COP-26 and its results expectations and myths

by Charles Daly

Introduction

As I write on 5th November 2021 we see the start of the COP-26. This is the United Nations conference of participants in the great debate facing our planet in Glasgow, Scotland.

Is global warming a reality and is the target of 1.5^{0}C rise to the planet's average temperature likely to be achieved by 2050?

A lot of expectations have been raised about the outcome of this conference. However, the fact that the atmosphere does not recognise borders means that without full global participation there is no likelihood of this temperature goal being achieved.

Targets and commitments

The target set in Paris at COP 21 was of maintaining a global average temperature rise of 1.5^{0}C. Based on current carbon dioxide emissions being maintained, the temperature is expected to rise by 2.5^{0}C or more. The International Committee on Climate Change (IPCC) have forecast that such a temperature rise will lead to flooding of the lower coastal plains, in areas such as Bangladesh, Egypt and many other river deltas.

Many countries have made commitments to get to net-zero by 2050-2060. India is an outlier at 2070. For the benefit of those who do not already know, net-zero does not mean zero carbon, but no additional carbon. i.e., for each tonne of carbon put into the atmosphere one tonne needs to be taken out.

Whether these commitments will result in action by these countries has yet to be realised. The politicians currently making these commitments will not be the ones to implement them. The unpalatable cost of achieving these commitments and their unintended consequences, will have to be faced by those who succeed them.

The potential for societal disruption looms large and there is no telling what will happen when people are impoverished to meet some challenge that they cannot easily connect to their daily lives.

To try and understand the effects of these targets and commitments I have tried to identify some of the problems that I feel are not being aired with sufficient vigour. Thus, leaving the population of this small planet without a full understanding of the implication.

Electric Vehicles

The current mantra in developed nations is, that the electric battery driven vehicle will reduce global pollution by some 30%, since this is the calculated contribution that road transport makes to atmospheric carbon emission.

The best batteries that we currently have are the lithium-ion (LI) battery. This is because it stores power in a very efficient way and is light in comparison to the historic lead-acid battery. It is not without problems such as flammability and toxicity.

The LI battery requires three primary metals, Lithium, Manganese and Cobalt. All three are rare commodities and are produced from low yielding sources in which they are found. There is a desire to extract Lithium from seawater, however the concentrations of 0.2 parts per million makes the economics infeasible now.

The major problem with Lithium extraction is the effect on the environment. Lithium is an alkaline metal that requires sulphuric acid to extract it from hard rocks or brine. The liquids disposal has caused substantial damage to the environment. The manufacturing processes of lithium, including the solvent and mining waste, present significant environmental and health hazards. Lithium extraction can be fatal to aquatic life due to water pollution and is known to cause surface water contamination, drinking water contamination, respiratory problems, ecosystem degradation and landscape damage. It also leads to unsustainable water consumption in arid regions (1.9 million litres per ton of lithium is required in the extraction process). A massive by-product of lithium extraction also presents unsolved problems, such as large amounts of magnesium and lime waste.

These wastes are sometimes dumped around areas of population., with consequential damage to foetuses, resulting in deformed births and the general health of the populations.

Lithium is found in significant deposits in Argentina, Australia, Canada Congo, Chile and China, with smaller deposits in Brazil and the USA.

EV car batteries require about 10kg of pure lithium per vehicle. Current estimates of production capability is 300,000 tonnes per year. Based on this figure this will produce only 30 million cars per year. This is roughly the car population of the UK.

The other metals that go into making the LiCM battery are Cobalt and Manganese. Both of these metals are found in geopolitically difficult countries. There are similar challenges of extraction and availability with other metals used in batteries, which is leading to rapid technological development, with some metals falling out of favour, resulting in the closure of mining operations.

Nevertheless, if the world believes that the electric car will solve the problems of climate change, they must consider the impact on other parts of the environment. These problems cannot simply be put aside and forgotten.

There is another major issue with LI batteries and that is the recycling thereof. Currently only 5% of batteries are recycled.

Power demand

Another aspect of the EV revolution is the conversion of liquid hydrocarbon derived power, to electric power. The mathematics may have been addressed in academic papers but it is certainly not mainstream discussions on the front pages of the newspapers or social media feeds.

I have made some calculations of the size of this switch as it relates to my country, the UK.

In the UK, our government have committed to meet net zero by 2050 and towards reaching this goal are stating that they will ban the sales of ICE (internal combustion engines) powered vehicles by 2030.

Here are the simple numbers from my equations.

Number of cars in the UK, 31.6 million, average mileage, 12,000, average speed 45 mph, average engine size 6Kw.

Total 65,611 TWH (terawatt hours) of demand. This is equivalent to 8 (800MW) new gas fired power stations or 2 x 1,325 MW Hinkley Point sized nuclear plants.

Another commitment is to ban the sales of gas fired water boilers from 2025. Again, here are the numbers.

Number of homes in the UK 28.1 million, average consumption of the pump and compressor, 1.5 KWH per heating day. Average number of heating days 120, Total demand netting out the saving in gas burning is **about 15,000MWH or the equivalent of 5 additional nuclear power stations.**

We are given the impression that all this power is going to be provided by wind and solar and other renewables.

However, since wind and solar are intermittent, we will need to build large scale power storage capability. At present this is only feasible with LI batteries. These are huge batteries the size of a football pitch.

There is another consideration that, in my opinion, has not been aired sufficiently and that is the transmission and distribution lines that will need to be built to accommodate all this power.

