Why De-Carbonise Energy by 2040?

How do we know the planet's warming?
Because there are so many signs, including:

- Shrinking glaciers in every mountain range that has them world-wide:, including Greenland, Antarctic, Himalayas, Rockies, Andes, Patagonia
- Shrinking ice caps north and south: Greenland, Arctic (and again), Antarctic, Bering Sea
- Growing deserts - almost every one world-wide including Sahara, Northern Mexico / Southern USA, China, Middle East which is creating deprivation that extremists exploit, for example in Syria and Yemen as well as mass migration of populations (and again and again and again)
- Rising sea levels (and again)
- Warming oceans pushing fish to migrate and killing corals
- Record temperatures – 9 of the 10 globally hottest years on record were in the last decade
- Increasing ferocity - of storms - world-wide
- Increasing instability of weather patterns such as monsoons and seasonality, world-wide
- Climate changing 10 times faster than all previous natural climate change events
- We're living through the most rapid mass extinction event in the geological record, and deaths of increasing millions of people
- Almost complete unanimity among scientists (~97% of them) that it's man-made e.g. IPCC culling global views, UK's Met Office

The evidence is really overwhelming.

Hasn't the planet warmed before, naturally?
And we need to hit our climate change targets to stop man-made climate change. Yes, the planet has warmed before by more, but never as fast - in a couple of hundred years this time round, as compared with millions of years the previous times. And each previous time has been accompanied by mass extinctions world-wide. We're currently at the start of a mass extinction event, and I really don't want it to pick up speed while I am around. Emissions and the planet dealing with it, and thus planetary heating and cooling, is like two giants balanced on a see-saw: it only takes a child on one side to unbalance it completely – and that's what we're doing.

Migration
Moreover, we think that migration is primarily driven by economic aspirations. In large part it is, but a lot of it (e.g. from the Middle East and the Sahel Belt) it's driven by encroaching deserts, which are driving up warfare and other instability. There are forecasts (admittedly, these are high-end projections long into the future) that by 2100 up to three quarters of a billion people will be displaced by growing deserts and another quarter of a billion due to rising sea levels (this study says 148 million by 2050) – that's enough to overwhelm any country's or continent's border controls. And that ignores those displaced by the increasing frequency of extreme climate events

in America and world-wide. Moreover, that's accompanied by a huge reduction in farmland in some areas (with some compensation elsewhere), hence in food, for the entire world. Even if the numbers are too high by a factor of 2 or 4, I really don't want to risk that for my own selfish reasons, let alone in consideration of the humanitarian tragedies that this would entail world-wide.

How much do we have to limit global warming?
To 1.5ºC by 2050, or the consequences even of exceeding this by half a degree will be dire. And doing this will take a lot of effort, reducing global emissions by ~50% by 2030 and to zero by 2050.

So why de-carbonise energy by 2040?
100% renewable energy is a target for the energy systems by 2040, though if it can be achieved by 2030 (which I doubt), then so much the better. It's important for energy to go to zero because it's possible without additional costs in the overall system, if done properly with good regulation and lots of large-scale long-duration storage (see various other blog posts). This will enable other sectors (e.g. cement, chemicals, plastics) which can't decarbonise as cheaply or as "easily" (I'm not saying energy is easy, just less challenging than other sectors) to continue to emit some greenhouse gases while the economy as a whole meets its climate change targets.

How much will we have to change?
Less than is apparent at first sight.

First, what remains relatively unchanged:

- Travel by road and rail - these can be electrified (or hydrogen-powered) without inordinate cost;
- Trade and short haul flight as it's foreseeable that this will be possible to decarbonise at reasonable cost;
- Powering our homes, industries and infrastructure - ditto;
- Eating the same volume, variety and quality of food - we'll have to change its mix, though, to cut down on (not eliminate) beef, lamb and dairy.

Now, what will have to change:

- Long haul flight will have to be cut (not eliminated), especially for holidays;
- De-forestation around the world, replacing it with sustainable forestry and better land use;
- Transferring resources from hydrocarbon industries to clean technologies, which will not entail greater global expense - just its relocation and an appropriate amount of re-training / re-skilling the workforce;
- Wasteful water usage in places with water shortages;
- Related to the above, we'll have to fight the resistance to change of those who are too comfortable with the status quo politically, industrially or socially.

