Net Zero by 2050- Hurdles to a distant dream

The Net Zero concept is an initiative aimed at mitigating further environmental damage by rapidly reducing global greenhouse gas emissions. This is achieved through a dual approach: transitioning to renewable energy sources and leveraging Carbon Capture, Utilization, and Storage (CCUS) technologies to prevent emitted carbon from escaping into the atmosphere. Unlike the more stringent Zero Carbon Emissions goal, which requires absolute nil carbon emission, Net Zero is considered more feasible and realistic by experts. In the Net Zero scenario, emitted carbon is captured and utilized, effectively balancing out the emissions.

World Electricity Capacity in GW				
	2022	2030	2040	2050
Renewables	3,629	11,008	11,008	30,275
Nuclear	417	541	541	916
Hydrogen & Ammonia		129	129	427
Fossil fuel with CCUS	0	50	50	241
Unabated fossil fuels	4,535	3,423	3,423	892
Battery Storage	45	1,018	1,018	4,199
Total Capacity	**8,626**	**16,169**	**16,169**	**36,950**

Credit Bloomberg

A useful analogy to understand Net Zero is to imagine a tap filling a basin with a closed drain cock. When the drain stopper is opened, allowing water to drain at the same rate as the tap fills the basin, the water level remains constant. Similarly, in Net Zero carbon emissions, the existing carbon in the atmosphere is stabilized, and further emissions are offset by capturing, storing and even cycling carbon dioxide back into the soil. This approach ensures that the carbon footprint remains neutral, without further contributing to atmospheric pollution.

To combat climate change, the Paris Agreement sets ambitious targets: reducing carbon emissions by 45% by 2030 and achieving Net Zero emissions by 2050. Meeting these deadlines is crucial to

limiting global warming to 1.5 degrees Celsius. According to Bloomberg data, experts have outlined a roadmap to reach this goal, taking into account the projected global energy demands over the next 26 years. This requires a fourfold increase in electricity production, with renewable energy sources tripling, nuclear energy doubling, and battery storage technologies growing by a remarkable 100-fold. Additionally, electricity generated from fossil fuels with Carbon Capture, Utilization, and Storage (CCUS) technologies must expand from scratch to over 200 Gigawatts.

While these targets appear promising on paper, achieving them will be a daunting task. The transformation of existing technologies into new ones within the next 25 years will require a fundamental shift. Experts consider this feat achievable, but politico-economic complexities on the ground may hinder progress. Ultimately, individual countries must develop strategies to meet these goals, making the journey ahead both challenging and uncertain.

For instance the transformation of the automobile industry through battery storage is underway, but its impact varies greatly between developed and third-world countries. While developed nations are embracing this change relatively smoothly, third-world countries face unique challenges. Battery technology remains expensive and limited, with high-end lithium-ion batteries in electric vehicles (EVs) offering a range of only 200-320 miles on a single charge, compared to an average priced gasoline-driven car's 400-mile range on a 40-liter tank. Moreover, the shift from complex gas-driven cars to simpler modular EVs threatens significant job losses in the automobile sector, which could be devastating for third-world economies.

Furthermore, current battery technology is only suitable for surface transport, with the industry still struggling to develop compatible solutions for massive airliners and military vehicles. The military, in particular, is likely to remain reliant on oil to power its high-performance engines across land, air, and sea, due to the limitations of existing battery technology.

Estimates suggest that integrating Carbon Capture, Utilization, and Storage (CCUS) units into thermal power and gas-powered electricity production plants will significantly increase costs. Without delving into technical specifics, it's generally agreed that attaching a CCUS unit to a 1 Megawatt electricity-generating unit will raise production costs by 30%. Additionally, a further 40% increase is required to account for sequestering or recycling the captured carbon dioxide.

The question isn't whether CCUS is necessary, but rather whether third-world countries can afford to invest in such technologies.

In comparison, setting up a 1 Megawatt Solar Power Plant can cost around half a million dollars, while a nuclear power plant with the same capacity can cost approximately 1.7 million dollars. Nuclear plants offer the advantage of providing continuous electricity generation, unlike solar units which require battery storage for night time use, adding to the overall cost burden.

An October 2023 paper by the International Monetary Fund highlights that achieving net zero emissions by 2050 will require substantial climate mitigation investment in emerging market and developing economies, which currently produce about two-thirds of global greenhouse gases. According to the International Energy Agency, these countries will need approximately $2 trillion annually by 2030, primarily in the energy sector, to meet this ambitious target. This is a significant increase from the current $400 billion allocated for climate investments over the next seven years.

The IMF notes that while public investment in this area will increase, it will be insufficient on its own. The private sector will need to contribute at least 80% of the necessary capital for the transition to green technologies. The paper also points out that, while larger emerging economies like China have

sufficient domestic financial resources, many other countries lack the developed financial markets needed to secure large-scale private funding. Additionally, attracting international investors is challenging because most major emerging market economies and nearly all developing countries do not have the investment-grade credit ratings that institutional investors typically require. Few investors have experience in these countries and may not be willing to accept the higher risks involved.

The Paris Agreement's goal of achieving Net Zero by 2050 takes into account the limited capacities of third-world countries to adopt new technologies for climate change mitigation. However, it may not have fully anticipated the strong resistance from the powerful fossil fuel industry, which has vested interests in maintaining the status quo. These companies, with annual revenues surpassing the GDPs of many global south countries, wield significant influence. Moreover, entire nations, particularly oil producing ones, have geopolitical interests that could undermine efforts to combat climate change. Ultimately, the collective political will of global leaders is crucial to achieving this goal. As humanity stands at a precipice, the only way forward may be a unified commitment to change course so as to reverse the devastating effects of climate change and forge a sustainable future.