, the Emission Performance Regulation should be changed to require that all vehicles that are manufactured have zero exhaust-pipe emissions, or that from 25 December 2021 no dividends or director compensation may be paid. Emission Performance Regulation (EC) 443/2009 contains the present rules. For each month of infringement, fines amounting to 10 percent of annual turnover shall be paid.

Beyond that, car ownership remains a luxury that not every member of society can afford. Without robust, inexpensive public transport networks and a continued focus on private car ownership, our transport systems will continue to allow exclusion of certain segments of the population.

Another solution is to invest in fleets of clean, shared vehicles forming part of connected transport systems that minimise environmental degradation while maximising access and opportunity, which the Green New Deal for Europe points out. These can take the form of electric taxis operating on a car-pooling model, providing door-to-door services to all passengers at low cost. But one thing is certain: we need to radically reimagine the way we travel and commute.

*Originally published by Diem25.org January 14, 2021*

# Greta-a star in a galaxy of young climate activists

**Sweden honored their young citizen by depicting her on a postage stamp. Fortunately, Greta is not alone in her endeavors. Millions of young people are striking, marching, and organizing. Since the world's young people are going to be affected by climate change their entire lives, it is certainly appropriate and reasonable for them to become activists.**

LENORE HITCHLER

ONE

In 2019 the world was awed when Greta Thunberg emerged as a global activist against climate change. She was named "Time Person of the Year for 2019" and was the youngest to be honored in this way. Sweden honored their young citizen by depicting her on a postage stamp. Fortunately, Greta is not alone in her endeavors. Millions of young people are striking, marching, and organizing. Since the world's young people are going to be affected by climate change their entire lives, it is certainly appropriate and reasonable for them to become activists.

The following global statistics from the office of the United Nations (UN) Secretary-General's Envoy on Youth reflect the relationship between young people and climate change. Approximately 73% of surveyed youth report they currently feel the effects of climate change. Moreover, a mere 9% of those surveyed are very confident the world will act quickly enough to address climate change. 89% of youth respondents say young people can make a difference to climate change. In many countries people under thirty constitute a large proportion of the population. Nearly half a million youth worldwide have participated in various projects in their homes, schools and communities which were funded by Small Grants Programs.

Youth and children worldwide are particularly vulnerable to climate change. Climate change represents a major threat to their health and socio-economic stability, particularly in developing countries, where 80% of young people live. Plan International is an organization that focuses on children's rights. They state that "Climate change is

Greta Thunberg urges MEPs to show climate leadership (March 2020).
Photo credit: European Parliament

recognised as the greatest threat to global health in the 21st century and can increase vector and water borne diseases, malnutrition, mental illnesses, respiratory diseases and injuries."

A variety of statistics reveals the sizable scope of the ways in which climate change harms the young. According to the World Health Organization, children under the age of five suffer more than 80% of illnesses and mortality resulting from climate change.

The 2019 *Lancet* Countdown Study on Health and Climate Change reported "A child born today will experience a world that is more than four degrees warmer than the pre-industrial average." To put this into perspective, the Little Ice Age from 1305-1850 saw worldwide temperatures drop by approximately two degrees centigrade. This resulted in crop failures, famines, and massive social disruption. Witchcraft trials, the Plague, and increased warfare have also been linked to the Little Ice Age. Besides disrupting social relations and damaging health in general, natural disasters particularly affect the young in many ways. A report produced by Save the Children UK states that 50% of those killed by natural disasters are children. The Society for Research in Child Development published an article titled "Understanding the Impacts of Natural Disasters on Children." The authors state that approximately 85% of billion-dollar disasters from 1980 to 2019 were linked to climate change and globally affected 175 million children. Some consequences for children include somatic symptoms such as headaches and nausea. Physical and mental health also deteriorates. Trauma can also alter brain anatomy and function which can lead to learning and memory difficulties. Fifty percent of children experience post-traumatic stress symptoms after natural disasters.

Girls are particularly vulnerable to natural disasters. The organization Plan International is especially concerned with conditions affecting girls. They report that "Evidence shows that adolescent girls face further protection issues after disasters and when migrating as they are particularly susceptible to violence and exploitation—including rape, sexual and gender-based violence and abuse, and trafficking. These protection issues are particularly heightened


when collecting natural resources" [such as water and firewood.]

Despite all the reasons that justify youth activism in climate change, these young people face many criticisms. Critics state that they are manipulated by adults and claim they haven't accomplished very much. Their adversaries also maintain that students use climate strikes as an opportunity to skip school. They also call activist's fears hysterical, and charge that their demands are too extreme.

These young crusaders face many additional obstacles. They do not control any branches of government, do not enact laws nor do they enforce them. They do not control businesses or large financial institutions, bureaucracies, or major news outlets. In other words, they have no official power. They also have to contend with patronizing attitudes, stereotypes of being immature and irresponsible, invalidation, mockery, and even hatred. They also face a lack of trust in their ability, systemic silencing, and they lack funding and other resources.

In spite of these many liabilities, younger climate change activists have many assets to bring to the movement, including their high population numbers. The Statista Research Department reports that 26% of the global population is under fifteen. According to the UN, in 2019 youth worldwide numbered 1.2 billion persons between the ages of 15-24, or around 1 in every 6 persons. Young people are thus an outstanding and logical group to mobilize against climate change. Furthermore, most are already convinced that it is an important issue. A Gallup poll in 2018 found that 70% of those aged 18 to 34 report worrying about global warming compared to only 56% of those aged 55 or older. A 2019 Washington Post-Kaiser survey found that four out of five youth aged 13 to 17 called climate change a crisis or a major problem. Forty percent of high school students state that they have taken steps to reduce their carbon footprint, and one in four said they had participated in direct action.

Youthful activists frequently display incredible creativity. For example, the organization "Do Something" creates new methods to reach people. They suggest putting book markers into books showing how climate change affects those book's settings. Another suggestion is to put pro-environmental scriptures in books at places of worship.

Many young climate activists work with other social causes, especially the Black Lives Matter movement. The organization "One Million Of Us" was started to promote voting and to unite youth social movements. Their goals are to fighting gun violence, immigration reform, both gender and racial equality, and climate change. Greta Thunberg is concerned with climate justice and stated that "There can be no social justice without climate justice. And there can be no climate justice unless we acknowledge the fact that we have dumped large parts of our emissions overseas, exploiting heap labour and poor working conditions as well as weaker environmental regulations."


San Francisco Youth Climate Strike (California, USA).
Photo credit: Intothewoods7

One advantage for youthful climate activists is that they possess moral authority. UN Secretary General Antonio Guterres has endorsed school strikes, saying: "My generation has failed to respond properly to the dramatic challenge of climate change. This is deeply felt by young people. No wonder they are angry."

Youth activists are working with influential allies including the Dalai Lama. They are engaged worldwide in lawsuits in various court cases against several governments maintaining that they are not adequately fighting climate change. Large numbers of youth worldwide have taken a stand against climate change.

The March 15, 2019 strike took place in 125 countries and involved an estimated 1.6 million kids. On May 24, 2019, activists took part in more than 1,600 cities in 150 countries during the Global Climate Strike. The organization 350 reported that 7.6 million took part in climate strike actions the week of September 20-27, 2019.

There are many national youth organizations in the United States working against climate change. These organizations stress solidarity with all groups that have faced discrimination, especially those facing disproportionate damage from climate change. The Sunrise Movement works against climate change and promotes the Green New Deal.