Yes, but How?
All the following can be done without costing the economy any more than we're currently spending on all the wrong things:

1. Stop subsidising fossil fuels and related infrastructure;

2. Penalise (principally, tax) all climate-hostile activity;
3. Level the regulatory playing field for renewable generation and renewably powered "stuff" by pricing (taxing?) in the costs to the environment;
4. Balance all these taxes with measures to help the poor - and, to some extent, all society, for zero net financial effect zero but incentivise good behaviour;
5. Provide incentives to (maybe firm conditional contracts, maybe subsidies, etc.) not only R&D but also commercial-scale first-of-a-kinds of all climate-friendly technologies - this is a re-direction of existing schemes, not the spending of additional money;
6. Ensure that all infrastructure investment supports a renewably powered / energy-efficient future;
7. Regulate properly, e.g. all new buildings to be net carbon neutral at worst;
8. Adjust the incentivisation of investment and of R&D so as to favour cleanness;
9. Help other countries to develop and industrialise without harming the climate – we had a free ride at the cost of the planet when we industrialised, so it's only fair to share that benefit;

…and with these measures, the economy can keep growing, we can continue to get richer and more comfortable, and the environment can recover.

But isn't this unaffordable?

Some renewable generation technologies (especially onshore wind) are already cheaper than gas; others will be soon. But that's only a small part of the story that looks at the economic viability for the person investing.

The big story is the economic viability for the economy and world as a whole. Here it is fossil fuels that receive much more subsidies, in three broad ways:

1. Overt subsidies and regulatory preferences that support the construction of such plants and their connections to grids (for which, in most countries, renewable generators have to pay) - this is the smallest way.
2. Regulatory bias and covert subsidy: fossil fuelled generators "blackmail" governments by saying that if they are not favoured regulatorily, they will become uneconomic and have to switch off, causing politically disastrous black-outs. Therefore regulators develop mechanisms that keep them in business, costing the economy billions. While this is necessary in the short term, governments and regulators should (but don't) simultaneously put in place the actions that will make them unnecessary in the medium term, like supporting the construction of large-scale long-duration storage.
3. The biggest way is that fossil fuelled generators don't pay for the harm they do to the environment which is evaluated at various levels by various agencies, ranging from $40/tonne to $220/tonne. While these evaluations differ, they have one thing in common: every single evaluating agency is gradually increasing its evaluated costs as the extent of the harm becomes clearer. Even the lower carbon cost makes gas CCGTs (the cheapest fossil fuelled technology) unviable in comparison with most renewables.

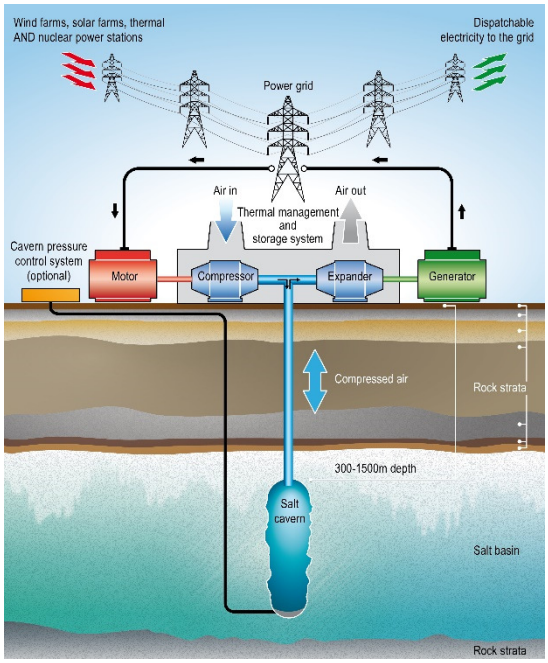
All these mean that it's the fossil fuelled energy, not the renewable stuff, that is unaffordable to countries and to the world.

Grid-scale electricity storage
using an innovative form of
Compressed Air Energy Storage

About Storelectric

Storelectric (www.storelectric.com) is developing transmission and distribution grid-scale energy storage.

- Innovative adiabatic Compressed Air Energy Storage (TES CAES). Our 500MW, 2.5-21GWh installations have zero/low emissions, operate at 68-70% round trip efficiency, levelised cost significantly below that of gas-fired peaking plants, and use existing, off-the-shelf equipment.
- Their CCGT CAES technology converts and gives new economic life to gas-fired power stations, halving emissions and adding storage revenues. Addresses the entire energy trilemma: the world's most cost-effective and widely implementable large scale energy storage technology, turning locally generated renewable energy into dispatchable electricity.



The potential to store the entire continent's energy requirements for over a week; potential globally is greater still. In the future, Storelectric will further develop both these and hybrid technologies, and other geologies for CAES.

About the Author

Mark Howitt is Chief Technical Officer, a founding director of Storelectric. He leads Storelectric's technical and operations, minimising technological risk, maximising efficiency and environmental friendliness, and speed to market. He focuses on technologically simple solutions using proven technologies wherever possible.

His degree was in Physics with Electronics. He has 12 years' management and innovation consultancy experience world-wide. In a rail multinational, Mark developed 3 profitable and successful businesses: in commercialising a non-destructive technology he had innovated, in logistics and in equipment overhaul. In electronics manufacturing, he developed and introduced to the markets 5 product ranges and helped 2 businesses grow strategically.