



## Enabling a renewable future for India

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**W**e live in strange times. The optimism and hope of a better world is often tempered by the difficult realities of conflict, economic stress and shortages. While technology has made human progress almost inevitable, the heavy demands that prosperity places on our natural resources has also driven home the lessons of restraint, cooperation and respect for nature. Nowhere is this more apparent than in the field of energy. The increasing demand for energy that has developed in the recent past has been constrained by rapidly diminishing conventional sources such as oil and coal. To further add to the problems of increased demand and constrained supply, there are serious questions about pursuing a fossil fuel-led growth strategy.

Globally, nearly 70 per cent of electricity today is generated from fossil fuels; as a result, electricity accounts for about 40 per cent of global energy-related green house gas emissions; these emissions are expected to grow by 58 per cent by 2030. Scientists believe that a temperature rise above 2°-2.5°C risks serious and intolerable consequences. The Intergovernmental Panel on Climate Change (IPCC) predicts that with rising temperatures, the frequency of heat waves, droughts, and heavy rainfall events will very likely increase. This in turn will seriously affect agriculture, forests, water resources, industry, human health and settlements.

The world will therefore have to work together towards new and alternative ways to decouple economic development from traditional energy consumption. And the core solution will be technologies that reduce carbon emissions per unit of energy. This is why, while striving to bridge its energy deficit, the world must necessarily increase the share of clean, sustainable, new and renewable energy sources. Whether or not renewable energy completely replaces fossil fuel, we must all work together to develop renewable energy to its fullest potential.

What about India? How far have we moved on the path of sustainable development? India is endowed with a substantial renewable energy resource base. Recent estimates indicate that a potential of over 2000 GW of electric power capacity exists from wind energy alone. Solar photovoltaic and solar thermal energy has the potential to generate around 50 MW per square km of area. Small hydro and biomass could add another 40 GW of capacity. Furthermore, there exists significant potential from decentralised distributed applications.

How far have we moved ahead in realising this potential? India today stands among the top five countries of the world

in terms of renewable energy capacity. We have an installed base of over 24 GW, which is around 12 per cent of India's total power generation capacity and contributes over 6 per cent to the electricity mix. This represents an almost 400 per cent increase in the past 5 years. Investment in renewables grew by 25 per cent last year alone. A recent E&Y study ranked India among the top 5 countries of the world in attracting renewable energy investments in the country. The Indian National Action Plan on Climate Change mandates an increase in the share of renewable power in the electricity mix to 15 per cent by the year 2020. The action plan of the Ministry of New and Renewable Energy aims at achieving a target of around 72 GW of renewable power including 20 GW solar capacity by 2022.

While the significance of renewable energy from the twin perspectives of energy security and environmental sustainability is usually well appreciated, what is often overlooked is its capacity to usher in energy access. In its decentralised or standalone avatar renewable energy is the most appropriate, scalable, speedy and viable solution for providing power to thousands of villages and hamlets. By providing energy access to the most disadvantaged and remote communities, renewable energy has become one of the biggest drivers of inclusive growth.

Already, around 9000 villages in different part of the country have been meeting electricity needs through off-grid renewable energy systems. Entrepreneur-based market-led systems are being evolved to provide renewable energy-based electricity for lighting and motive power applications in some of the remotest and poorest areas. Kilowatt-sized systems are being used to provide reliable power to run computers, televisions and provide e-connectivity to otherwise far-flung and poor areas. In many tribal and forest areas solar power is not only lighting up remote hamlets but also trying to bring about a convergence in forest conservation, education and rural development efforts. In other areas, energy-entrepreneurs are experimenting with generation of electricity and its local distribution through use of locally available rice-husk. Each of these endeavours is an effort at energy access for the poorest and the remotest. We in government are trying to encourage rural entrepreneurship and make it easier for poor citizens to access these services through policy and financial interventions including preferential tariffs and a combination of capital subsidy, soft loans and interest subvention.



Renewable energy applications have the great advantage of meeting decentralised needs other than rural electrification too. By doing so, they mitigate the consequences of power shortage by providing solutions at the consumption point. Over 25 GW of power is currently generated by diesel. Over 1 million tonnes of furnace oil is used annually for meeting incremental process-heat requirements. Solar energy can save both by acting as heat as well as power source. With oil prices going up and solar prices coming down, the tipping point is approaching for large-scale off-grid development. Quite naturally, industries facing power shortage, telecom towers using diesel, and agricultural pump sets using diesel, large kitchens using LPG are promising candidates for this effort. All these applications have the potential of saving hundreds of thousands of litres of diesel, kerosene and cooking gas annually. They will spawn new financial and business models as well as an acceptance of service delivery in a distributed manner that supports local entrepreneurs with low-cost funds.