Zero Hour is a climate justice organization especially concerned with how marginalized peoples, such as the indigenous, African American, Latinx, and LGBT (lesbian, gay, bisexual, and transgender) groups face more challenges from climate change than white middle-class America. There are local organizations concerned with climate justice found throughout the US.

Uplift is located in the region of the Colorado Plateau and the Southwest, and Treeage works in New York City. Defend Our Future was started by the Environmental Defense Fund and works for climate change and clean energy solutions. It is a good sign for the future of the environment that there are way too many organizations to include them all.

Besides organizations specifically devoted to climate change, many traditional organizations now include climate change in their work. In various states, girl scouts can earn climate change patches. 4H clubs also work against climate change. There are many youth organizations found throughout the rest of the world.

Earth Uprising is a youth organization committed to global action on climate change and one of their principles is that equity is the core of all climate change solutions. Climate Cardinals are found in over 40 countries. Some examples from developed countries are Youth 4 Climate, 350, and CliMates.

One Up Action emphasizes climate justice with a focus on gender, racial, and class inequalities. The International Youth Climate Movement is a network of youth organizations.

Generation Climate Europe is a coalition representing over 460 organizations and represents over 20 million young Europeans. Youth and Environment Europe unites 52 member organizations from 30 countries. The Australian Youth Climate Coalition represents over 200,000. Generation Zero is a youth-led climate action organization in New Zealand.

There are many organizations throughout the developing world dedicated to fighting climate change. Africa is served by the African Youth Initiative on Climate Change. The Sudan Youth Organization on Climate Change and Youth and Environment is just one of many youth climate organizations in Africa. There are also youth organizations in the Caribbean, Central and South America, and Asia.

Several books on fighting climate change were written by young activists. Xiuhtezcatl Martinez's book *We Rise—The Earth Guardians Guide to Building a Movement That Restores the Planet* was published when he was only seventeen. He organizes against climate change and is one of the leaders of Earth Guardians. It is an organization that strives to create a better world, including dealing with environmental problems such as climate change. Martinez suggested various methods of communicating about climate change, such as art and especially music.

His touched on many topics including pipelines, tar sands, fracking, agriculture, and the effects of climate change on oceans. He interviewed various people including international experts such as Vandana Shiva and Bill McKibben. McKibben used an eloquent metaphor when he stated, "the earth is running a fever, and the only antibodies available to fight that fever are us."

This book is an excellent overview on the causes of climate change and how to fight it. Martinez's book shows why climate change should be fought and Jamie Margolin's book provides an excellent primer on exactly how to do so. *Youth to Power—Your Voice and How to Use It* was published when she was just nineteen years old. Besides providing thorough methods to organize and publicize social movements, she also interviewed many activists. *Our House is on Fire—Scenes of a Family and a Planet in Crisis* was written by Greta Thunberg, her parents, and sister. The title is a perfect summary of the book since it fluctuates between climate change and family dilemmas and it is extremely eloquent. It is heart-wrenching when dealing with the neurological-based struggles of Greta and her sister. This book provides insights into Greta's struggle to deal with her distress over climate change and how she was able to start her strike for climate change.

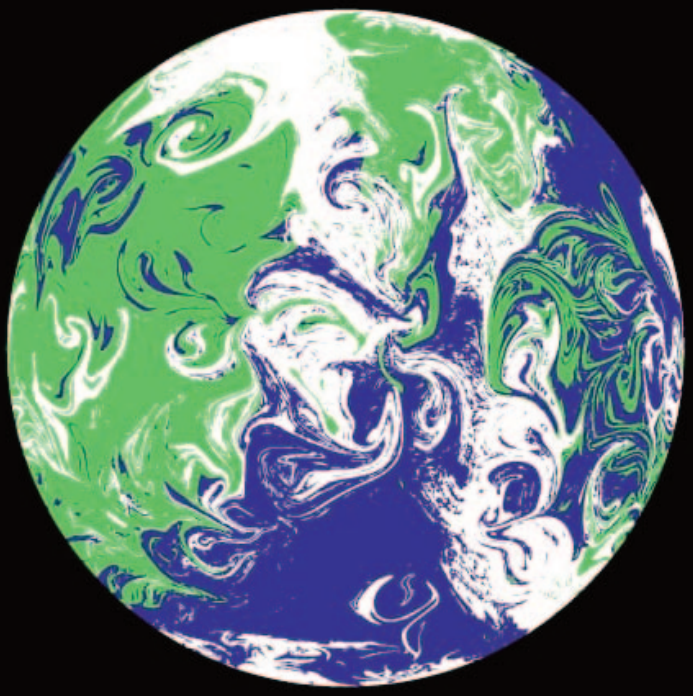
*No One is Too Small to Make a Difference* is a collection of Greta Thunberg's speeches. Her speeches are very authoritative as climate scientists fact check them. The book includes her speech at the World Economic Forum presented just after her sixteenth birthday and includes this powerful exhortation:

> *I don't want you to be hopeful.*
> *I want you to panic.*
> *I want you to feel the fear I feel every day.*
> *And then I want you to act.*
> *I want you to act as you would in a crisis*
> *I want you to act as if our house is on fire.*
> *Because it is.*

This book also contained her stirring speech at the UN General Assembly which included:

*This is all wrong. I shouldn't be standing here, I should be back in school on the other side of the ocean. Yet you all come to us young people for hope? How dare you! You have taken away my dreams and my childhood with your empty words. And yet I'm one of the lucky ones. People are suffering. People are dying. Entire ecosystems are collapsing. We are in the beginning of a mass extinction. And all you can talk about is money and fairy tales of eternal economic growth. How dare you!*

Very few adults are as articulate as she was at sixteen. There is no question why she is a worldwide icon and hero in the fight to preserve our planet. Greta represents just the tip of the iceberg of youthful activists attempting to steer us away from the ravages of climate change. They bring both knowledge and passion to the struggle, and their stories are inspiring for all of us. ONE



