

Development Paper August/September 2021

A short report from Chair of Air Quality People's chamber, Professor Reza Ziarati to COP26 Working Group

Energy cannot be produced or destroyed but can be transformed from one form into another.

Higher temperatures have negative effects and the higher CO₂ emissions the higher the atmosphere's temperature. We need to bring CO₂ emissions to Zero if the global atmospheric temperature is to remain unchanged.

We have two choices, either stick to transport issues or go to the core of the problem namely, what it takes to containing the global warming within 1.5 degrees. The CO₂ is still rising and global warming is getting worse.

As with Covid, climate change challenge should start with Challenging the UN Paris Accord Climate Emergency to contain global warming within 1.5 degrees so the challenge is clear. Now that we know what the challenge is we must start from the science based facts from which we, as Engineers, will determine the appropriate solutions. It is suggested that Engineers may identify the appropriate solutions, but governments and businesses – hopefully with the concurrence of local councils, parliaments and people - will determine the adopted solution.

Further more, like the pandemic the solutions will only be successful if the whole society is helped to understand it and fully want to engage. A great example is the symbiotic relationship emerging in the USA on both these global challenges with progressive people power in tandem with progressive business and government.

It could be said the quickest and cheapest way to transition towards achieving the 50% carbon reduction by 2030 climate emergency on the road to net zero is leadership from government complemented locally by public, private and third sector local partnerships.

It should be noted that the progressive governments are convinced and the UK 2014 Road Map to a Brighter Future strategy is a good policy. What is now the game changer is the election of a US President, Senate and Congress majority implementing this as opposed to the Trump sabotage.

Our research (C4FF) shows that to achieve the UK 2014 Road Map to a Brighter Future, it is imperative to replace all of the fossil fuels we use with clean, green energy for power, heat and transport which is now commercially competitive. Carbon reduction requires the combination of energy/resource efficiency together with generating 100% of clean green power, heating and transport fuel which this project can contribute to including reducing carbon in the local environment with adverse impact on the people's quality of life as well as reducing premature death and morbidity which have a costly impact on the health system (NHS in the UK).

Capacity of building of local communities to help them develop, implement and sustain their solutions should be an important consideration.

It is imperative to help popularise the science of the climate emergency along with the range of clean green solutions essential for citizen and community engagement. Regular forums and knowledge exchange, collaboration and partnership across all civil society organisations are essential. Particular attention should be given to school students using the STEM curriculum including using the school building for them to undertake not only solar mapping but what else is required to make their school zero carbon.

It has to be appreciated that reducing the use of fossil fuels in power stations will greatly reduce emissions and will ease the pressure on the transport system.

Furthermore, we are currently driving around with a 5% Ethanol blend in our petrol, right now; the EU target is to get that up to 10% when they can make enough; and diesel is 7% Bio-Diesel made chemically from rapeseed, sunflowers and so forth. Most of the UK's ethanol is imported, mainly from the USA, because we are so 'over populated' here that we cannot grow enough food, never mind grain for ethanol on top; this is called the 'fuel vs. food problem'. In the USA, something like **10%** of the total 'grain' (maize) crop is now turned into ethanol fuel.

Issues relating to transport

The average price of Electricity in the US dropped from \$2.5 in 1900 to \$0.1 in 2020 (\$ per kWh at 1990 prices). In fact the average price of electricity has dropped rapidly in the Western world and in many countries worldwide, albeit not at the same rate as in the West. Yet, global carbon emissions from energy transformation have gone up from Zero in 1850 to almost 35 Gigatonnes in 2020. There has been almost an exponential rise in CO₂ levels which is alarming. 26 billion tons of CO₂ per year; more tons/person in the West/the developed world and a lot less tons/person elsewhere, on average 5 tons per person worldwide. This is unacceptable.

The CO₂ emissions are directly proportional to world population (P), CO₂ per unit energy (C), Services per person (S) and Energy per service (E), namely: $CO_2 = P \times S \times E \times C$. If P goes up S will go up too but although E may drop and this may lead to a lower C, the anticipated increases in population and current upward trend for a greater need for services would mean huge increases in CO₂. So far CO₂ levels have not been falling and we need a miracle to reduce CO₂ levels to maintain a safe global temperature.