In January 2010, the Government of India launched the Jawaharlal Nehru National Solar Mission (JNNSM). This is a unique and ambitious Mission that aims to facilitate the deployment of 20,000 MW of grid-connected solar energy

being deployed in India by 2022 and 1100 MW by 2013 itself. By leveraging domestic and foreign investments, the Mission framework will facilitate and provide the foundation for the private sector to participate and to engage in research & development, and manufacturing & deployment. Within less than two years of its launch, the Mission has succeeded in catalysing the installation of around 500 MW capacity solar power projects in the country. One of the major achievements of the Mission is a significant reduction in solar power tariff, and the offered tariff has now fallen by over 30 per cent to an average of 17 US\$ cents per kilowatt-hour. This steep decline in solar power tariff affirms the Mission's aim to achieve grid parity in the shortest possible timeframe.

Despite the strong push for solar energy, wind energy continues to contribute significantly to our renewable energy matrix. With over 16 GW installed capacity, India competes globally in manufacturing and deployment and occupies the fifth position in the world. Our policy framework in wind energy generation is extremely investor-friendly. An attractive feed-in tariff, supportive regulatory regime, and fiscal and promotional incentives provide a strong foundation for the growth of the sector. Our latest decision to incentivise

generation of power by a generation-based incentive will help create a level playing field between foreign and domestic investors and attract more investments in this sector.

Biomass, which is a carbon-neutral fuel source of energy, holds considerable promise for India. Our surplus biomass material is estimated to be about 150 million tonnes; this could potentially be used to generate about 16 GW of power. Apart from providing relief from power shortages, power projects based on biomass would generate employment in our rural areas. They could also help the stabilisation of the electricity grid in such areas. We are working towards a National Bio-energy Mission. This mission will which will help devise a policy and regulatory environment to provide a predictable incentive structure for rapid and large-scale

*India's wind sector is the world's 5th largest with over 16 GW of installed capacity*





capital investment in biomass energy applications and encourage development of rural enterprises for project development and sustainable operation of bioenergy systems.

The challenge before us in the renewable energy sector, generally and in India, particularly is to reduce the per-unit cost of renewable energy. Hence, there is a continuous need to innovate, to increase efficiencies, ensure cost reductions and low material consumption, increased recycling and extended technical lifetimes. All these innovations can only result from better research and indigenous technologies. This is why, research and development in renewable energy is such a major area of action. I firmly believe that we need a whole new ecosystem involving business, academia and government in a symbiotic research effort.

A related challenge is reducing import dependence and development of indigenous technology and/or technology transfer. The currently skewed global distribution of intellectual property rights as well as the unaffordably high costs of imported technology acts as a barrier to the speedier indigenisation of renewable energy technologies. India looks to create partnerships between IPR holders and local technology expertise. Establishing targeted international collaborations among industry, academia and the private sector continues to be a challenge as well as a priority.

With increased volumes, handling intermittency of renewable power, particularly from solar and wind, pose another set of challenges. These call for planning for a balancing of power systems, developing hybrid systems, improvements in forecasting technology, creating an efficient and resilient renewable power transmission infrastructure and development of storage technologies. Globally, development of storage technologies has not been in line with wind and solar technology developments. This area requires learning from international experiences and targeted international collaboration.

All deployment, development and research require financing. Gearing up the banking sector to finance renewables

in large numbers and develop a suitable mechanism for risk mitigation or sharing is another key challenge. Innovative financing strategies are required – micro credit or micro-lending for energy access and targeted project credits and equity/debt financing.

With increasing deployment levels, ensuring availability of appropriately skilled manpower is another challenge. Although efforts have been made in this direction and a number of academic institutions, industrial training institutes etc have been involved, involving industry in a big way would be required.

The challenge for India is gigantic and exciting. We can set history on a hopeful course – away from poverty and despair, and towards development and dignity. We have made considerable progress on our own, but we still have miles to go. My vision is to see that every Indian has access to clean energy, reliably and affordably. Today's technology provides us this opportunity. It is for us to rise together to take advantage of these opportunities and translate to reality the vision of a better world for all mankind. □

*This article is an edited and updated version of The Tenth Darbari Seth Memorial Lecture on A Renewable Future for India delivered by Dr Farooq Abdullah, Minister of New and Renewable Energy at The Energy and Research Institute(TERI), New Delhi, India.*

*India's solar tariff has fallen by over 30 per cent to an average of US¢17 per kW/h*

