Indian innovation and our commitment to climate goals

March 24, 2022, 5:23 PM IST **Prof Rishikesha T Krishnan and N Dayasindhu** in Voices, Economy, TOI

Energy transition and climate action are important facets of *Amrit Kaal* detailed out in India's budget 2022-23. These are a natural corollary to India's commitments to climate goals and sustainable development made at the Glasgow COP26 summit. By 2030, India has committed to take its non-fossil energy capacity to 500 GW, meet 50 percent of its energy requirements from renewable energy, reduce the total projected carbon emissions by one billion tonnes, reduce the carbon intensity of its economy by less than 45 percent. India proposes to achieve the target of Net Zero by 2070.

What is the role of innovation in India in achieving these targets? And, how can India harness its innovation capabilities in this direction?

At a high level, the role of innovation is already laid out in Article 10(5), of the United Nations' Paris Agreement to which India is a signatory: "Accelerating, encouraging and enabling innovation is critical for an effective, long-term global response to climate change and promoting economic growth and sustainable development."

India's steady climb up the ladder of the Global Innovation Index rankings gives confidence that India is in a position to make significant contributions to this endeavour.

Achieving our climate goals will require both improvement of efficiencies in the existing technologies we use as well as substitution by new technologies.

Efficiency improvement

Currently, more than 70 per cent of our electricity is from coal-based thermal power plants. A report by The Council on Energy, Environment and Water gives us a glimpse of the inefficiencies in our thermal power plants. The efficiency at which energy embedded in coal gets converted into electrical energy in Indian thermal power plants is 29.7 percent. Most of the thermal power plants in India are in the 'sub-critical' category that typically has an efficiency of about 34 percent. The most efficient 'ultra-supercritical' thermal power plants have about 43 percent efficiency.

According to a trade report, Japanese thermal plants have the best efficiency in the world at about 41.6 percent followed by China at 38.6%. The USA whose thermal plants are relatively old "sub-critical" and "super-critical" units have an efficiency of about 37.4 percent. As a medium-term transition, we hope to see more 'supercritical and 'ultra-supercritical' power plants in India replace those that are 'sub-critical'. We should aim to modernize our thermal plants on a priority and aim to achieve a 35 percent efficiency in the medium term.

The Government of India's Department of Science and Technology is supporting research on clean coal technologies including an advanced 'ultra-supercritical' mission that aims to improve the efficiency of existing thermal plants. But, such investments in improving energy efficiency in thermal plants are unlikely to happen as long as the power sector faces significant financial challenges. Policy innovation to address the chronic financial woes of state-owned discoms should be a priority of the government.

Policy Innovation

Innovation is also required in the policy-making process. We need to be careful to take national decisions at a system level, cutting across ministerial silos. As is well recognised, a shift to electric vehicles may remain a local optimization of a reduction in consumption of oil and fuels and reduced automotive emissions, and not a national level optimization unless we move to a greener energy mix.

Such a systems view must also take into account the unintended consequences of policy decisions. We recently witnessed a global shortage in urea and related fertilisers arising out of a policy-driven change: the move of Germany and other European companies to renewables led them to depend more on natural gas to meet short-term energy gaps; this led to a higher demand for and shortage of natural gas leading to higher prices and reduced availability which affected urea production, and hence food output. Innovation in policy-making and governance will be important to anticipate such challenges and to be prepared for them.

Technology development and commercialization

Support for scale-up and commercialisation to Indian companies and agencies that have demonstrated promising technological solutions both for improvement of existing processes as well as substitutes needs to be strengthened. Processes like gasification are more thermally efficient and cleaner processes to convert the energy content of coal into electricity, hydrogen, clean fuels, and value-added chemicals. Recently, IIT Delhi and Thermax collaborated to pilot an indigenous gasification plant to convert high ash content coal to methanol. Log 9 Materials, which has its origins in IIT Roorkee, has developed electric two-wheeler and three-wheeler batteries that charge in about 15 minutes and 30 minutes respectively compared to about 1.5 to 5 hours for other batteries in the market. These batteries have a cycle life of about 15 years which is much longer than that of other batteries in the market. Tata Steel is conducting trials of a new process where they are injecting coal bed methane gas into a blast furnace. Not only does this use methane, but it is also the equivalent of reducing about 33 kg of carbon dioxide per tonne of crude steel produced. Pune-based Praj Industries has developed internationally-competitive, environment-friendly biofuels.

While the government already has the Technology Development Board for such support, there is a pressing need to set up an end-to-end programme for research, development and commercialisation of energy-efficient and environment-friendly technologies. We already have a blueprint in the form of the Department of Biotechnology's BIRAC which has created a strong platform in the biotech sector. BIRAC has schemes to support different types of organizations (academia, research institutes, individual inventors, start-ups and established companies) at different stages of the innovation lifecycle.

Acquisition

The good news is that we now have Indian companies that have the resources and capability to buy out technologies and companies with promising technologies globally and commercialise these efficiently. For example, Reliance is building a portfolio of technologies in renewable energies that include solar, batteries, and hydrogen through buyouts or partnerships with global leaders in energy technologies. Reliance has bought REC, a company specializing in polysilicon, photovoltaic cells, and modules. They are partnering with Ambri to develop and commercialize liquid metal batteries. They are also partnering with Stiesdal for technology development and manufacturing of electrolysers for large-scale industrialization of hydrogen production. More such buyouts and partnerships are in the pipeline. Reports indicate that Reliance is targeting 100 GW solar energy manufacturing and bringing green hydrogen costs to about USD 1 per kg by 2030. According to the EU, green hydrogen produced with renewable resources costs between USD 3 and 6.55 per kg now. Reliance plans to spend USD 10 billion on the green energy business over the next three years.

Perhaps the most interesting of Reliance's technology buyouts so far is Fardion, a company that specializes in sodium-ion batteries. These batteries do not use lithium and cobalt which are the mainstays of the currently prevalent lithium-ion batteries. This has strategic importance since India depends on external sources for lithium and cobalt. While the energy density of sodium-ion is not yet on par with lithium-ion batteries, this is improving. Sodium-ion batteries are expected to be used in applications like large-scale energy storage.

Initial reports suggest that the Government's PLI scheme has been successful in attracting major investments in the 13 designated sectors. Of these, only one is explicitly linked to the energy sector and is focused on high-efficiency Solar PV manufacture. Some new PLI schemes may be helpful to support large-scale commercialisation of emerging energy-efficient technologies and these would be a useful complement to the BIRAC-type scheme suggested above.