There are no easy solutions. Wind, Solar and Hydrogen have huge problems of transmission and storage but the cost of transformation of free wind and solar energy to clean and usable energy is falling. One solution could be Nuclear and use of small, safer and highly efficient units spread over the globe rather than a few numbers of huge power plants. In any case, Nuclear energy has its problems of cost, safety and long term storage. Another partial solution is carbon capture and its storage which poses serious engineering challenges of affordable cost, suitable locations and long term stability.

One method suggested by C4FF was conversion of wind energy to potential mechanical energy (Reza's Coil) and its storage. This one potential area which can have a huge potential as it removes the storage problem of wind energy.

On electrical energy all the batteries on earth can store about 30 minutes of the world's energy needs. There is a great deal about cars. Toyota which is the world's largest automakers, this week, reiterated an opinion it has offered before. That opinion is straightforward: The world is not yet ready to support a fully electric auto fleet. Just 2% of the world's cars are electric at this point. There are 289.5 million cars just on U.S. roads as of 2021. About 98 percent of them are gas-powered. Toyota selling 81% of its cars in the US warns that the grid and infrastructure simply are not there to support the electrification of the private car fleet. A 2017 U.S. government study found that we would need about 8,500 strategically-placed charge stations to support a fleet of just 7 million electric cars. That's about six times the current number of electric cars but no one is talking about supporting just 7 million cars. We should be talking about powering about 300 million within the next 20 years, if all manufacturers follow GM and stop making ICE cars. 300 million cars is still a drop in ocean and who is here in 20 years time.

There is no free lunch. Electrifying the auto fleet will require a massive overhaul of the power grid and an enormous increase in power generation; hence, the reason for success of Hybrid. Read award prize winning and given a national diploma award Ziarati (1995) paper to know why the time for hybrid vehicles is with us - http://www.c4ff.co.uk/history/papers/Emerging_transportation_system.pdf .

I believe the Government is saying the right things and doing a great deal of good, however the problem is that of strategy. We need to set up a strategy for most sustainable means such as reducing energy demand by reducing consumption and energy use followed by energy efficiency and utilisation of renewable and sustainable resources. Logic also dictates that the focus should be on the least sustainable means such as utilisation of other low GHG-emitting resources as well as utilisation of conventional resources. The methodology in treating raw data on air quality and presenting it also is a cause for concern. We should pay greater attention to producing evidence; currently, there are a number of factors being used to amend raw air quality data which defies logic. Using and reporting on raw data from the diffusion tube measuring NO₂, for instance, are cases for serious consideration. DEFRA officials and Ministers including the Secretary of State overseeing the work of DEFRA are aware of my views on this subject.

The Policy Paper on Clean Transport, the Environment Bill, the draft industrial strategy report and work on an innovation strategy as well as DEFRA's three identified research ideas are all a way forward but several key points are worth being considered. I have already given my views to senior ministers in the Government on these key issues.

We must all do whatever we can to save our planet for the next generation. The role of any advisor should be to explain the fundamental Engineering and Scientific truth with the hope to enact better policies. I have some doubt about current AQEG to have sufficient and over embracing expertise of the realities viz., CO₂ emissions are still rising and global warming is getting worse. Particularly considering that the Government is not meeting its own air quality targets and yet intends to adopt WHO levels for key pollutants. The future is stark and this is why I am showing interest

RZ Solutions:

- A major programme of reducing car journey and encouraging modal shifts from cars to bikes and from air to rail.
- Electrification of the rail and re-use of existing tracks and development of massive rail tracks for the expansion of the rail.
- Massive installation of solar panels on flat roof tops, car park and so forth.
- Continuation with wind turbine installation including R&D on more efficient units such as C4FF's twin bladed wind turbines.
- Massive investment in tidal and wave energy.
- Switch to hybrid propulsion system to counter air quality in cities and towns.
- Discourage the use of LNG until means have been found to reduce Methane emission some 100 times worse of CO₂ with regard to its impact on global warming.
- Encourage local small highly efficient nuclear power station using U238.
- Reconsideration of using Ammonia for larger propulsion systems and use of Ethanol and Methanol in Internal Combustion Engines.
- Apply RZ's Coil (Inertia wheels) to wind turbines to store energy.
- Encourage local stakeholder collaborations.
- Involve schools in climate change projects see attached IMechE Midland examples.
- Invest in invention and research in energy efficiency and technologies to reduce emissions of harmful pollutants.