A Note on Advocacy for Reworking Strategies of Infrastructure Development in India

M.M.K. Sardana*

*[**Abstract**: At the recently concluded Paris Summit on Climate Change, India has committed to lay greater emphasis on renewable resources like solar and wind energy for electricity generation. By placing substantial emphasis on renewables over fossil fuels, India will soon be on its way to develop an Internet of Energy. However, it will only be possible if India is able to set up appropriate infrastructure, which will open up avenues for providing distributed power at the level of enterprise. Further, a mesh up of the Internet of Energy and the Internet of Communication will help create a system of Internet of Transport and Logistics. The three internets put together will result in Internet of Things wherein all subsystems in the economy will be interconnected through communication and mobility and India will graduate to the phase of zero marginal cost. Conventional infrastructure—which is otherwise facing development constraints and is saddled with debts—may develop some redundancy. In light of the potential of the Internet of Things coming up, infrastructure development priorities will be reordered to accommodate infrastructural requirements of the era of renewable energy.]*

In India, efforts to develop infrastructure are such as to subserve the model of development based on fossil fuels as the primary source of economic development. At the recently concluded World Summit on Climate Change held in Paris, the international community, including India, has resolved to minimise the use of fossil fuels to curtail emissions; they have sought to place reliance on renewable sources such as solar and wind energy instead. In its Intended Nationally Determined Contribution (INDC), India has unfolded its plan of action for (i) clean energy, (ii) energy efficiency in various sectors of industries, (iii) steps to achieve lower emission intensity in the automobile and transport sector, (iv) a major thrust to non-fossil based electricity generation, and (v) a building sector based on energy conservation. India has pointed out in its paper on INDC that it is running one of the largest renewable capacity expansion programmes in the world. It has asserted that between 2002 and 2015, the share of renewable grid capacity has increased over six times, from two per cent (3.9 GW) to around 13 per cent (36 GW). It has been proposed to significantly scale up this momentum with the aim to achieve 175 GW of

* The author is a Visiting Fellow at the Institute.

renewable energy capacity in the next few years. While the solar energy target has been set at 100 GW for the year 2022, the wind energy and biomass energy targets are 60 MW and 10 GW, respectively, for the same year. Besides, urban development programmes such as Smart Cities Mission and the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) also include components of renewable energy use in a significant way.

India has pledged to increase its share of non-fossil fuels to 40 per cent of its total power generation capacity by 2030[1]. The fall in solar energy prices has been a great incentive for this sector[2]. In terms of computing, the fixed costs of solar and wind harvesting technologies have been on an exponential curve. In 1977, the cost of generating a single watt of solar electricity was more than $76. By the last quarter of 2012, the cost of generating a watt had fallen to $0.50 and by 2017 the cost is projected to fall to $0.36 per watt. After the installation costs of solar and wind power are paid back (often as little as two to eight years), the marginal cost of harvested energy is nearly free.[3]

The renewable processes of energy are capable of operating the Internet of Energy established upon five foundational pillars, all of which have to be phased-in simultaneously. These are:

1. Buildings and other infrastructure will need to be refurnished and retrofitted to make them more energy-efficient so that renewable energy technologies like solar and wind can be installed to generate power for immediate use or for delivering it back to the electricity grid for compensation.
2. Ambitious targets must be set to replace fossil fuels with renewable energy sources by introducing premium tariffs to encourage early

[1] UNFCCC (2015), India's Intended Nationally Determined Contribution: Working towards Climate Justice. Available at: *www4.unfccc.int/.../India/1/INDIA%20INDC%20TO%20UNFCCC.pdf*

[2] Ramesh, M. (2016), 'Solar Power Tariff Touches a New Low of Rs. 4.34/unit,' *Business Line*, January 19.

[3] Rifkin, J. (2016), 'The Rise of the Internet of Things and Race to a Zero Marginal Cost Society,' *The World Post*, October 26.

adopters to transform buildings and property sites into micropower generation facilities.

3. Storage technologies including hydrogen and fuel cells, batteries, water pumping, etc., will need to be embedded at local generation sites and across the electricity grid to manage both the flow of intermittent green electricity and the stabilisation of peak and base loads.
4. Advanced metering devices will have to be installed in every building to transform the grid from servo-mechanical to digital connectivity in order to manage multiple sources of energy flowing to the grid from local generators.
5. Each parking space will have to be installed with a charging station to allow electric and fuel cell vehicles to secure power from the electricity grid as well as sell power back to the grid. Such vehicles connected to the Internet of Energy will also act as a backup storage system that can feed the grid during peak demand.

The phasing-in of the above-mentioned five pillars will convert the grid from a centralised to a distributed electricity system and from fossil fuel to renewable energy. In this system, every homeowner, neighbourhood and business will become a producer of electricity, sharing its surplus with others on a smart energy internet that will stretch across the geographical spread. Experiences of countries like Germany, which have advanced in this sector, is that not only has a massive shift taken place from a centralised to a distributed power system, but also that the bigger power and utility companies have to adjust to the fact that, in the long run, the earning capacity in conventional electricity generation will be markedly below than what has been seen in recent years[4].

