Nu Carbon Climate Change Premise Paper

How to Achieve Deep Decarbonization Without Causing a Global Economic Depression?

By Erfan Ibrahim, PhD, Advisor to NuCarbon, LLC

Background:

The global Climate Science community has concluded that carbon dioxide emissions from human activities are the largest contributor to greenhouse gases causing climate change on earth. Fossil fuels and industrial activity account for 2/3 of total global emissions of carbon dioxide (28 billion tons per year). The current atmospheric content of carbon dioxide at 409 PPM is growing by about 2 PPM per year. The climate change models predict catastrophic weather beyond 450 PPM carbon dioxide in the earth's atmosphere. Based on the current trends, we can reach that break point within 20 years. If the global fossil fuel consumption and industrial activities keep growing to meet the needs of developing countries and rising world population, that 20-year period could be cut short significantly. If the world's water bodies start releasing carbon dioxide because of global warming instead of absorbing it, we can reach 450 PPM within 10 years or less.

Motivation:

Something drastic needs to be done to reverse this dangerous trend in atmospheric content of carbon dioxide before catastrophic weather patterns destroy the global economy and life as we know it. This is a strong motivator for action. The question is – what can we do that is based on scientific logic and informed by the economic realities in which we live?

Some renewable energy advocates have suggested that if we make massive investments in energy efficiency and renewable energy (solar, wind, hydro, and electric storage) immediately we can reduce the carbon footprint of human activity to the point where we can stop the increase of atmospheric carbon dioxide content or even reverse it. The challenge with this recommendation is that is fails to address four uncomfortable economic and scientific realities:

1. 80% of primary energy use in the world today comes from fossil fuels.
2. There are trillions of dollars of invested infrastructure in fossil fuel-based power generation and industrial processes that has not reached end of life.
3. The demand for raw materials to fabricate the solar, wind and electric storage infrastructure to meet global energy needs will exhaust the supply of many precious and semi-precious metals and other

minerals in short supply (not to forget the carbon footprint associated with the mining, processing, and transportation of these raw materials).

4. In the absence of sufficient electric storage, the intermittency of solar and wind power will force natural gas peaker plants to remain in operation to provide ancillary services to meet customer demand to maintain a stable electric grid (locking in permanent carbon footprint).

The nuclear industry is advocating building several Gen III and Gen IV nuclear power plants globally to reverse the trajectory of atmospheric carbon dioxide content. While this is a good idea in principle, the time frame to build and commission enough nuclear power plants to offset the increase in carbon dioxide emissions from fossil fuel plants and industrial activity globally is too long to have any real impact for the short time left. The economic price for such a change is not practical in a world coming out of the COVID-19 pandemic.

The key conclusion from these observations is that:

- real impact on the carbon footprint from human activity in the short run is only possible if something were done to capture and recycle the carbon dioxide from the fossil fuel plants and industrial processes before they are released into the atmosphere.

Two additional opportunities exist to further reduce the atmospheric content of carbon dioxide:

- using pyrolysis to trap the carbon dioxide and other greenhouse gases from organic waste that would normally be released into the atmosphere from composting and decay in farmlands and landfills.
- direct air capture of the carbon dioxide from the atmosphere.

The world emits 42 billion tons of carbon dioxide per year from human activity. The volcanoes and other natural events release another 1 billion tons per year of carbon dioxide into the atmosphere. The trees and oceans are absorbing about 28 billion tons of carbon dioxide per year. The net increase of carbon dioxide in the earth's atmosphere is about 15 billion tons per year (~ 2 PPM). If 2/3 of the 42 billion tons (28 billion tons) of carbon dioxide that is coming from fossil fuel and industrial activity is captured and recycled, there will be a net decrease of 13 billion tons (15 billion minus 28 billion tons) of carbon dioxide in the earth's atmosphere each year (~1.73 PPM per year). The capture and recycling of carbon dioxide and other greenhouse gases from pyrolytic organic waste remediation and direct air capture will make the carbon dioxide content in the atmosphere decrease even further to avoid catastrophic climate change.

Recommendation

A global campaign to sequester the carbon dioxide from fossil fuel plants and industrial processes combined with pyrolysis of organic waste and direct air capture of carbon dioxide from the atmosphere can collectively reduce the carbon content of the earth's atmosphere to mitigate the effects of climate change in the 10-year time frame without excessive expenditures and disruption to the economy. All the technologies to accomplish this feat exist today. It is simply a matter of will and action to make it happen. An integrated approach for doing all 3 will prove to be far more energy efficient and cost effective than doing them separately.

Additionally, the high value carbon-based products from these 3 processes (biochar, charcoal, carbon black, synthetic liquid fuels and synthesis gases) will create a manmade carbon cycle alongside photosynthesis of plants to recycle some of the atmospheric carbon dioxide to ensure long term climate stability. This is a much better alternative than largescale carbon capture and sequestration – a costly and potentially risky option.

Benefits of Recommendation:

The 3-prong carbon dioxide capture, and recycling strategy described above protects the current energy and industrial process infrastructure investment, gives developing nations more time to move to cleaner and more efficient energy sources and processes and gives the nuclear, solar, wind, hydrogen, and storage technologies more time to develop to replace fossil fuels reliably and cost effectively. Additionally, there are several cutting-edge carbon-based technologies under development that can convert the captured carbon dioxide into high value products such as carbon fiber and carbon nanotubes. This will reduce the dependence on graphite mining and create new economic opportunities in multiple industrial sectors globally.