Decentralisation in Electricity Services with Reference to Renewable Energy in India

Saraswathi Unni, Ph.D[1]

[1]Associate Professor and Head of Department (Political Science),
N.E.S Ratnam College (University of Mumbai),
National School Marg, Bhandup (Mumbai, India)
Email: saraunni228 [AT] gmail.com

ABSTRACT – ***This paper deals with how small scale decentralisedrenewable electricity has the potential to drive democratic decentralisation in India, offering self-reliance to local communities in their energy needs. The focus is on rural local government institutions or the Panchayati Raj Institutions and their capacity to use alternative methods of decentralised grid technology for electricity generation to attain autonomy from the states and the Centre in the long run. The author examines challenges for decentralised renewable energy and why centralised generation does not meet the objective of access to electricity, rural electrification and the needs of the poorest in the present scenario. It is further argued how the status quo stymies the realisation of the purpose of Panchayati Raj, often requiring local governments to depend on higher tiers of government for sustenance and local development. Through various case studies and evaluation of existing practices possible models and alternatives are also suggested.***

Keywords – Renewable Energy, Electricity, Local Governance, Decentralisation

1. INTRODUCTION

The concept of democratic decentralisation is founded upon the notion thatdemocratisation and empowerment of local political bodies create institutions that are moreaccountable to local citizens and more appropriate to local needs and preferences.Ideally, decentralisation when understood as a political process in governance and administration should involve devolution and deconcentration of administrative authority and transfer of resources and responsibilities in a layered governance framework. Such transfers involve the power to decide the allocation and distribution of public resources, the power to implement programmes and policies and the power to raise and spend public money. It should also provide space for greater public and community participation, leading to a "bottom-up" approach to governance. One can even argue that decentralisation is a process of more or less equitable redistribution of the state's powers and responsibilities among different layers of authority.

The sheer size and ambition of India's experiments with democracy provides a vast canvasfor the study of decentralisation.While the 73nd and 74th Amendments of 1993 did bring in a third layer of constitutionally recognised authority for governance, it did not lead to the creation of local autonomythat would share responsibility with the central and the state governments.Even here one can note that urban local governments possess a certain degree of autonomy which is entirely absent in the case of PanchayatiRaj Institutions (hereafter PRIs). This is tobe blamed partly on the wary approach that India has adopted for decentralisation and partly on the lack of fiscal independence in the case of rural local governments. Another notable aspect of the Indian experiment withdecentralisationis that it largely tends to confine itselfonly to devolution of the decision-making process. Provision of basic services, like electricity, water and education, as such havenot been so significant in the decentralisation process, when in fact it is one of the fundamental functions of the state.

1.1 Centralised Electricity Systems: Limitations

When it comes to utilities, especially electricity, India's delivery system is largelycentralised. Being under the Concurrent list, the central government, while playing a greater role, delegates certain responsibilities of provision of electricity with state governments. So while the centre formulates policy, finances and builds (even maintains and operates) power projects, and generates electricity, the states through their respective State Electricity Boards undertake the responsibilities of transmission and distribution. For the past two decades, the emergence of private parties in electricity services led to certain amount of decentralisation, but the kind of decentralisation that fostered a political culture where the state recedes from its responsibilities. Thecentralised model of large thermal power stations and a central grid is a conventional systemto supply electricity to consumers. This centralised model has failed to provide electricity to the rural and remote areas andto achieve theobjective of rural electrification. Un-electrified areas are

generally located in remote, hilly and forested regions, where gridextension is likely to be difficult for various reasons. Instead,decentralisedrenewable energy (DRE) for electricity generation can provide an avenue to electrify theseremote areas and improve their social and economic conditions, while a decentralised framework in the administrative front will help in the democratisation of electricity services.