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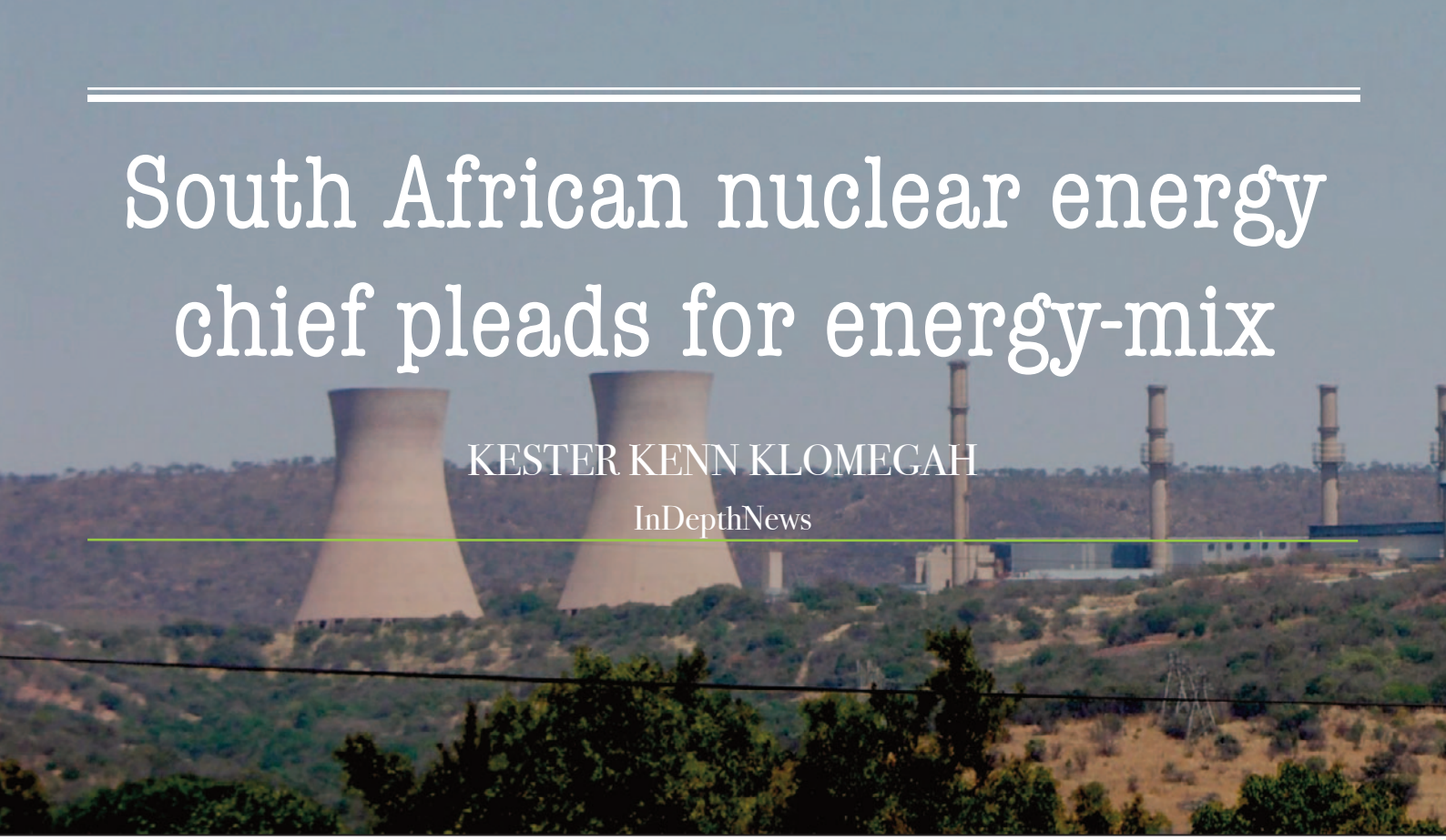

# South African nuclear energy chief pleads for energy-mix

KESTER KENN KLOMEGAH
InDepthNews

The power industry in South Africa is faced with huge challenges. Knox Msebenzi, Managing Director of the Nuclear Industry Association of South Africa (NIASA), discusses the impact of challenges on the country's economy and a way out of the power generation difficulties in South Africa.

The Nuclear Industry Association of South Africa is a body committed to promoting the highest standards in the development and application of nuclear technology in South Africa.

NIASA is composed of organisations, groups, and individuals, from not only the established nuclear sector but also any entities involved in any technology endeavour related to the development and operation of nuclear technology.

Here are excerpts from the interview:

**IDN: How would you describe the level of power shortage and its impact on the economy currently in South Africa?**
Knox Msebenzi: Eskom, the utility company had a good handle on electricity consumption growth and had asked to build new capacity to meet the growing demand but was stopped by the government whose policy was to introduce other players in building new capacity. However, the timing was poor and when a crisis was on the doorstep, two new coal plants, Medupe and Khusile, were built rather hurriedly and the project management was not done very well. As a result of this delay and the ageing of the coal fleet, supply became increasingly a problem, resulting in load shedding. The impact was devastating. Some industries closed down and prospective investments could not come into the country because of no security of supply offered by the utility

**IDN: What do you see as the main problems in the power industry? Besides the country's cabinet, has parliament also involved in discussing this?**
KM: The Parliamentary Portfolio Committee on Energy hosted public inputs into the issues relating to the energy policy of the country. They clearly recommended that South Africa should pursue an energy mix that includes coal, nuclear and renewables going forward. The problem with the power industry is that there are too many players with self-commercial interest mudding the waters and driving the agenda that favours one type of technology at the detriment of the others.

**IDN: Is it better under the political administration of Cyril Ramaphoza or Jacob Zuma? Can you please discuss how the power industry has been managed?**
KM: Under Zuma the narrative was that the insistence on nuclear power was driven by a corrupt agenda. No evidence was brought to the law enforcement offices for prosecution of the offenders, so it remains hearsay whether there was any truth in the allegations or not. Under Ramaphosa, it seems those who are pushing for renewable energy as the only sustainable source are getting more exposure. My view is that an all-

Pelindaba Nuclear Research Centre, South Africa.
Photo credit: NJR ZA

inclusive energy mix is the answer to South Africa's energy needs. It cannot be an either-or scenario. The Integrated Resource Plan (IRP) which is the government's energy policy, is very clear that an energy mix is the answer.

**IDN: What is your expert views about "energy mix" -- a combination of wind, solar, hydro and nuclear power? Why nuclear is still bug down with problems?**
KM: Not only is it my view that an all-inclusive energy mix is imperative, but the government policy recognises that as well. As soon as the government invited inputs for the procurement of nuclear, antinuclear lobbyists were on the minister's neck wielding knives to kill nuclear. (The fact is that) No energy source is without problems. The challenges relating to nuclear are well articulated but are manageable. There are no silver bullets when it comes to energy sources. The problems are exaggerated by a deliberate antinuclear lobby which is well funded internationally. Criticisms of nuclear relating to costs and project managements (long delays with huge projects) are being addressed with Small Modular Reactors. The few nuclear incidents which are always cited as reasons to abandon nuclear, are melodramatised. But when statistics about the number of deaths per kWh generated are analysed, it is found that nuclear is one of the safest energy sources.

**IDN: If, for instance, South Africa decides to strengthen nuclear as an additional remedy, how about nuclear safety regulations and training of staff for this?**
KM: South Africa is one of the founding members of the International Atomic Energy Agency (IAEA) and has had a nuclear power plant in operation since 1984. It has a well-established National Nuclear Regulator which is well recognised and respected by its peers worldwide. The issue around the training of staff has been addressed at the time when there was an expectation of 9600 MW to be added to the new nuclear build. Some of the developed skills have since left South Africa for opportunities in countries like the UAE that have embarked on nuclear. So the capacity to develop these skills, starting from tertiary institutions, is there.

**IDN: Do you see any possible way out of the power shortage in the country? Do you think foreign players (countries) are already showing interest and could help South Africa?**
KM: The best way out of the current situation is to fully implement the IRP. Nuclear power will not come online today, but countries do not plan for now but for the future. Foreign players will invariably be attracted by commercial interests. South Africa was at the forefront of developing SMRs (Small Modular Reactors) at one stage, but this was interrupted by political decisions. South Africa is capable of solving the electricity situation. We set the developmental agenda we want, and foreign players can slot in in pursuit of their interests. Manufacturers of renewable energy equipment overseas are already pushing to sell their goods and services. Nuclear vendors are also very keen to participate in the South African nuclear bid and this can be a gateway to the rest of the continent.

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# Life-saving drinking water disinfectancts have a "dark side"

**Disinfecting drinking water against pathogens is necessary, but by-products from the process are a ubiquitous – and likely growing – problem across the U.S. Solutions exist, though.**

LYNNE PEEPLES

Ensia.com

In late September 2020, officials in Wrangell, Alaska, warned residents who were elderly, pregnant or had health problems to avoid drinking the city's tap water – unless they could filter it on their own.

