

Here's the “steam engine” of the 21st century

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Sudipto Mundle

The shift to green hydrogen will sharply reduce CO2 emissions, but it is not carbon neutral and certainly not carbon negative.

Green hydrogen and new carbon-capture technologies could do for the 21st century what the steam engine did for the 19th.

We are living through difficult times. The horizon looks gloomy on both the economic and the political fronts, even more so globally than within India. However, limiting this column to the economic front, there are reasons to expect that a promising future lies beyond the gloomy horizon that faces us in the immediate future.

The economic outlook on the home front is a policymaker's nightmare: declining growth combined with high inflation. Stripping away the base effect that has driven high growth in the first quarter of this year (Q1 of 2022-23) reveals that the economy is actually on a sub-5% growth path. However, without sustained long-term growth of 7-8% our massive backlog of unemployment and under-employment is only going to get worse.

Drawing on an interesting parallel between the period 1998-2002 and 2016 -2022, Chief Economic Advisor V. Anantha Nageswaran has argued in a column in *Mint* on 18 October (bit.ly/3MM0N1a) that now, as then, the growth-stimulating effects of significant structural reforms have been muted by repeated shocks. He assesses that as the effects of the shocks wane, the lagged impact of these reforms will drive up India's growth to over 6%. If external demand turns favourable, growth could even exceed 8%, as during 2003-2008.

The reference to external demand conditions necessary for sustaining 8% growth is key. Based on the latest World Economic Outlook of the International Monetary Fund (IMF), T.N. Ninan pointed out on 15 October in *Business Standard* that during the 2001-11 period of record 8-9% growth in India, its growth was actually lower than the average for all developing and emerging market economies. In other words, India grows exceptionally fast when the world is also growing exceptionally fast. Thus, achieving our aspiration of growing at 8% or so will depend critically on the state of the global economy.

So, what is the global economic outlook? In the short-term, the world is headed for stagflation, a sharp dip in growth this year—even recession in some advanced economies—

along with high inflation. But the important question is what lies beyond this gloomy horizon? In my view, the long-term global economic outlook will largely depend on what happens on the climate front. Global warming has been rightly described as the greatest threat being faced by humanity.

The narrative on this subject has been dominated by the frightening consequences of average global temperatures rising beyond 1.5° Celsius. But the lay public is not much aware of the phenomenal technological progress that has been achieved in combating global warming. Essentially, the problem has been ‘cracked’, as they say, but the deployment of these new technologies is just starting. Two technologies in particular stand out, production of green hydrogen and CO₂ capture from the air.

The use of renewable energy sources is growing at an unprecedented pace. But fossil fuels emitting CO₂ still account for 85% of total energy consumption, the root cause of global warming, and that share is rising. Green hydrogen is the technology to address this challenge. It refers to hydrogen produced through electrolysis of water using renewable power. Though hydrogen is widely used in industrial production, use of green hydrogen is just starting. With the cost of green hydrogen production declining from \$6/kg in 2015 to an estimated \$3/kg by 2025, new investments are underway on a massive scale in 25 countries across the world to switch to green hydrogen. The fuel will be used in a wide range of industries including steel, cement, ammonia for fertilizers, home cooking and heating, heavy-duty transportation such as trucks, shipping and air transport, power generation and blending with natural gas. The market for green hydrogen, barely worth \$900 million in 2020, could grow to over \$1 trillion by 2050, according to some estimates.

The shift to green hydrogen will sharply reduce CO₂ emissions, but it is not carbon neutral and certainly not carbon negative, which is what is required to combat global warming. There is now a race among competing technologies that capture CO₂ from industrial emissions or from the air and break down and convert the molecule for use in products such as fuels, plastics and other polymers, building materials, etc. Perhaps the most promising of these technologies are those which synthetically reproduce the natural photosynthesis process of plants and improve upon it to directly consume CO₂ from the air for useful applications. These technologies exist, but need to be refined and scaled up massively to eventually reduce the CO₂ in the atmosphere. Direct carbon capture is again a startup industry with a market of less than \$1 billion. But it is expected to grow to \$550 billion by 2040 according to some estimates.

Clearly there is still a long way to go. The road map is clear and the required technologies

are now available for green hydrogen and CO2 capture, which can be further refined. The challenge is to mobilise the huge investments that will be required globally to deploy these technologies at sufficient scale to arrest and eventually reverse global warming. The huge investments required for the worldwide deployment of these technologies could set off a new investment boom and a new wave of other product and process innovations which could drive a new phase of high global economic growth. Green hydrogen and CO2 capturing technologies could do for the 21st century what the steam engine did for the 19th century.

These are the author's personal views.

Sudipto Mundle is chairman, Centre for Development Studies.