

# Energy solution hinges on better technology



Illustration: Eric Lobbecke

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- 12:00AM June 15, 2019
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What will be the solution to climate change? It would be very nice to be able to point confidently to a single technology. In fact, many people do. They say the answer to climate change has already arrived in the form of, say, wind turbines or solar panels, and we just need to build more of their favoured technology to achieve a so-called “energy transition” from fossil fuels to renewables.

This idea that we already have the needed technology is so pervasive that before we can establish what the solution to climate change really looks like, we first need to dismantle the faulty idea that we have the solution already.

The reality is, today, solar and wind energy together deliver only about 1 per cent of global energy. The International Energy Agency estimates that even by 2040 these will cover a little more than 4 per cent of global energy.

One of the world’s leading energy researchers, Czech-Canadian Vaclav Smil, has said: “The great hope for a quick and sweeping transition to renewable energy is wishful thinking.”

Former US vice-president Al Gore’s chief scientific adviser, Jim Hansen, who put global warming on the agenda back in 1988, agreed, saying: “Suggesting that renewables will let us phase rapidly off fossil fuels in the United States, China, India, or the world as a whole is almost the equivalent of believing in the Easter Bunny and Tooth Fairy.”

How has such a fundamental misunderstanding become so firmly entrenched at the centre of climate policy debate? Partly through self-interest. Many private companies — from Vestas to Tesla — have an interest in making us believe the solution is simply to buy lots of their products.

And partly because, as any good political strategist will tell you, it's impossible to get people engaged in a problem without offering a solution.

There are a lot of political and activist groups that coalesce support around the idea that climate change can be solved with more green energy and less fossil fuels. But we need to remember that we don't emit CO2 to annoy environmentalists. It is the by-product of today's immense availability of power, which provides everything we need and demand from modern society: heat, cold, transport, electricity and food.

The link is strong and clear: if you have access to lots of cheap energy, this typically means you've escaped poverty, you will live a long life, you have access to a good education and healthcare, you won't starve to death or die from easily curable diseases. These are manifestly good things, which is why the world has spent the past two centuries ensuring more and more people can access lots of energy.

In 1800, almost all energy was renewable. Humanity used energy from draught animals ploughing fields and pulling carts and from firewood heating hearths and homes. And almost everyone put in long hours of harsh, backbreaking labour. Studies from Sweden suggest that 80 per cent of energy came from wood, with animals and humans each providing about half of the rest. Wind and water provided crucial ship transport and flour milling but rarely much more — in Germany, this provided only 1.5 per cent of all energy.

After this, coal, then oil, gas and finally nuclear power were transformative in helping humanity. These gave us the ability to achieve much more with much less labour. At the end of the 19th century, human labour made up 94 per cent of all industrial work in the US. Today, it constitutes only 8 per cent.

Yet humanity has actually never experienced an “energy transition” — a shift from one set of energy sources to another set. Rather, we have added more and more. When the world first discovered coal, we didn't stop using wood. In fact, global wood consumption has kept increasing during the past two centuries, and since 1850 coal has kept increasing, too. The same is true with oil, gas, hydropower and nuclear.

The only consistent development shift during the past centuries is the relative move away from renewables: in 1800 they provided about 94 per cent of all energy in the world, dropping to about 14 per cent by 1971 and flattening out from there. In 2017, after almost three decades of intense climate policies, the world still received 14.2 per cent of its energy from renewables (not only wind and solar but also hydro and biomass). This is not surprising: renewables have two big problems.

First, they take up an amazing amount of space that often replaces nature. To replace a 1ha gas-fired power plant, society needs 73ha of solar panels, 239ha of onshore wind turbines or an unbelievable 6000ha of biomass.

Second — and most important — solar and wind power are intermittent or unreliable. Solar energy isn't produced when it is overcast or at night. Wind energy isn't produced when there is little or no wind. We often hear that wind and solar energy are cheaper than fossil fuels, but at best that is true only when the wind is blowing or the sun is shining. It is deeply misleading to compare the energy cost of wind or solar to fossil fuels only when it is windy and sunny.

What's more, because modern society requires 24-hour power, even when solar or wind is introduced, it's still necessary to pay for back-up service from fossil fuels (for when there's no wind or sun), only these are now more expensive because fossil fuels have fewer hours to back the capital investment. And batteries are nowhere near ready to help solar and wind energy last longer. In the US, total battery storage could power the nation for only 14 seconds.

But fixing global warming is not mostly about cutting Australian emissions. It is about finding a way to cut global emissions: from China, India, the US, all of Europe and the rest of the world. Furthermore, it is not only about fixing where we get our electricity from as electricity constitutes about only a quarter of global emissions.

There is a focus on emissions from electricity because although it is very hard to end our reliance on fossil fuels and solutions are far from effective, it's actually easier and further ahead than the other sectors: agriculture (24 per cent of emissions), manufacturing (21 per cent), transport (14 per cent), buildings (6 per cent) and other (10 per cent).