More than 3,000 miles (4,800 kilometers) away, the people of Scituate, Massachusetts, received a letter that same month cautioning about the same group of contaminants in their drinking water.

At issue wasn't any of the well-known and widely feared water infiltrators such as E. coli or per- and polyfluoroalkyl substances (PFAS). The culprit chemicals tainting taps from Cocoa, Florida, to the Finger Lakes of New York to a correctional facility in Only, Tennessee, are, in fact, less recognized yet more ubiquitous: disinfection by-products.

"Take a glass of water. You may or may not have pesticides, pharmaceuticals, PFAS and lead in it. Usually not," says Susan Richardson, a professor of biochemistry at the University of South Carolina in Columbia. "But there's always something that is in your drinking water, and that's disinfection by-products."

Aptly named, the chemicals form in water when disinfectants that are widely used to kill pathogens in municipal drinking water facilities react with organic compounds. These compounds may be present in the water as a result of natural processes such as the decay of leaves and animal matter, as well as human activities that may release solvents, pharmaceuticals, pesticides and industrial chemicals. Exposure to disinfection by-products through drinking, bathing or swimming has been linked to potential increased risks of low birthweight babies, birth defects, miscarriages and cancer.

"Disinfection is hugely important. We've got to kill those pathogens," says Richardson. "We had millions of people dying from waterborne illnesses before we started disinfecting water in the 1800s."

Cholera and typhoid fever were once deadly and pervasive threats. Still today, when concentrations of disinfectants fall too low, drinking water can become a breeding ground for dangerous pathogens such as Legionella, E. coli, even cholera.

"It's a trade-off between inactivating pathogens that are going to make people sick today versus the long-term, low-level risk of chemicals in the water," says Christy Remucal, an associate professor of civil and environmental engineering at the University of Wisconsin–Madison.

Striking a balance may be even more challenging today as waters become increasingly compromised due to population growth, wastewater intrusion, energy exploration, climate change – and now the Covid-19 pandemic, according to Richardson.

Pure water gushes from mineral spring at Thermopolis, Minas Gerais, Brazil.
Photo credit: Jonathan Wilkins/Wikimedia

During the pandemic, many places have increased use of chlorine for disinfection in indoor and outdoor settings and during wastewater treatment, resulting in the potential for higher levels of disinfection by-products. Authors of a study published in October warn that this "upsurge and overuse of chlorine-based disinfectants" may pose a threat to human health "by impacting water quality."

Concentrations of harmful chemicals have also likely increased in buildings left vacant during Covid-19 shutdowns. The longer that water sits in pipes, explains Richardson, the longer it has to react with disinfectants and form more by-products.

Still, Gregory Korshin, a professor of civil and environmental engineering at the University of Washington in Seattle, encourages perspective on the issue of disinfection by-products. The answer, he and others say, is not to stop disinfecting water, nor is it for everyone to buy bottled water.

"There is a dark side of disinfection," adds Korshin. "But this doesn't compromise the notion that drinking water in the U.S. is safe."

## Unintended Consequences

Chemists first discovered disinfection by-products in treated drinking water in the 1970s. The trihalomethanes they found, they determined, had resulted from the reaction of chlorine with natural organic matter. Since then, scientists have identified more than 700 additional disinfection by-products. "And those only represent a portion. We still don't know half of them," says Richardson, whose lab has identified hundreds of disinfection by-products. Identification of disinfection by-products is incredibly difficult, she explains, because these chemicals are not simply flowing down a river from an industrial site or running off a farm. "They didn't exist before," she adds. "It's a complete unknown – there's no preconceived idea of what these chemicals look like."

Another research team recently discovered more previously unidentified disinfection by-products. As they described in a January 2020 study, potentially carcinogenic chemicals are formed through the interaction of chlorine and not only organic matter in the environment but also manmade materials that include phenols such as bisphenol A (BPA) and other plasticizers, as well as sunscreen agents and antimicrobials.

"These phenol compounds are incredibly widespread because of their properties," says Carsten Prasse, a coauthor on the study and an assistant professor of environmental health and environmental engineering at Johns Hopkins University. He highlights their use in both plastic pipes and

Talapus and Olallie Lakes, Washington State (USA).
Photo credit: discoveringcascadia.com

plastic bottles, which frequently carry drinking water.

## What's Regulated and What's Not?

The U.S. Environmental Protection Agency (EPA) currently regulates 11 disinfection by-products – including a handful of trihalomethanes (THM) and haloacetic acids (HAA). While these represent only a small fraction of all disinfection by-products, EPA aims to use their presence to indicate the presence of other disinfection by-products. "The general idea is if you control THMs and HAAs, you implicitly or by default control everything else as well," says Korshin.

EPA also requires drinking water facilities to use techniques to reduce the concentration of organic materials before applying disinfectants, and regulates the quantity of disinfectants that systems use. These rules ultimately can help control levels of disinfection by-products in drinking water.

Still, some scientists and advocates argue that current regulations do not go far enough to protect the public. Many question whether the government is regulating the right disinfection by-products, and if water systems are doing enough to reduce disinfection by-products. EPA is now seeking public input as it considers potential revisions to regulations, including the possibility of regulating additional by-products. The agency held a two-day public meeting in October 2020 and plans to hold additional public meetings throughout 2021.

When EPA set regulations on disinfection by-products between the 1970s and early 2000s, the agency, as well as the scientific community, was primarily focused on by-products of reactions between organics and chlorine – historically the most common drinking water disinfectant. But the science has become increasingly clear that these chlorinated chemicals represent a fraction of the by-product problem.

For example, bromide or iodide can get caught up in the reaction, too. This is common where seawater penetrates a drinking water source. By itself, bromide is innocuous, says Korshin. "But it is extremely [reactive] with organics," he says. "As bromide levels increase with normal treatment, then concentrations of brominated disinfection by-products

will increase quite rapidly."

Emerging data indicate that brominated and iodinated by-products are potentially more harmful than the regulated by-products.

Almost half of the U.S. population lives within 50 miles of either the Atlantic or Pacific coasts, where saltwater intrusion can be a problem for drinking water supplies. "In the U.S., the rule of thumb is the closer to the sea, the more bromide you have," says Korshin, noting there are also places where bromide naturally leaches out from the soil. Still, some coastal areas tend to be spared. For example, the city of Seattle's water comes from the mountains, never making contact with seawater and tending to pick up minimal organic matter.

Hazardous disinfection by-products can also be an issue with desalination for drinking water. "As desalination practices become more economical, then the issue of controlling bromide becomes quite important," adds Korshin.

## Other Hot Spots

Coastal areas represent just one type of hot spot for disinfection by-products. Agricultural regions tend to send organic matter – such as fertilizer and animal waste – into waterways. Areas with warmer climates generally have higher levels of natural organic matter. And nearly any urban area can be prone to stormwater runoff or combined sewer overflows, which can contain rainwater as well as untreated human waste, industrial wastewater, hazardous materials and organic debris.

These events are especially common along the East Coast, notes Sydney Evans, a science analyst with the nonprofit Environmental Working Group (EWG, a collaborator on this reporting project).

The only drinking water sources that might be altogether free of disinfection by-products, suggests Richardson, are private wells that are not treated with disinfectants. She used to drink water from her own well. "It was always cold, coming from great depth through clay and granite," she says. "It was fabulous."

Today, Richardson gets her water from a city system that uses chloramine.

## Toxic Treadmill

Most community water systems in the U.S. use chlorine for disinfection in their treatment plant. Because disinfectants are needed to prevent bacteria growth as the water travels to the homes at the ends of the distribution lines, sometimes a second round of disinfection is also added in the pipes.