1.2 What is Decentralised Energy?

Decentralised energy or decentralised electricity generation or distributed generation means "an electric power source connected directly to the distribution network or on the customer side of the meter".The size of the power plant may be varied from Micro-DG (below 5 kW), small DG (5 kW to 5 MW), medium DG (5- 50 MW), and large DG (50-300 MW). When contrasted with large centralised generation facilities the economies of scale from decentralised electricity generation is small, but is suitable for electrifying remote villages and tribal settlements while causing little or no damage to the environment. (Karger & Hennings, 2009)

It must be understood that decentralised energy does not necessarily imply administrative decentralising of the energy sector. The Indian renewables sector, for instance, is highly centralised as a sector with the central government running the sector through the Ministry of New and Renewable Energy (MNRE). But at the same time, the MNRE has employed decentralised energy generation for the sector.

1.3 Why Renewables?

The importance of increasing the use of renewable energy sources was recognised in India in the early 1970s. During the past quarter century, significant effort has gone into the development, trial and induction of a variety of renewable energy technologies for use in different sectors. Several renewable energy systems and products are now commercially available and are also economically viable in comparison to fossil fuels. The Ministry of Non-Conventional Energy Sources (MNES) created in 1992 is the nodal agency of the Government of India for all matters relating to non-conventional/renewable energy. It was renamed as the Ministry of New and Renewable Energy (MNRE) in October 2006. The statedmission of the Ministry is to ensure energy security, increase availability and access and increase energy affordability and replace fossil fuel based electricity with renewable electricity. India is the only country to have a separate ministry to look after renewable energy. (Ministry of New and Renewable Energy)

India has high potential in RE. The total share of renewable in India's electricity sector increased from around 6-8% in 2006 to 12% in 2013. It is estimated that RE could meet about 60% of India's total electricity supply by 2050 in a planned phased manner. But this would require a change in the government spending pattern and concrete policy support for renewables in electricity sector.(Reid, Simms, & Johnson, 2007; Ministry of Power, 2013)

Renewable energy technologies are ideally suited to distributed applications i.e., DRE, and they have substantial potential to provide a reliable and secure energy supply as an alternative to grid extension or as a supplement to grid-provided power. Over 400 million people in India, including 47.5% of those living in India's rural areas, still have no access to electricity. Because of the remoteness of much of India's un-electrified population, renewable energy can offer an economically viable means of providing access to electricity to these groups. (The Energy and Resources Institute, 2013)

2. ISSUES IN THE ELECTRICITY SECTOR IN INDIA

2.1 Low user charges

In rural India, electricity is supplied at highly subsidised rates as compared to urban domestic consumers. However, the cost of transmission and distribution of electricity to these areas is very high. These areas are mainly characterised by highly scattered communitieswith poor infrastructure resulting in long and dispersed transmission and distribution lines. Therefore, the actual electricity delivered at the consumer end is very little. Further, low paying capacity and large number of subsidised customers aggravates this problem (Nouni, Mullick, & Kandpal, 2008)

2.2 High transmission and distribution losses

India is known to have some of the highest transmission and distribution (T&D) losses in the world. These losses are both physical (weak, overloaded networks) and commercial (power theft). Several policies and regulatory efforts aim to improve services to the poor and reduce financial losses. Though regulatory commissions have annual targets for reduction in T&D losses progress has been limited. Although average T&D losses have reduced from 30.4 per cent to 23.65 per cent between 2008 and 2013, it is still higher than the global average of 15 per cent reported in 2013. (Central Electricity Authority, 2013)

2.3 Lower technical and operational efficiency

Lower technical and operational efficiency aggravates the problem of electricity loss. Technical inefficiencies include substandard quality of distribution network and lack of required investment in extending grid connectivity. Non-technical issues like large number of unauthorised connections and power theft contribute to the problem. (Planning Commission, 2007-12)

Under centralisedsytems, poor revenue generation hinders provision of grid electricityto rural and remote areas. In India even if the rural areas have grid connectivity the supply of electricity is often interrupted and of poor quality. Thusregular recovery is therefore a prerequisite forthe financial sustainability of centralisedsystems. (Unni, 2013)

2.4Lack of penetration of efficient and modern sources of energy

According to the 66th round of Consumer Expenditure Survey in 2009/10, 76 per cent of households in rural areas still use firewood as the primary cooking fuel and 33.54 per cent of rural households used kerosene as a primary lighting fuel. (The Energy and Resources Institute, 2013)This is due to the adoption of centralised energy planningwhich tends to ignore the electricity demand of the rural poor. Centralised electricity generation with coal fired power plants all over the world has been the main culprit and major cause of climate change. (Bell, 2007)