These lines demand copper. Copper yield from ore is around 3% from the most efficient mines.

These copper mines are enormous scars on the environment. Here is a picture of one mine in Chile.

This is effectively the top of a mountain being gouged out. The world is going to need a number of these mines if we are to increase electricity transmission lines to accommodate the demand for EVs.

The problem is that as EVs become fashionable they will be demanded. A bit as SUVs have become to car of choice. However, the buyers will have no idea as to the consequences their purchase.

The other problem is that the old cars they will replace are likely to end up in the developing world, where proper maintenance is unaffordable and the result will be increased particulate pollution.

Aviation and Marine

Aviation contributes 3% to the CO_2 emissions and the shipping fleet just 2%. However, both these industries have been targeted as they are very visible. There is a burgeoning industry developing sustainable alternatives for both sectors. For Aviation, there is Sustainable Aviation Fuel or SAF. For the Marine sector, there are multiple alternatives, including green methanol, green ammonia, and in the short-term, LNG as well as renewable alternatives to Marine Gasoil or Fuel Oil. There is no single, simple short-term pathway and both industries have to contend with expensive asset investments on around 30-year replacement cycles. The challenge is – what technology to invest in?

The marine industry has a better chance of decarbonisation as ultimately there is always wind power. Up to the mid-19th century we relied on wind powered clipper ships to carry the world trade. There is absolutely no reason why we cannot do it again, albeit with more modern technology. It might make goods a bit more expensive, but that may be a low price to pay compared to the cost of EVs and Heat pumps.

Batteries and energy storage

If we are to truly move away from hydrocarbon powered electricity generation then we need to accept that we need storage to cope with the intermittent nature of wind and solar power.

This is no different to the storage of liquid petroleum products to act as a buffer to disruption to the supply chain. These currently exist at the major oil hubs of the world. As these storage installations become redundant, due to the shift away from oil, then they could serve as the base for batteries and other storage systems, such as liquid hydrogen and nitrogen.

However, in order to do this, there has to be an incentive to these storage owners to invest in the changeover.

One of the technologies that I have seen, is the development of a turbine driven by liquid air. This technology makes use of low cost electricity at night to liquify air. The air is stored in tanks and then can be released to drive a turbine when demanded by the grid. The problem for such investments is that they need to be paid for as an insurance premium for their standby facility, rather than relying on high prices for electricity at undefined times when the grid calls.

Being somewhat conversant with the economics of oil storage installations, I know that unless an installation is paid for its capacity to store, rather than the actual amount stored, it cannot survive.

Land Use and agriculture

In the search for sustainable solutions to replace fossil fuels, there have been plenty of casualty business models. Changes in land use has been one of the hottest topics. The early biofuels industry was successful in developing fuels that could be blended (within specification limits) into conventional gasoline and diesel. A win? Only a partial one.

The unintended consequence of this was competition between food and fuel for land use. What was overlooked was the sheer scale of land use required to produce a significant quantity of biofuels. The regulators are now addressing this and the latest round of obligations for Europe includes a “crop cap” to limit the competition. What this dilemma has nevertheless revealed is that there cannot be a complete solution from the first generation of biofuels.

The big challenges that this raises, are firstly, what are going to be the leading technologies for second generation biofuels, and secondly, what will the feedstocks be? The regulations can have unintended consequences. First generation biofuels (as well as the food and cosmetics industry) spawned massive scale production of palm oil, with the well-known consequences of deforestation. Now the search for second generation feedstocks has encouraged interest in palm oil mill effluent, which is ironically the product of inefficient palm oil milling.

The production of ethanol for gasoline blending carries similar dilemmas. On the one hand, increasing the percentage of ethanol in gasoline would seem a logical move – double the percentage, equals double the reduction in fossil fuels. However, ethanol is also challenged with issues of land use conflict and land degradation. The crop cap is intended to mitigate this.

Carbon Cap and trade systems universally

I and many others believe that to achieve a balanced approach to global decarbonisation we must provide incentives to investors to develop technologies to make it work. I do not think that leaving such investments to governments will ever work, and even if it did work it would be in the most inefficient form.

A Global cap and trade carbon mechanism is reliable and workable and has already been tried. However, there are a number of carbon trading systems around the world, which is not a recipe to achieve our targets. We need to have a standardised mechanism that all nations adhere to. At the moment the various carbon pricing systems throw up price differences from as low a as few cents a tonne to $142 per tonne.

Conclusions

Having covered a lot of detail above, I regret to say that I do not have high hopes for a global agreement on the solution at COP 26, given that China, Russa and S. Arabia have not deemed the conference sufficiently important to send their heads of state. Without these three and India, any effort by the EU and the USA will be in vain, as the emitters will be the winners in the end.

We also note that India, China, Australia and the USA have not signed up to the pledge of shutting down all their coal burning systems. So much for global cohesion.

The calls by the eco warriors to the financial institutions to cut off funds for the search and production of fossil fuels, which has been agreed by over 100 banks and financial institutions, will be counterproductive, as the alternatives are too expensive compared to hydrocarbons and this will impoverish those who make the effort and allow the emitters to gain the upper hand economically.

The EU is talking about a border adjustment tax, based on the carbon footprint of imports. The main rationale is to protect European industries from the full force of competition; however, the reverse might be true. The tax will not be paid by the emitters, but by the European consumer and the European companies are still likely to favour outsourcing their industries to cheap energy based economics.

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- Chairman and founder of Channoil Energy. Served in Supply, refining and operations with BP, Ultramar.
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