Here, systems usually opt for either chlorine or chloramine. "Chloramination is more long-lasting and does not form as many disinfection by-products through the system," says Steve Via, director of federal relations at the American Water Works Association. "Some studies show that chloramination may be more protective against organisms that inhabit biofilms such as Legionella."

If a drinking water facility fails to meet EPA regulations for disinfection by-products, one relatively easy and cheap modification is to add ammonia to the existing treatment, turning chlorine to chloramine. Many large community water systems in the U.S. now use chloramine. By doing so, according to Richardson, they have dropped levels of regulated disinfection by-products by up to as much as 90%.

However, there is one major drawback to this shift: the creation of potentially more harmful by-products. "It might push down on regulated disinfection by-products, but then other things pop up that are even more toxic," says Richardson, whose research team discovered previously unknown disinfection by-products in chloraminated drinking water. One of those finds, iodoacetic acid, is the most DNA-damaging disinfection by-product known to date.

Prasse underscored the concern: "From a regulatory perspective, we could say we're fine. But it's a false sense of security."

Rather than continuing on the toxic treadmill of replacing one potentially toxic chemical for another, a more effective solution may be to focus upstream in the treatment process – such as keeping organics out of the system in the first

place. "That requires engineers, chemists, toxicologists and regulators to come together and figure something out," says Prasse.

## Alternative Approaches

When he moved to the U.S. from Germany, Prasse says he immediately noticed the bad taste of the water. "You can taste the chlorine here. That's not the case in Germany," he says.

In his home country, water systems use chlorine – if at all – at lower concentrations and at the very end of treatment. In the Netherlands, chlorine isn't used at all as the risks are considered to outweigh the benefits, says Prasse. He notes the challenge in making a convincing connection between exposure to low concentrations of disinfection by-products and health effects, such as cancer, that can occur decades later. In contrast, exposure to a pathogen can make someone sick very quickly.

But many countries in Europe have not waited for proof and have taken a precautionary approach to reduce potential risk. The emphasis there is on alternative approaches for primary disinfection such as ozone or ultraviolet light. Reverse osmosis is among the "high-end" options, used to remove organic and inorganics from the water. While expensive, says Prasse, the method of forcing water through a semipermeable membrane is growing in popularity for systems that want to reuse wastewater for drinking water purposes.

Remucal notes that some treatment technologies may be good at removing a particular type of contaminant while being ineffective at removing another. "We need to think about the whole soup when we think about treatment," she says. What's more, Remucal explains, the mixture of contaminants may impact the body differently than any one chemical on its own.

Richardson's preferred treatment method is filtering the water with granulated activated carbon, followed by a low dose of chlorine. Granulated activated carbon is essentially the same stuff that's in a household filter. (EWG recommends that consumers use a countertop carbon filter to reduce levels of disinfection by-products.) While such a filter "would remove disinfection by-products after they're formed, in the plant they remove precursors before they form by-products," explains Richardson. She coauthored a 2019 paper that concluded the treatment method is effective in reducing a wide range of regulated and unregulated disinfection by-products. Despite the technology and its benefits being known for decades, relatively few full-scale plants use granulated active carbon. They often cite its high cost, Richardson says. "They say that, but the city of Cincinnati [Ohio] has not gone bankrupt using it," she says. "So, I'm not buying that argument anymore."

Greater Cincinnati Water Works installed a granulated activated carbon system in 1992. On a video call in December, Jeff Swertfeger, the superintendent of Greater Cincinnati Water Works, poured grains of what looks like black sand out of a glass tube and into his hand. It was actually crushed coal that has been baked in a furnace.

Under a microscope, each grain looks like a sponge, said Swertfeger. When water passes over the carbon grains, he explained, open tunnels and pores provide extensive surface area to absorb contaminants.While the granulated activated carbon initially was installed to address chemical spills and other industrial contamination concerns in the Ohio River, Cincinnati's main drinking water source, Swertfeger notes that the substance has turned out to "remove a lot of other stuff, too," including PFAS and disinfection by-product precursors.

"We use about one-third the amount of chlorine as we did before. It smells and tastes a lot better," he says. "The use of granulated activated carbon has resulted in lower disinfection by-products across the board."

Richardson is optimistic about being able to reduce risks from disinfection by-products in the future. "If we're smart, we can still kill those pathogens and lower our chemical disinfection by-product exposure at the same time," she says.

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# GOALS


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# Biden's Keystone XL death sentence requires Canada's oil sector to innovate

While some reactions imply U.S. President's move came as a shock, the truth is that cancelling Keystone XL was was telegraphed clearly throughout the campaign.

WARREN MABEE

The Conversation

In one of his first acts of office, U.S. President Joe Biden has issued an executive order that effectively kills the Keystone XL pipeline project.

The order states that the pipeline "disserves the U.S. national interest" and that approving it would be inconsistent with his campaign climate pledges.

Alberta Premier Jason Kenney called the move a "gut punch" and an "insult" and has threatened legal action to recoup Alberta's $1.5 billion investment in the project.

Prime Minister Justin Trudeau issued a statement that expressed disappointment, but struck a far more conciliatory tone. He signalled a desire to work with the Biden administration and implicitly conceded that the pipeline won't be resurrected again.

Joe Biden and Barack Obama in Springfield, Illinois. Photo credit: Daniel Schwen/Wikimedia

While the reaction from Alberta implies Biden's move came as a shock, the truth is that cancelling Keystone XL was a key part of Biden's election platform and was telegraphed clearly throughout the campaign.

## Obama's rejection

It's worth remembering that Keystone XL was rejected previously by Barack Obama's administration in 2015, after several years of controversy, and that the environmental concerns used to justify that decision have not gone away.

This decision should have been expected and planned for.
But it would seem that both Alberta and TC Energy (formerly TransCanada) felt that

there was a good chance the project would proceed despite Biden's election win. Early in January 2021, TC Energy opened bidding on existing pipeline space expected to be freed up by the construction of the new line.

The Keystone XL cancellation will significantly impact Canada and Alberta. TC Energy has estimated that Canada would have added 2,800 jobs directly associated with this project, mostly in Alberta, and contends the United States would have seen 10,400 new positions.

Let's put that in perspective: in 2020, it was estimated that total oil and gas employment in Alberta was 128,180, and thus the number of lost jobs represents 2.2 per cent of the total sector employment in the province — a very significant proportion for a single project.

The loss of Keystone XL also will impact future projects in the province's oilsands. We know that one of the reasons that companies are reducing investments in the oilsands is that there is a transport bottleneck that affects the ability to get new product to market.

Keystone XL would have been able to move 830,000 barrels per day. Total Canadian oilsands production is only 2.9 million barrels per day, so adding Keystone XL may have attracted new investment to the oilsands to take advantage of this transportation capacity, which in turn would have meant billions in royalties to the province. GDP growth resulting from this investment would have benefited all of Canada.

The cancellation of Keystone XL could leave Alberta out-of-pocket for the $1.5 billion invested by the government earlier this year. This investment — almost $400 for each individual in the province — may be recouped through legal means or reinvested by the company, or simply written off. The province also made $6 billion in loan guarantees that may be recovered. Overall, however, the province will likely lose money on this deal — and the voters ultimately will decide the price.

## Energy East born again?

So what's next? There have been reports that some of the pipe and materials may be sold for scrap if Keystone XL can't move forward. In reality, the majority of the actual pipe has not yet been laid, meaning pipes could easily be repurposed for other projects. So some investment may be recovered over an extended time.