2.5Dominance of coal-based generation

As of 2013, coal-fired plants accounted for around 59% of the India's total installed electricity capacity. (Ministry of Power, 2013) Although this is better when compared to other nations like South Africa (92%) China (77%) and Australia (76%), there has been an unhealthy reliance on coal. (World Coal Institute, 2009) The fact that,this reliance grew from 52% in 2010 to 59% by the end of 2013 indicates that environment is still not a priority for the government. (The Energy and Resources Institute, 2013; Ministry of Power, 2013)The progress in RE that India witnessed in recent years is nowhere near comparable to the growth that coal based electricity generation has experienced. While this growth has contributed to bridging the demand-supply gap, it surely is detrimental to the environment.

If the target of providing electricity to allhas to be met, provision of electricity first to the remote areas where the grid connectivity is not feasible, should be the priority. This can bedone by deploying large scale renewable energy (RE) options from the supply side andefficient energy management from the demand side. (Reid, Simms, & Johnson, 2007)

3. THE CASE FOR DREs

The issues that the electricity sector faces highlight the need for a bottom-up approach for overall energy-led development. What is therefore required is a state-wide network of decentralized energy plants(stand alone and micro-grids),developed with support from state government agencies in collaboration with Panchayati Raj Institutions (PRIs) for a high impact and accelerated economic development of the state. The main thrust of the paper is to argue for a favourable environment for the establishment of the decentralised systems with DREs all across to provide electricity to the rural population.

A dual focus on increasing access to energy for poor and promoting clean sources of energy is what India needs. While initiatives to increase energy supply do not adequately impact the poor, schemes intended for energy access to the poor do not give enough weightage to RE. Access to energy for the poor can have far reaching consequences. It can combat poverty, foster education, improve child and maternal health, bring in environmental sustainability, and help combat malaria and HIV/AIDS. Therefore, the definition of "access to energy"should not simply be provision of connection to an electricity grid, but must be broader which includes elements of poverty reduction and development goals. But, focusing on conventional oil, gas and coal based power generation has had damaging effects on environmental and public health. So while it is necessary to consider RE as a supplementary source for electrification and energy generation, India needs to treat rural electrification and energy access for the poor as a priority in the development of RE. From environment (climate change) perspective, DREs have several benefits. The use of local, biodegradable waste resources reduces the need for waste management and of capital intensive infrastructure support. (Buragohain, Mahanta, & Moholkar, 2010) They are also flexible, easily and effectively manageable as they are far less resource dependent and allow the government to interact internationally through carbon trading and carbon mitigation societies.

DRE technologies are more suitable and economical in rural areas that are far from a grid. Even at a distance of 5 km from the grid to a village, the cost of generation from micro or mini hydro systems is more or less the same as the costs per kWh from coal-fired grid based power plants. For a load of 100 kW which is at 12 km distance from the grid/33kVA line, the cost of generation of hybrid wind-solar is the same as that of coal (which is Re. 1 per km for transmission cost for grid and maintenance cost). (Bast & Krishnaswamy, 2011) Also when compared to centralised systems DREs have more positive, holistic and developmental impact on society because of their local and socio-economic dynamics. These systems utilise local raw material, generate employment by engaging local human resources for operation and

maintenance of the system and create local investment. Moreover, these systems provide higher entrepreneurial opportunities due to their need for limited financial resources and higher returns on investment. Power loss during transmission and distribution is significantly higher in the centralised systems. The decentralised systems, being local in their supply and demand, lead to limited power loss and radically improve efficiency. Moreover, the localised generation and maintenance increase supply security, like it did in Pathanpara a hamlet of three hundred and sixty five families in the Kannur district of Kerala. While there was no grid electricity there, the village had many perennial and seasonal streams, providing potential for a micro-hydro plant. Thirty-six households donated Rs 6000 each and their labour. Another 50,000 rupees were taken on loan from the Thalaserry Social Service Society, a local organisation. The forest department was persuaded to donate the same amount, giving the project capital of around Rs. 300,000 to set up with. Two pieces of land were donated for the project: one for the reservoir, and one for the powerhouse.A plant of 5 KW with lean flow of 22lps (litres per second), 60m head and a diesel backup was setup and a strong local committee took charge of the day to day affairs. In order to ensure democratic decision making, the community together sets rules. The Pathanpara experiment presents a case for empowerment of the community as they get to manage the system. Even when the grid later came into the village many people preferred the micro-hydro plant as the quality of grid supply was poor. (Boyle & Krishnamurthy, 2010)