Right now, our solutions to climate change are failing. We may feel as if we're doing a lot, but the reality is we are mostly tinkering at the margins, often with incredibly ineffective policies.

The EU has already set up an emissions trading system, putting caps on how much CO<sub>2</sub> the electricity sector emits. This means that when Germany or Denmark puts up solar panels or wind turbines with expensive subsidies, it doesn't cut one single tonne of CO<sub>2</sub>. Every tonne of CO<sub>2</sub> avoided there simply means the price on the ETS declines slightly, making it cheaper for, say, Polish coal to emit that much more CO<sub>2</sub>. While the EU likes to point to its green achievements, more than two-thirds of its energy still comes from fossil fuels. Nuclear energy contributes 13 per cent of CO<sub>2</sub>-free energy and renewables 15 per cent. And even this figure of 15 per cent is dubious.

Most people think renewables are overwhelmingly made up of solar and wind. Nothing could be further from the truth. Solar and wind contributed only 2.4 per cent of the EU total energy demand in 2017, according to the latest numbers from the International Energy Agency. Another 1.7 per cent came from hydro and 0.4 per cent from geothermal energy.

In comparison, 10 per cent — more than two-thirds of all the renewable energy in the EU — comes from the world's oldest energy source: wood.

The EU adopts the fictitious position that biomass such as wood pellets produce no CO<sub>2</sub> at all. The truth is wood emits more CO<sub>2</sub> per kilowatt hour than even coal, mostly because its combustion is less effective. The EU position assumes that felled forests will be replanted, with each new sapling eventually soaking up all the burned CO<sub>2</sub>. But forests often are not replaced, in which case CO<sub>2</sub> emissions are permanent and large, and even under optimal conditions the wood burned today will become CO<sub>2</sub>-neutral only towards or after the end of the century.

Moreover, reliance on burning American forests in EU stoves leads to “biodiversity loss, deforestation and forest degradation”, according to a European Commission report. This shows the EU’s climate “achievement” — of increasing its use of renewables — is mostly deceptive, and the vast part of it is unsustainable.

But climate policy is non-existent or failing even more markedly in the rest of the world for a very simple reason: more energy means more income, longer lives, less disease and more education. Typically, the cheapest way to achieve this is through coal. The International Energy Agency’s newest report finds that when adjusting for the unreliability of solar and wind, existing coal will be cheaper than new solar and wind everywhere at least until 2040, and dramatically so in the EU. This simple fact is the reason we do not yet have a solution to global warming: green energy mostly can’t yet compete globally with fossil fuels. Campaigners casually suggest we can capture CO<sub>2</sub> and store it underground, disregarding the reality that even capturing a slim 15 per cent of emissions would require infrastructure larger than the world’s biggest \$US2 trillion industry, the oil industry, which took 100 years and an incredibly profitable product to create.

Promises to populate the world with electric cars have failed just as spectacularly, despite unprecedented subsidies. Today, fewer than 0.3 per cent of all cars are electric, and even if we could reach 200 million electric cars in 2040, the IEA estimates this would reduce emissions by less than 1 per cent. That is why, in the face of years of failure, politicians have continued doing one thing: making ever bigger promises.

The promises made in Rio de Janeiro in 1992 and in the Kyoto Treaty in 1997 fell apart. A new study of the promises made under the Paris Agreement finds that of almost 200 signatories, only 17 countries — the likes of Samoa and Algeria — are living up to them, and these are succeeding mostly because they promised so little. But even if every country did everything promised in the Paris Agreement, the emission cuts by 2030 would add up to only 1 per cent of what would be needed to keep temperature rises under 2C.

Failure has not made politicians more careful. If anything, they have doubled down on making nice-sounding promises, even ones that are objectively ludicrous with zero chance of happening. The German promise to phase out coal in 2038, for example, is described by Smil as “completely unrealistic”.

Politicians across the world happily promise to emit net zero CO<sub>2</sub> by 2050, knowing they will be long retired from politics when those vows are broken. Achieving this will be almost impossibly expensive, likely provoking “yellow vest” street riots long before their conclusion. After New Zealand made its 2050 zero emissions promise, the government commissioned a report on the costs. This found that achieving this goal in the most cost-effective manner (which strains credulity because policy seldom if ever manages to be cost efficient) would cost more than last year’s entire national budget on social security, welfare, health, education, police, courts, defence, environment and every other part of government combined. Each and every year.

UN secretary-general Antonio Guterres is inviting all heads of state to New York next September to promise jointly to cut global emissions to zero by 2050. To see exactly how unrealistic this is, look at the UN Intergovernmental Panel on Climate Change’s five policy scenarios for the 21st century. The most optimistic “sustainable” scenario puts on green-tinted glasses to envisage a world in which the rich countries happily accept having their energy

availability cut in half and people in the poor world accept they will never catch up even to half of rich-world energy availability.