Indeed, TC Energy may look to the past when figuring out its next move.

One option that might be explored is revisiting Energy East, a pipeline that would have seen 1.1 million barrels per day of Alberta oil travel over 3,000 kilometres to reach tidewater at Saint John, N.B.

Energy East was arguably the most complicated infrastructure project ever imagined in Canada, involving the federal government, six provincial legislatures, hundreds of municipalities and 180 traditional Indigenous territories. The project would have crossed thousands of waterways ranging from streams to major waterways including the South Saskatchewan, Red, Ottawa, and St. Lawrence rivers.

The project was hugely controversial, and was cancelled in 2017 — partly because former president Donald Trump had re-approved Keystone XL earlier that year.

## Rethinking pipelines

But before backing yet another pipeline project, Alberta and all of Canada ultimately need to decide if more pipeline capacity is really needed.

Keystone XL struggled to find investors prior to Alberta's decision to provide funds. The frequently cited "Canadian discount" in oil prices, which entails Canadian oil being sold at lower prices than the West Texas Intermediate (WTI) index, has in recent months been reduced as oil prices have begun to recover.

In Ottawa and in Washington, policies to address the climate emergency have taken precedence over new investment in conventional, fossil fuel-based industries. The future of Canada's oil sector may not be in volume, but in value. Consider that four to five per cent of the volume of oil becomes high-value products like plastics, rubber and chemicals; these products can account for 40 per cent or more of the value derived from a barrel of oil.

New refineries are being designed that focus on these value-added products and minimize bulk fuel products; these new facilities may be smaller and require far less in terms of input, reducing the need for new pipelines.

The death of Keystone XL is a wake-up call for the oil sector. The old way of doing business is fading away, and it must innovate to survive.

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# Obsession with GDP, disregard of nature leading towards eco-system collapse: Report

## "Securing nature is investing in our self-preservation."

ANDREA GERMANOS
Common Dreams

A new report out Tuesday from the U.K. government framing the natural environment as "our most precious asset" says the world's destruction of biodiversity has put economies at risk and that a fundamental restructuring of global consumption and production patterns is needed for humanity's survival.

The 600-page review was commissioned by Britain's Treasury and authored by Partha Dasgupta, Professor Emeritus of Economics at the University of Cambridge, who wrote that gross domestic product (GDP) is a faulty measure of sustainable economic growth.

In a foreword to the report, renown naturalist and TV host David Attenborough wrote that although we "are totally dependent upon the natural world," we "are currently damaging it so profoundly that many of its natural systems are now on the verge of breakdown."

Humanity is "plundering every corner of the world, apparently neither knowing or caring what the consequences might be," wrote Attenborough. "Putting things right will take collaborative action by every nation on earth."

"The Dasgupta Review at last puts biodiversity at its core and provides the compass that we urgently need," he added. "In doing so, it shows us how, by bringing economics and ecology together, we can help save the natural world at what may be the last minute—and in doing so, save ourselves."

The report argues that a recovery effort like that seen in the aftermath of World World II is necessary. "If we are to enhance the biosphere's health and reduce our demands, large-scale changes will be required, underpinned by levels of ambition, coordination, and political will akin to (or even greater than) those of the Marshall Plan," it states.

As the Associated Press reported: *Dasgupta called on the world to ensure demands on nature do not exceed sustainable supplies by changing food production and consumption, investing in natural solutions such as restoring forests, and protecting natural habitats. He said coordinated action now would in the long-run be less costly and would also help tackle other issues such as climate change and poverty. Additionally, he pointed to a need to move away from using gross domestic product, or*

Deforestation in Barrio Florido, Iquitos (Perú).
Photo credit: LLs

*GDP, as a measure of economic success toward one that accounts for the benefits of investing in natural assets such as forests, soils, and oceans.*

"Truly sustainable economic growth and development means recognizing that our long-term prosperity relies on rebalancing our demand of nature's goods and services with its capacity to supply them," Dasgupta said in a statement. "It also means accounting fully for the impact of our interactions with nature across all levels of society."

The coronavirus pandemic "has shown us what can happen when we don't do this," Dasgupta added. "Nature is our home. Good economics demands we manage it better."

According to Bloomberg, "The review is the first time natural capital accounting—the act of quantifying ecosystems and their losses—has been discussed in detail by a mainstream economist with the support of the U.K. government." The outlet added: *Academics have spent decades attempting to put a price on nature. A widely-cited study in 1997 estimated that the global flow of the earth's biosphere was valued at an average of $33 trillion per year—far higher than the global gross domestic product of that era.*

Dasgupta said assigning absolute monetary values to nature would be meaningless because life would simply cease to exist if it was destroyed. The Indian-British economist called on governments to find an alternative to GDP as a way of measuring wealth, warning it is "wholly unsuitable" for ensuring sustainable development. Instead, he said, governments should use a more inclusive measure of wealth that accounts for nature as an asset.

"The message from the Dasgupta Review is clear," said United Nations Environment Programme chief Inger Andersen. "Securing nature is investing in our self-preservation."

"It is armed with this knowledge that in 2021 we must agree on an ambitious post-2020 global biodiversity framework that ends nature loss," she said.

The report was also welcomed by Marco Lambertini, director general of WWF International, who said its findings "are clear: nature underpins our

Bush fire at Captain Creek central Queensland (Australia).
Photo credit: 80 trading 24 /Wikimedia

economy and our wellbeing."

"Our failure to recognize this relationship, and take decisive and urgent steps to reverse nature loss, is costing us dearly and putting the future of humanity at risk," said Lambertini. "To safeguard our future, we must stop taking nature for granted as an expendable commodity, value its services, and transform our economies and finance systems so they are geared towards conserving and restoring the natural world on which we all depend."

"This should be required reading at @hmtreasury," tweeted Green Party MP Carolie Lucas of the report.

"Biodiversity and enhancing nature cannot be separated from economic policy," she wrote, calling for a replacement of "GDP growth with a wellbeing economy, starting with next month's budget."

The report was not without criticism from environmental advocates, including from author and climate activist George Monbiot, who took issue with putting a price tag on nature.

In a set of tweets ahead of and after the report's release, Monbiot called the review's approach "morally wrong" and accused Dasgupta of promoting "a kind of totalitarian capitalism" in which "everything must now be commodified and brought within the system."

"Destruction is driven, above all, by the power of the rich. Regardless of how others value nature, those with power will destroy it, until their power is curtailed," Monbiot wrote.

"Dasgupta's natural capital agenda," he added, "is naive on many levels, but above all it is naive about power. Putting a social price on something does nothing to stop anti-social interests from exploiting it."