As a technical system, the centralised grid requires intensive capital investment and a huge capacity to provide electricity to large number of establishments (household, commercial, others). However, the system becomes economically unfeasible when providing electricity to scant population in large spreads. Alternately, the decentralised systemsuse local raw material and have a small spread. Moreover, the operational capacity of the decentralised system is determined by the supply and demand sources. The technology functions as a flexible system, which operates according to local demands. Hence, the cumulative local impact is enormous. (Nouni, Mullick, & Kandpal, 2008; Deshmukh, 2009; Krishnaswamy, 2010)

Decentralised systems have low capacity factor and can support small and medium scale commercial activity. Significantly, they are highly flexible and allow to be tailored to local conditions and needs, i.e. supply can be adjusted and designed to optimise agriculture, commercial and households needs. Decentralised technologies, as stand-alone, small capacity technical systems, can cater to a vast number of area spreads and are suitable for remote locations. (Cust, Singh, & Neuhoff, 2007)They can be more cost-effective for the state in the long run by boosting commercial activities in rural areas. Moreover, they can be managed by community participation. But, local cooperation and consent is a critical requirement for the success of this system. They impact the community by providing access to modern educational aids and health. A case in point here is the solar photovoltaic (SPV) plant in the Durbuk in Changthang, Ladakh. A 100kW solar plant -1360 solar photovoltaic panels- with some of the most cutting-edge electricity generating technology has been setup in Durbuk which is so remote that extending the main gridwas neverreally an option. Even though they had a 250 kVA diesel generator set, it led to health issues and every year 48,000 litres of diesel had to be bought by the state government at a cost of Rs 16,00,000. After the installation of the plant, 347 households receive uninterrupted electricity. It has also enhanced heath care with the Primary Health Centre (PHC) being able toprovide modern medical facilities. For instance, it is now able to store polio and measles vaccines through refrigeration. Renewable Energy Development Cooperative (REDCo), which operates this plant, is a registered non-profit entity created by the community with 15 elected members and aBoard of Directors headed by the councillor. Rules enforced are followed by the people and there is 100 per cent bill payment in this area with people being charged a flat rate of Rs 50 per month. The managing committee now acts also as a micro-financing institution, providing loans for business. (Boyle & Krishnamurthy, 2010)

The potential of decentralised generation from locally available renewable sources, such as biomass, hydro, wind and solar is very high in India. The rural areas of the state have a wide variety of biomass, which is readily available due to large-scale agricultural activities. Hilly and coastal areas are ideal locations for harnessing wind energy whereas for solar energy large surface in the rural areas can be used. Many of these systems can be useful in urban and semi urban areas also to conserve the use of electricity and other fossil fuels. Solar water heating systems have helped in demand side management of electricity in various cities and towns during peak hours. Standalone roof top SPV systems are increasingly in demand for day time diesel abatement in areas where power cuts are very high. (Chaurey & Kandpal, 2010)The DRE system also has other advantages,for instance, less transportation cost, no cost for gridconnection and effective use of local resources. Consequently,clean, cost effective and reliable electricity can be generatedwith considerably reduced transmission and distributionlosses.

