**Renewable energy**

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T H E importance of Pakistan`s energy transition from traditional carbon-based sources to renewables cannot be overemphasised. As one of the countries most vulnerable to climate change, Pakistan needs to prioritise drastic energy generation and consumption choices.

Such a transition offers benefits beyond international appeasement. Achieving energy security through cheap and locally availably energy, and the development of a robust energy market (where private players become generators and suppliers of composite energy services for transport and residential/industrial sectors) are perhaps most important within our context.

In the last five years, there have been substantial policy developments to support renewable energy. While policy interventions leave much to be desired, Pakistan at least has a Renewable Energy Policy and Nationally Determined Contributions for renewables. A clear feed-in tariff policy, introduction of net metering/billing, fiscal incentivisation for private investment, public investments through loans, grants and capital subsidies have all helped create a competitive, encouraging landscape for renewables.

There have also been significant investments in energy sector institutions, including NTDC, Discos and AEDB, in both infrastructure and organisational capacity.

The result: growth within the renewables market. In onshore wind, for instance, Pakistan has 24 operational wind power projects with 1,235MW capacity (308MW capacity in 2015), with another 12 projects reaching financial close in 2019. Utility-scale solar projects have 1,329MW of capacity (230MW in 2015) with another 12 solar photovoltaic (PV) projects in the pipeline.

Solar and wind sectors are expected to grow fast both have very high potential in Pakistan. To put this targeted `growth` in perspective, Pakistan`s target of 30 per cent renewables in the energy-mix by 2030 equate to 11,220MW of production capacity. While it might appear too soon, policymakers must start contemplating what happens once more (and bigger) projects commence operations.

The targeted production capacity will require policies not only in incentivisation, process facilitation, composite service provision and human resource capacity development, but also in technology lifecycle considerations. These include operational support throughout the life of projects, as well as disposal and redeployment after decommissioning (end-of-life) by developing auxiliary sectors.

Wind and solar plants require careful preventive and corrective operational maintenance during their lifespans. For wind plants, this means strategically located maintenanceworkshops, indigenised manufacturing of important parts and oils, and creation of technically adept manpower. Currently, there is a dearth of workshops for wind plants. While certain operators are contemplating establishing workshops themselves, policy must encourage independent players to do so too.

End-of-life considerations (eg, what to do when multimillion-dollar turbines and multiton blades need to be disposed of) must be assessed now. Once, on a visit to Jhimpir, I noticed two 38-metre long turbine blades sitting proudly at the entrance of a power plant.

As it turned out, they were not showpieces but once having become operationally redundant (there was no place to recycle/reuse the blade material) they had been unceremoniously dumped.

It is worth mentioning that for a 1.5MW turbine (many installed across Gharo and Jhimpir) typical blades measure about 34-38m in length, weigh 5,000kg of composite material, and cost around $100,000-125,000 each. The financial and environmental cost of these parts is huge. The material itselfneeds to find ways into recycling and reuse.

Similarly, most PV and wind projects are planned to last between 25-40 years.

However, the same issue remains. In solarPV, for example, the dominant technology is of silicon-based panels (92-95pc of global capacity), while 5-8pc comes from cadmium telluride-based panels. While the dominant silicon-based technology has a lifespan of 25 years, plants using older, polycrystalline technology that yield lower output (11pc compared to multi-crystalline`s 15-20pc) are being decommissioned earlier. The sheer volume of decommissioned panels (during the plant`s operational life and post-decommissioning) in the coming decades will, therefore, be huge. The development of an appropriate local waste management industry can greatly impact employment, provide potential regional expertise into second life (reuse) and end-of-life (recycling) alternatives.

If end-of-life and through-life considerations of renewable plants are not addressed, they may turn into future environmental and financial catastrophes. However,if addressed appropriately through policy now, they can offer considerable employment opportunities while inducting private-sector investment in the PV/wind recycling industry.  The writer is director of the Centre for Business and Society at Lums.