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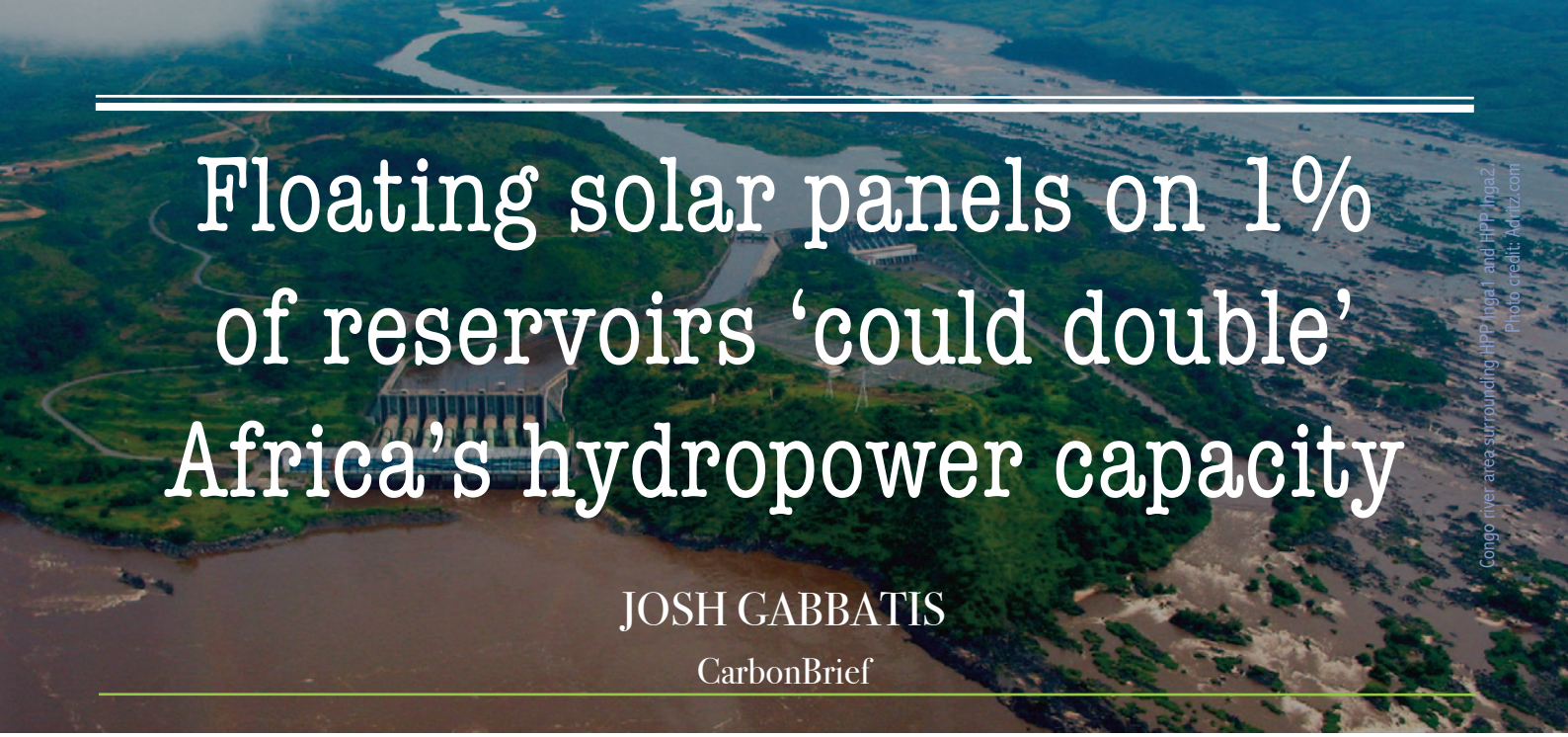

Congo river area surrounding HPP Inga1 and HPP Inga 2. Photo credit: Aquiz.com

# Floating solar panels on 1% of reservoirs 'could double' Africa's hydropower capacity

JOSH GABBATIS

CarbonBrief

Solar panels floating on the lakes formed by Africa's hydropower dams could be a major new source of power, according to a new study. If these panels covered just 1% of reservoirs, this alone could double African hydropower capacity and increase electricity generation from dams by 50%.

Hydro dams are the largest renewable power source in a continent where millions of people still lack access to electricity. However, their future potential could be hampered by climate change. In a new paper published in *Renewable Energy*, researchers lay out the possibility of using floating solar panels installed on lakes to boost the generating capacity of existing dams.

With the continent caught between "a climate crisis and widespread energy poverty", one regional expert tells *Carbon Brief* that floating solar could be a valuable tool to help African nations expand their power infrastructure sustainably.

**Boosting hydro**

Hydropower accounts for 17% of the electricity generated across Africa and more than 90% in some nations, including Ethiopia, Mozambique and Zambia. Dr Samuel Gyamfi from the University of Energy and Natural Resources in Ghana, who was not involved in the new study, tells Carbon Brief that African nations have still built far less than other parts of the world: "This is basically due to financial constraints… Africa has about 90% of its hydro resources yet to be developed for power generation."

As it stands, less than half the population of sub-Saharan Africa has access to electricity. With more than 50 new dams currently under construction, this technology is often touted as a renewable solution to Africa's energy needs. But, with rising global temperatures leading to disrupted rainfall and droughts, existing African facilities are expected to generate less power in the future. On top of this, the dams that have been built have often been linked to social, environmental and political problems.

The new paper proposes floating solar panels as a solution that boosts hydropower capacity using Africa's "vast solar resources". Panels can be mounted on floating structures and plugged into existing electricity infrastructure.

The authors* – a team from the European Commission's Joint Research Centre – tell Carbon Brief: "Floating photovoltaics could be a potential alternative to expanding hydropower in certain areas, especially in water scarce regions where droughts are causing severe repercussions on hydroelectric generation."

At the same time, they note that during the wet season hydropower could compensate for the intermittency of solar power in these hybrid systems. The researchers used a combination of satellite images and data from hydropower reservoirs and solar radiation to estimate floating solar's potential at the 146 largest hydropower facilities in Africa as of 2016. In a maximum scenario where 100% of each reservoir was covered with solar panels, there would be an accompanying 100-fold increase in capacity, with 2,922 gigawatts (GW) of solar added to the existing 28GW of hydropower.

This would mean a 50-fold increase in electricity production compared to current hydro output, from 106 terawatt hours (TWh) to 5,293TWh. This dwarfs the total electricity demand across the whole of Africa, which is only around 700TWh. While covering every reservoir with panels is clearly "not feasible", the authors note that, even in cases with far less coverage,

the gains were substantial. With just 1% cover, the installed capacity of existing hydropower plants could be more than doubled, rising from 28GW to 58GW. This would mean increasing the overall electricity output of the hydropower and solar hybrid system to 159TWh, a 50% increase from hydropower alone.

The paper also includes a scenario in which the installed solar exactly matched hydropower capacity, allowing for full use of the dam's connection to the grid. This resulted in 0.9% coverage, but only for 108 reservoirs as the remaining 38 required more than 100% coverage to equal hydropower capacity. These reservoirs are shown in the map below, with the size of the circles indicated the size of solar power output.

**'Just solar on a boat'**

Though still at the early stages of development, floating solar power has been "growing exponentially", according to a 2018 report by the *World Bank*. Some African nations have taken the first steps towards this new technology, but they are far behind the big players, such as China. A 2019 report found there was 64kW of floating solar deployed in Africa compared to 813,788kW in Asia. Mohamed Adow, director of Nairobi-based thinktank *Power Shift Africa*, tells Carbon Brief that diversifying the continent's energy portfolio with technologies such as floating solar could reduce "outages and overreliance" on hydropower.

Jenny Chase, a solar analyst at *BloombergNEF (BNEF)* who was not involved in the new study, tells Carbon Brief "sticking solar on hydro plants should be an obvious win". She adds: "It's just solar on a boat. You've got the grid connection, so you're good to go."

In general, solar power is set for considerable growth in the region, taking advantage of Africa's ample solar resources and falling prices. "The continent really just needed it to get cheap," says Chase. She adds that, while the new study quotes Africa's total solar capacity as 5GW, according to BNEF figures it was 12.7GW in 2020 and is expected to be 16.7GW by the end of 2021. An additional benefit provided by floating solar panels on hydropower reservoirs comes from their potential to reduce water loss during periods of drought by forming a shield that blocks any evaporating moisture. This, in turn, could further boost the power output from the dams. The paper found that using floating panels that fully cover 1% of the water surface would increase hydropower output by 0.17% due to water savings.