Another case is that of Bihar's experiment with husk power.Husk Power Systems was established in 2008 by Gyanesh Pandey andRatnesh Yadav. It generates electricity from rice-husk, a waste product of rice milling. Rick-husk is used in an innovative manner by converting into combustible gas and then using this gas to produce electricity through a generator. Their rates stand at Rs 2.20 per watt which is among the cheapest across the globe. Also they were able to introduce cost minimisation effectively through the use of bamboo poles instead of underground cables or cement poles; while electricity theft is avoided by the design of low-cost, prepaid energy metres. Also the rice husk char which is a by-product can be used for making incense sticks, thus giving employment to women. HPS then sells the incense sticks

to companies who add various fragrances and market the incense under their own brands. The system has been made simple so as to impart training to locals for generating employment. HPS has successfully installed more than 80 plants in Bihar, providing electricity to over 2,00,000 people across 300 villages and hamlets[*]. (Husk Power Systems, 2014)The HPS model aims at not only providing electricity but empowering the village and the people by providing energy, employment, training, women's empowerment and health care. (IFMR Reseach, 2010; Wharton School of the University of Pennsylvania, 2011; Boyle & Krishnamurthy, 2010)

3.1 Case Study: Akshay Prakash Yojana

The Akshay Prakash Yojana (APY) implemented in Maharashtra attempted to regulate power use through consumer-utility-partnerships. The scheme included collective responsibility for tackling load shedding problems in the villages. The scheme included initiatives toward taking collective responsibility for tackling load shedding problems in the villages. Villagers were asked to regulate electricity use during peak hours, using it only for residential lighting during these times.Electricity used for agricultural pumps, flour mills, and lights required in schools was scheduled for use only during the necessary hours. Theft was also checked and people were asked to give up appliances consuming extremely high amounts of electricity, e.g. hot plates and heaters. The demand in these villages dropped, sometimes by as much as 50-70%. In return they were given 22 hours of assured electric supply in a day. This scheme had been implemented in 4,611 villages and according to MSEDCL figures, had reduced the peak demand by 960 MW. But the programme was discontinued in 2007. Official reasons given for this were extreme shortage which made it difficult to supply electricity for 22 hours to the Akshay Prakash villages, and lower benefits than expected from the scheme. (Reddy & Dixit, 2010) It can be argued that Maharashtra government's neglect of decentralised systems or RE and its over reliance on the centralised energy system is to be blamed for the failure of APY. When electricity shortage became acute in the state, electrification of the AP villages became non-essential for policy-makers who cited low remunerative potential as the primary reason for abandoning the project. However, the absence of decision making powers with the local communities and the slackening in regulated use of electricity by the villagers also led to the failure of the scheme. The failure of the APY is to a large extent indicative of the failure of the centralised model of elecltricity generation in providing services to rural and remote areas,where the most needy live.

4. DREs AND PANCHAYATI RAJ INSTITUTIONS

Changes in the immediate terms can include integrated planning of state-wide natural resources and technologies, incorporating electricity in the National Programme for Rural Industrialisation (NPRI), state-incentivisedpanchayati business models for setting up local energy companies in DRE generation, meeting renewable energy obligations, empowerment of relevant government agencies. There is a need to recognise the right to "energy for all" through the enactment of a legislation similar to the Right to Education Act. Once recognised as a fundamental right the state's responsibility towards the marginalised sections society will be non-negotiable. While long-term changes can include a policy to facilitate DRE use with better fiscal management, institutional support for micro-grids, tariff design to encourage DRE, regulatory provisions through the Electricity Regulatory Commission (ERC) including evolution of pricing models through regulation.

The existing framework under Electricity Act (EA) 2003 can be drawn upon to establish a local level regulatory framework for DREs, which may be under the aegis of CERC, SERCs and related ministries. This framework could specify institutional arrangements, oversee bidding procedures, monitor compliance of the procedures of the EA 2003, develop safety norms and operational standards and establish guidelines for grid connectivity of the off-grid RE projects.

Standards and rating need to be developed for off-grid RE products, suppliers and service providers, which should include consumer-relevant parameters like quality and output, development of star rating systems for RE consumer products, development of accreditation procedure for suppliers, and third party certification from approved laboratories. The idea is to replicate the model of the centralised systems in order to ensure quality, accountability and professionalism.

