Political Economy of Energy Policy in India: Electricity and LPG

By

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Abstract

Clean energy is key to good quality of life, effective production, productivity enhancement and innovation. India has abundant amount of coal and renewable energy, matured technology and institutions for meeting the clean energy needs of lighting, cooking and other utilitarian and productive requirements. Over the years, country's energy consumption is highly skewed towards fossil fuels. In addition to high grade coal for steel and power production, India's oil and natural gas need is mostly met through import. Geographically, there has been wide disparity in energy consumption, with regions (Eastern and North-Eastern states) having larger share of primary commercial energy resources, consuming much below average quantity of clean energy.

The energy intensity of India has shown a declining trend (1.3% per annum during 2005 to 2013) over the years as a consequence of the service sector led growth, focus on energy conservation and rational use of energy. The emission intensity of the country had shown a declining trend till 2009-10 and then has gone up marginally, primarily because of massive rural electrification and improved quality of life. With the adverse environmental consequences of fossil fuel powered electricity generation and large hydro power production, the direction of energy policy has moved, albeit slowly, towards renewable, primarily solar. Additionally, with government's thrust on LPG use for cooking in rural areas, the emission intensity will further come down. Given the fact that renewable energy resources are almost uniformly distributed all over the country, it is surprising that the energy policy has not changed its track towards decentralized production. By 2030, country's goal is to have the non-fossil power generation capacity of 40% and reduce the emission intensity of the economy by 35% (measured against a base line of 2005).

The energy plans, since independence, have been primarily growth oriented, with state specific utilitarian rural electrification, in case of powerful political constituencies. Interests of excluded, including women, excepting pious intentions, hardly got its due place. Interests of such excluded groups were taken care of by specific programs, with mixed result. Their interests were not mainstreamed.

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India's energy mix is 65% commercial and 35% non-commercial. The commercial energy mix in 2013-14 was coal (41%), Oil and gas (39%) and renewable and nuclear (20%). Since country has large reserve of coal, hydro and other renewable energy resources, the policy has been directed towards coal and renewable. Given the scarcity of oil and gas, difficulty in accessing nuclear technology and fuel, existence of large reserve of coal and renewable energy sources, the national energy policy is biased towards the latter for energy security. As far as electricity is concerned, considering the fact that large scale hydro-electric power plants have huge environmental consequences, require long gestation period and require very high initial investment, both public and private sector companies find it convenient to move to thermal power generation. Additionally, excess capacity to manufacture power plant equipment in China, credit facility from international financial institutions and reliable supply of high quality coal at reasonable price from Australia and Indonesia have facilitated growth of thermal power plant in the country.

After nearly seven decades of independence, as on 31st May 2015, the country had 59.2 million un-electrified rural households, and the electrified households have to remain satisfied with daily electricity availability of less than 12 hours. As on 31st March 2015, there were 64.8 million households in the country who did not have LPG connections, thus depending primarily on unclean biomass fuel.

In the given political context, Government, both at national and state level have plans and are determined to provide '24x7 Electric Power for All' and 50 million LPG connections to women head of Below Poverty Line (BPL) families by 2019 with associated subsidies. Long-term availability and affordability of clean energy for the underprivileged sections can be ensured if they are taken up in the economic spiral through sustainable income generation programs in convergence mode. Towards this end, alternative strategies are available to provide affordable clean energy in inclusive and sustainable manner. It will call for decentralized production of clean energy from locally available primary energy sources, local distribution with or without central grid connection, local value addition and local market creation by local institutions. Such a system, in addition to reducing transmission and distribution losses, will provide pollution free local energy security while facilitating a socio-economically, politically and technologically empowered community. Of course, it will not meet the political-economic interest of big business and politicians, located far away from the grassroots. And, this is the challenge, especially the economically underprivileged communities (including excluded) will face in future.