Despite such heroic and far-fetched assumptions, this scenario expects the world to get only one-fifth of its energy from renewables by 2050. In this wonder-scenario, global emissions will be 10 per cent above what they are today. And of course all other, more realistic scenarios find 2050 emissions much higher.

The belief that we already have the solutions is a delusion on a planetary scale. It may be comforting to tell ourselves that global warming is effectively solved. It's dangerous because it leads to us taking at face value promises and vows that have no chance of being enacted. And it is reckless because it stops us from focusing on what we need to do instead.

If we do care to fix climate, we need to change course. This was clearly shown by 27 of the world's top climate economists and three Nobel laureates who looked at the whole gamut of climate solutions for Copenhagen Consensus.

If we keep doing what we've done so far and make more promises to cut carbon in ineffective ways such as subsidising wind and solar, each dollar spent will avoid only 3c of climate damage.

The Nobel laureates and climate economists found investing in green innovation is the best investment. To see why, think back to the 1960s and 70s when the world worried about mass starvation, epitomised by recurrent famines. If we had adopted today's approach to climate, we'd have asked everyone (especially the rich) just to eat less while we sent small amounts of food from rich countries to poor. It didn't succeed.

What did work was the Green Revolution. Through practical innovation — irrigation, fertiliser, pesticides and plant breeding — the Green Revolution increased world grain production by an astonishing 250 per cent between 1950 and 1984, raising the calorie intake of the world's poorest people and reducing the incidence of serious famines.

Instead of tinkering around the edges, innovation tackled the problem head-on. Instead of asking people to do less with less, innovation offered the ability to produce more with less. Would-be catastrophes have regularly been pushed aside throughout human history because of innovation and technological development.

In general, investment in long-term innovation is woefully underfunded because it is hard for private investors to capture the full benefits of their innovations. If you discover a new technology that during the next 40 years becomes the foundation for a new, cheap green energy source, that is great for the world but your patent will have run out long before that happens. Therefore we can't rely solely on private innovation. (This is true in medicine and many other areas where governments regularly invest huge sums into basic research, some of which eventually results in amazing breakthroughs.)

The best example in climate is the 10-year \$US10 billion public investment into shale gas in the US. While it wasn't intended as climate policy, it led the way for a surge in production of cheap gas, which outcompeted a significant part of US coal consumption. Because gas emits about half the CO<sub>2</sub> of coal, the US has reduced emissions more than any other country in the past 10 years.

The evidence created by specialist climate economists for Copenhagen Consensus showed that a substantial increase in green R&D could do much more than any carbon-cutting promises. If we could help innovate the price of low or zero CO<sub>2</sub> energy down below fossil fuels, not only rich Australians but also Indians, Chinese and everyone else would switch. Right now, unfortunately, the world is spending ever less on low-carbon research and development. Since the 80s, spending has slid from 0.06 per cent to less than 0.03 per cent of gross domestic product in the OECD.

There is a compelling case to do a lot more. The Nobel laureates looking at all the evidence for Copenhagen Consensus concluded that we should aim to reach about 0.2 per cent of global GDP — or about six times more than today. This could be funded by a low and moderately rising carbon tax (giving businesses an incentive to cut emissions but not telling them how to do it) and would set us on a pathway to resolving climate change.

On the sidelines of Paris in 2015, Tony Abbott, the prime minister at the time, US president Barack Obama and philanthropist Bill Gates promised to double green energy R&D by 2020 — much less than what the Nobel laureates suggest but at least a start. The government is not living up to this promise: since 2015, Australian investment has fallen from 0.02 per cent of GDP to 0.01 per cent in 2016 and 2017, the latest years for which the International Energy Agency has data.

Investing dramatically more into green energy R&D means we can start looking for lots of solutions. It could mean better solar and wind, combined with batteries. We certainly should research those areas further (rather than erecting masses more inefficient solar panels and wind turbines today). But we also need to focus on exploring fusion, fission, water splitting and many other ideas.

Craig Venter, the biotechnologist and geneticist who led the first draft sequence of the human genome, argues for research into an algae, grown on the ocean surface, that produces oil. Because it simply converts sunlight and CO<sub>2</sub> to oil, burning it will be CO<sub>2</sub>-free. It is far from cost-effective now, but researching this and many other solutions is not only cheap but offers our best opportunity to find real breakthrough technologies.

If we could make alternative technologies cheaper than fossil fuels, we wouldn't have to force (or subsidise) anyone to stop burning coal and oil. Everyone would shift to the cheaper and cleaner alternatives.

Nobody can predict with certainty whether the breakthrough technology will be algae, solar and batteries, fusion or something else altogether. Finding the solution could take a decade or it could take four. But we do know that we certainly won't solve climate change with the current approach of making big promises and investing in inefficiency.

Climate economists for Copenhagen Consensus calculated the returns to society from investing in green energy R&D as \$11 for every dollar invested — more than 500 times more effective than current EU climate policies.

Those who claim we already have a solution to climate change are right in only one sense: - humanity has no shortage of capacity for innovation. It needs to be unleashed.

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