"For a continent that will need to cherish every last drop as global heating continues to rise, this is significant," says Adow.

**Costs and challenges**

Experts tell Carbon Brief that while the new paper paints an interesting picture, there are issues with floating solar in Africa. "The technology is excellent, but rather expensive," says Dr Mmantsae Moche Diale, a solar power researcher at the University of Pretoria. The study notes evidence from the EU that floating solar power can cost around 20-25% more than the conventional variety.

However, the authors tell Carbon Brief that, with electricity grid infrastructure already in place at hydropower plants, the saving on grid connection costs can make floating solar "more economically viable". Chase downplays the additional costs, telling Carbon Brief that "it's a bit more expensive than ground mount, but not much", adding: "Solar's got so cheap that these days it's more a 'why not?' than 'why do this'"

Nevertheless, Adow says that to make the scenarios laid out in this paper a reality there will need to be targeted financial support for African governments from richer countries: "This is why developing nations talk about the importance of 'technology transfer' at the UN climate summits…It must be top of the agenda when countries meet this year at COP26 in Glasgow."

"Africa is caught between both a climate crisis and widespread energy poverty. Its leaders need to think creatively and be supported," he adds.

The authors of the new study note that, with floating solar still a relatively new technology, there remain many unknowns, such as the impacts on water quality and technical challenges including the impact of bird fouling and corrosion. Gyamfi says these issues will vary considerably between countries and notes that more research will be needed to determine how best to scale up floating solar in the region. The authors say the nations that stand to benefit most from floating solar are northern African countries, as well as South Africa, owing to their relatively low hydropower capacity. Virtually all of South Africa's electricity is currently provided by coal, while nations such as Algeria and Libya rely heavily on natural gas.

*The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission. The authors are Rocio Gonzalez Sanchez, Ioannis Kougias, Magda Moner-Girona, Fernando Fahl and ArnulfJäger-Waldau.

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Burning garbage (Philippines).
Photo credit: Øyvind Holmstad

# The open burning of waste poses grave health risks to millions

DANIEL T CROSS

Sustainability-Times

We're generating more waste than at any other time in history what with a greatly increased global population, rampant consumerism and the wanton use of single-use items like plastic bags and wrappings.

Most of us rarely spare a thought to what happens to our household waste once we put it in the bin, but much of it gets simply burned. And the practice of burning waste poses grave health risks to tens of millions of people around the world, according to a new report, which is the first study of its kind.

"The decommissioning, dismantling and disposal of products and structures at the end of their life can damage the environment and squander scarce resources if not carried out responsibly," William Powrie, professor of geotechnical engineering at the University of Southampton, explains in the Foreword.

"These processes can also be dangerous and harmful to those people involved in them, especially as the waste and processes in question are often displaced to parts of the world least able to manage them safely," he elucidates.

The research was commissioned by Engineering X, an international collaboration founded by the Royal Academy of Engineering in the United Kingdom, and conducted by experts at the University of Leeds in partnership with the International Solid Waste Association and other organizations.

The scientists behind it have found that a quarter, or half a billion tons, of all municipal solid waste generated worldwide is left uncollected while a further 27% of all total waste ends up being mismanaged after it is collected.

"Much of this [waste] is disposed of by open burning. Uncontrolled burning of waste is particularly widespread in low- and middle-income countries where collection and disposal systems are often poor or completely absent," they explain.

To make matters worse, waste is frequently burned close to people's homes at industrial sites and large dumpsites. "The hazardous cocktail of emissions released into the atmosphere and onto land threatens the environment and the health of those who live and work nearby," the researchers note.

Their review, they add, "found evidence of emissions from open burning that are classed as persistent organic pollutants, as well as those that are carcinogenic, mutagenic, cause immunological and developmental impairments, and may lead to reproductive abnormalities."

Across the world, from Southeast Asia to Africa to South America, as many as 11 million so-called waste pickers, including women and children, live at or near garbage dumps eking out a living by sorting through garbage for recyclables, which they then sell for pittances.

Often languishing in grinding poverty with their families, the millions of waste pickers worldwide collect and sort for resale anywhere between 20% and 50% of overall generated waste.

They collect more than 90 million metric tons of waste for recycling each year, but as they do so they are routinely exposed to health hazards from the open burning of waste, including toxic materials. Yet despite their contribution to recycling, they are routinely marginalized and shunned in societies, other researchers say.

"They provide services to society free of cost, but their work and rights are not always fully recognised. In some countries, such as Brazil and Colombia they are strongly organised in cooperatives and associations. This enables them to voice their claims and even formally take up municipal waste services," stress Federico Demaria, a researcher at the Autonomous University of Barcelona in Spain, and Marcos Todt, a PhD student at the Pontifical Catholic University of Rio Grande do Sul in Brazil.

At the same time, their health needs are also largely neglected or ignored. "There is no doubt that the handling of humanity's waste and its impact on health and safety should be much higher up the global agenda. It beggars belief that we are still using crude and ancient methods of disposal to deal with our 21st century waste problem," Powrie says.

Costas Velis, an expert at the University of Leeds who cowrote the report, concurs. "Over the past 200 years or so, affluent countries have developed waste management to a point where new research and potential improvements are directed at resource recovery and the development of a circular economy rather than on safeguarding public and occupational health and safety," Velis says.

"We need to remember that in other parts of the world the disposal of man-made materials, products and structures once they become 'waste' at the end of their engineered life can still be a dangerous and harmful business for those involved in the process but much more research and robust data is needed to fully understand the scale of the problem," he adds.

"In particular, open uncontrolled burning is a huge public health challenge we cannot afford to keep ignoring."

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*by Sustainability-times.com*
*January 8, 2021*


Photo credit: ONE

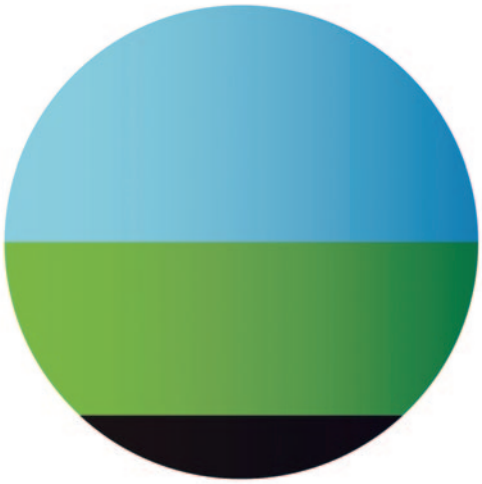
# CAGLIARI PORT SILO

At the time of writing, the Cagliari silo is under demolition. Built-in 1973, the grain silo has been an iconic landmark of Sardinia's primary town waterfront.

It was originally made of a 54-mt tower and 21 storage cells, three for each row, 44-mt tall. An internal explosion in 2011 signalled the beginning of the end for the Silo. No reparation was made, and the area was sealed off. The lack of maintenance was justified with the need to give a new purpose to the whole site. In the next ten years, any attempt to follow the inspiring Cape Town's Silo district restoration turned out to be just an illusion. No one really cared.

The final silo demolition will cancel the last remaining trace of Cagliari's most characteristic old industrial site. ONE

SOTACARBO



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