Securing priority finance for off-grid RE can also be very helpful. Off-grid energy generation needs to be included as "priority sector" for lending and this initiative should be extended to RE options. This is to accord priority sector status to lending for DREfor agriculture, households and MSMEs (micro small and medium enterprises). Disbursement of subsidies and finances needs to be governed by financial intermediaries with a viable track record, in association with PRIs. These intermediaries may be chosen by the Reserve Bank of India. Training,sensitisation and capacity building activity here should not be restricted only to technicians but also include institutions like PRIs, banks and insurance agencies. Existing government institutions like the National Skill Development Corporations can be helpful in implementing capacity building and training programmes. The insurance agents in rural areas may be trained to serve as auditors and verifiers for RE systems. Capacity building programmes should also aim at making PRIs well-equipped with

[*] These figures are constantly increasing. See www.huskpowersystems.com for recent figures

the technical know-how of maintaining and running DRE systems. At the same time, the PRIs need to be trained to raise revenue through DREs, which can then be used to finance other local projects.

Setting up institutional arrangements, similar to the Santacruz Electronics Export Processing Zone (SEEPZ) or Maharashtra Industrial Development Corporation (MIDC), may play a key role in clustering small RE projects, disbursing subsidies, and organising maintenance. The regulatory framework and training needs for the rural renewable energy service company must be understood and factored in.Policy makers and planners need to be sensitised to the need for incorporating local knowledge in the process, consider social inequalities based on gender, class and caste in the programme design and help strengthen local governing institutions to take decisions for their areas. It also calls for formulation of policies that specifically encourage the development of rural energy enterprises involving women.

5. CONCLUSION

While participatory planning has been said to be time consuming and resource intensive, one must question whether the centralised projects, which undoubtedly accelerated the growth of the electricity sector, have been able to mitigatethe huge human and environment costs they incur. Also have they achieved any real development considering the huge resources and investments made on them?

There is no doubt that there areseveral barriers to implementing such rural energy programmes. The biggest barrier todecentralisationis to ensure genuine participation of people. There is a need to integrate participatory processes into the institutional framework for the systems to run and function effectively. Thus participatory planning and participation of the people involved in the project are crucial for the success of any initiative.

6. REFERENCES

- Bast, E., & Krishnaswamy, S. (2011). *Access to Energy for the Poor: The Clean Energy Option.* Oilchange International, Actionaid, and Vasudha Foundation.
- Bell, J. (2007). *Security Via Decentralized Energy.* Washington, DC: WADE Publications.
- Boyle, G., & Krishnamurthy, A. (2010). *Taking Charge: Case Studies of Decentralized renewable energy projects in India in 2010.* Greenpeace.
- Buragohain, B., Mahanta, P., & Moholkar, V. (2010). Biomass gasification for decentralised power generation: The Indian perspective. *Renewable and Sustainable Energy Reviews , 14*, 73-92.
- Central Electricity Authority. (2013, December). *Highlights of the Power Sector.* Retrieved from Central Electricity Authority, Ministry of Power, Government of India: http://cea.nic.in/reports/monthly/executive_rep/dec13.pdf
- Chaurey, A., & Kandpal, T. C. (2010). Assessment and evaluation of PV based decentralised rural electrification-An overview. *Renewable and Sustainable Energy Reviews , 14*, pp. 2266-2278.
- Cust, J., Singh, A., & Neuhoff, K. (2007). *Rural Electrification in India: Economic and Institutional aspects of Renewables.* Faculty of Economics, University of Cambridge.
- Deshmukh, A. (2009). *The Role of Decentralized Renewable Energy for Rural Electrification.* Lund: IIIEE, Lund University.
- Husk Power Systems. (2014). *Home*. Retrieved February 20, 2014, from Husk Power Systems: http://www.huskpowersystems.com/
- IFMR Reseach. (2010). *Empowering Villages: A Comparative Analysis of DESI Power and Husk Power Systems: Small-scale biomass power generators in India.* Centre for Development Finance, IFMR Research.
- Karger, C. R., & Hennings, W. (2009). Sustainability Evaluation Of Decentralized Electricity Generation. *Renewable and Sustainable Energy Reviews , 13* (3), 583-593.

- [illegible] *Renewable Energy* , *12* (5), pp. 1187-1220. http://knowledge.wharton.upenn.edu/article/husk-power-systems-generating-electricity-from-waste-for-indias-rural-poor/