In India, the upward movement in the clean energy ladder from Kerosene to Electricity for lighting is primarily due to accessibility and affordability criteria. There is no specific evidence of women-specific consideration at household level relating to drudgery reduction or quality of life improvement. Whereas, transition to cleaner cooking fuel, say from

biomass to LPG, has significant consideration related to gender and context specific energy resource availability and socio economic factors. Hence, to ensure gender sensitive energy policy in the country, there is a need for reorienting monitoring and evaluation protocols to reflect gender concerns in energy programmes, linking women's empowerment with energy development and making cooking fuel available and affordable (through sustainable livelihood security) within the proximity of the habitation.

1. Introduction

India's per capita energy (606 kg of oil equivalent in 2013) and electricity (1010 kWh in 2014) consumptions are less than one tenth of developed countries' per capita consumption. The disparities in urban vs rural; southern, western and northern region vs eastern and northeastern region; and higher income vs lower income households are very high. Unfortunately, the regions where large fossil and renewable energy sources are available have lower per capita energy consumption.

Given the country's over dependence on coal, difficulty in meeting the financial burden of importing large volume of oil and gas, environmental consequences of energy production, transformation, transportation and use, India needs to chalk out strategies for development without resorting to the developed country level of energy consumption. To improve the quality of life of Indian citizens, there is no doubt that per capita energy consumption has to increase. Through judicious approach, higher quality of life can be achieved with moderate increase in energy consumption.

The country needs to make timely change of our emphasis on nonrenewable energy. Such a change in strategy calls for a paradigm shift in our development approach, i.e. from an unsustainable growth oriented economic development to an environmental friendly equitable development. Since three most serious environment related problems (Global warming, acid rain and ozone layer depletion) owe their origin to energy, it is in our interest to minimise 'energy want' without sacrificing the 'energy need' for a decent quality of life. A time bound plan is essential to move to 'renewable energy dominant decentralised system' from the existing 'nonrenewable energy focused, fossil fuel-centric centralised system'.

The paper addresses energy policy, with a focus on regional disparities in modern energy supply (electricity and LPG) and poor outcomes in modern energy use by women. It begins with a discussion on energy sources, uses, scarcity and disparity. Country-wise electricity uses, scarcity and disparity in consumption are discussed next. Subsequently, development of energy policy in general, and electricity policy in particular, are presented in Section 4. The discussion encompasses structural factors, key actors and strategies since independence, but with a focus on post-liberalisation period. Section 5 covers LPG demand

and supply situation. Both Section 4 and 5 covers changing role of stakeholders, regional disparity and the consequences with respect to realising inclusive clean energy security. Before concluding, an attempt is made to bring women into the ambit of inclusive energy policy.

2. Energy Sources, Uses, Scarcity and Disparity in India

Energy used can be broadly divided into commercial and noncommercial form. Commercial energy, i.e. traded in the market, includes coal, oil, gas, electricity and in some cases biomass. Noncommercial energy includes mostly biomass that is used for cooking, predominantly by the rural communities. Accurate and more recent data on noncommercial energy use in the country is not available. In 2000, India's energy mix was 65% commercial and 35% noncommercial (TEDDY 2010, pp 2).

Considering the stage of transformation, energy can also be classified as primary (coal, crude oil, natural gas, water, geothermal, wind, solar heat, biomass, etc.), secondary (steam, chilled water, petrol, diesel, biogas, hydroelectricity, solar electricity, etc.) and tertiary type (electricity). Since primary energy is often not clean and inconvenient to use, it is transformed to higher level that calls for sophisticated and often expensive technology. A number of political, economic, social, technological, legal and ecological factors play a critical role in ensuring access to and use of right quantity and quality of energy by the people.

Table 1 indicates the energy reserve and annual production of the primary energy. Although country has enough coal deposit, it has to depend on import for high grade coal used in steel plants and some power plants. 79% of oil demand is imported, putting huge burden on economy and associated insecurity. The reserve-to-production ratio for coal, lignite, oil and gas are respectively 532, 98, 20 and 41 years. Country’s uranium deposit is low and of poor quality. Technology for using Thorium needs to mature. There is a plan to develop 20000 MW of nuclear capacity by 2020. India has large potential for renewable energy exploitation. However, there is a wide gap between the potential and actual utilization. Technological constraints in few areas, high cost of production, weak institution and policy measures are coming in the way of large scale use of renewable energy.