Thus, with substantial emphasis on renewables over fossil fuels, India is on its way to develop an Internet of Energy as outlined above, provided India adopts appropriate policy initiatives for creating the five pillars mentioned above. This will necessitate the creation of appropriate infrastructure and matching skills, including

[4] *Ibid*.

incorporation of target-based incentives. The advantage of this type of infrastructure is that it will help create jobs; besides, the development process will not only become decentralised and democratised, but also environment-friendly. With the decentralisation of power, the pattern of industrial development will get substantially restructured.

India has already advanced in the field of Internet of Communication with more than a billion users in the country. The meshing up of the Internet of Communication and the Internet of Energy makes possible the building-up and scaling-up of the automated Transportation and Logistics Internet. These three internets together make up the kernel of the Internet of Things platform for managing, powering, and transporting goods in the Third Industrial Revolution economy where (i) renewables will be the primary source of energy, (ii) internet will be an important tool of communication, and (iii) internet principles will be applied to freight movement in the so-called "physical internet" (transportation and logistics). The Internet of Logistics and Transportation is based on four fundamental pillars, which, like the Internet of Energy, have to be phased-in simultaneously for the system to operate efficiently.

1. As for the Internet of Energy, charging stations will have to be installed ubiquitously across land masses allowing cars, buses, trucks and trains to power up or to send electricity back to the grid.
2. Sensors will have to be embedded in devices across logistics networks to allow factories, warehouses, wholesalers, retailers and end users to have up-to-the-moment data on logistical flows that influence their value chain.
3. The storage and transit of all physical goods will need to be standardised so that they can be efficiently passed off to any node and sent along any passageway, operating across the logistics system in the same way in which information flows effortlessly and efficiently across the web.
4. All logistics operators will have to form a collaborative network in order to bring all of their assets into a shared logistical space to optimise the

shipment of goods, taking advantage of lateral economies of scale. For example, warehouses and distribution centres can share storage spaces, allowing carriers to drop off and pick up shipments using the most efficient route to their destination.

The convergence of the Internet of Communication, Internet of Energy, and the automated Transportation and Logistics Internet leads to the Internet of Things—a platform that will fundamentally change the way we manage power and economic activities across the numerous value chains and networks that make up the global economy. The digitalised Internet of Things platform is the core of the Industrial Revolution.[5]

Thus, India—which has committed to phase-out the use of fossil fuels—should relook into the ongoing processes of infrastructure development. The large infrastructure projects (presently being implemented or conceived) neither focus on local issues nor demonstrate the potential of changing the lives of local people faster. For example, large highways or transmission lines seem to bypass people living in adjoining areas. Rather, these are perceived as developments which have brought social upheavals in their lives for the benefit of those at a distance. In contrast, whenever solar panels are installed on houses or buildings, the benefits are available directly to people living in and around the immediate vicinity.[6] Resultantly, the infrastructure that will be developed in pursuit of creating the aforementioned five pillars will be a distributed one which will enjoy the support of the populace for whom it will be made available. Besides, the various components of the tasks around which the pillars of the Internet of Energy and the Internet of Transport and Logistics will be built will not only be employment intensive, but also ensure development of local areas. Therefore, for drawing optimum benefits from investments being contemplated in renewables, a flow of investments in sectors facilitating the building up of Internet of Energy and Internet of Transport and Logistics needs to brought

[5] *Ibid*.

[6] Saluja, D. (2014), '5 Ways India Can Overcome its Infrastructure Challenges,' *World Economic Forum*, November 26. Available at: https://www.weforum.org/agenda/2014/11/five-ways-india-can-overcome-infrastructure-challenges/

about and, if necessary, by redrawing funding priorities for conventional infrastructure. Redrawing of such priorities should not be difficult as for various reasons projects relating to conventional infrastructure remain logged down with no immediate solution in sight. Rather, the cost of such projects keeps escalating; as a result, there has been an unhealthy growth of nonproductive assets with lending institutions[7].

Hence, resources which stand locked up presently need to be redeployed to meet the infrastructure requirements for developing the Internets of Energy and Transportation and Logistics. With these two internets developing optimally, the industrial processes will get substantially restructured; however, it may lead to redundancy in conventional infrastructure. For example, when production is decentralised in local areas, say, through a distributed network of 3D printing services, it may no longer be important to have large scale manufacturing units obviating the necessity of large capacity highways for the movement of goods. Things will be manufactured locally and designs and drawings could be transmitted through internet, say, from start-ups having intellectual rights. Such a process will encourage customised manufacturing and that too at the doorstep of the customer. The number of such manufacturers will be substantially low as the marginal cost of inputs as well as the transport costs will be at their minimum.

[7] Sender, H. (2015), 'India Infrastructure: Built on Debt,' *Financial Times*, June 22. Available at: https://www.ft.com/content/7b101156-f310-11e4-a979-00144feab7de