Energy Uses

The total commercial energy use in India in 2011/12 was 353.01 Mtoe. Energy use in industry, transport, residential and commercial, agriculture, other energy use and non-energy use (fertiliser, petrochemical, etc.) were respectively 45.4%, 21.7%, 13.8%, 6.2%, 4.3% and 8.8% (TERI 2014/15, pp 3). In 2013/14, provisional energy intensity of India was 0.4192 Mega Joules/rupee and per capita energy consumption was 19522.2 Mega Joules

(CSO, 2015). Energy consumption in the country increased from 124.9 Mtoe in 1990/91 to 314.4 Mtoe in 2010/11, nearly 2.5 fold. It is slower than the rate of economic growth over the same period, that saw GDP 3.6 fold. The GDP of India at 2000 prices increased from USD 270.5 billion in 1990 to USD 971.5 billion in 2010 registering an annual average growth rate of 6.6 per cent in real terms (Economic Times, 2011).

Table 1: Primary Energy Reserve and Production Level

Type	Reserve	Annual Production	Geographical Distribution
Coal	301.05 billion Ton	565.77 million Ton	Jharkhand, Odisha, Chhattisgarh, West Bengal, Madhya Pradesh, Andhra Pradesh and Maharashtra
Lignite	43.24 billion Ton	44.27 million Ton	Tamil Nadu, Rajasthan and Gujarat
Oil	762.74 million Ton	37.70 million Ton	Western Offshore and Assam
Gas	1427.15 billion cubic meter	34.64 billion cubic meter	Eastern Offshore and Western Offshore
Biomass[2]	666.5 million Ton/year (Generation) 249.2 million Ton/Year (Surplus) for power generation of 33292 MW	5941 MW as on 31 March 2016	Maharashtra, Gujarat, Haryana, Punjab, Tamil Nadu
Biogas		47.52 lakh units as on 31 March 2014	Maharashtra, Andhra Pradesh, Karnataka, Uttar Pradesh, Gujarat
Wind	1,02,772 MW	22,645 MW in 2014-15	Andhra Pradesh, Tamil Nadu, Karnataka, Gujarat
Solar	7,48,000 MW	3,744 MW as on 31 March 2014	Entire country
Hydro[3]	Small Hydro: 19,749 MW Large Hydro: 84,000 MW at 60% load factor	Small Hydro: 4,055 MW Large Hydro: 36,000 MW	North Eastern States, Himachal Pradesh, Jammu and Kashmir, Uttarakhand, Karnataka

Note: Data for Coal, Lignite, Oil, Gas and Hydro are as on 31 March 2014

Source: 1. Energy Statistics (2015), Central Statistical Office, NSO, MOS & PI, GOI, www.mospi.gov.in

2. For Biomass, http://biomasspower.gov.in/biomass-info-asa-fuel-resources.php
3. For Hydro, https://www.pwc.in/assets/pdfs/publications/2014/hydropower-in-india-key-enablers-for-better-tomorrow.pdf

Between 1990-91 and 2010-11, the proportional shares of Agriculture and Residential sectors have gone up while those of Industry and Transport sectors have gone down (Table 2). The changes in proportional share of commercial energy use are due to large scale rural electrification, energization of pump-sets and other machineries used in agriculture, energy efficient measures in industry, and shift towards service sector.

Table 2: Final Commercial Energy Consumption (in Mtoe) in India by Sector

Sector	Agriculture	Industry	Transport	Residential and Commercial	Other energy uses*	Non-energy uses**	Total
1980/81	1.6	36.9	17.4	5.6	1.9	5.3	68.7
	2.33%	53.71%	25.33%	8.15%	2.77%	7.71%	100.00%
1985/86	2.4	49.2	21.7	8.9	2.7	7.9	92.8
	2.59%	53.02%	23.38%	9.59%	2.91%	8.51%	100.00%
1990/91	4.9	62.9	28	12.6	3.9	12.6	124.9
	3.92%	50.36%	22.42%	10.09%	3.12%	10.09%	100.00%
1995/96	8.4	77.5	37.2	15.3	6.8	14.1	159.3
	5.27%	48.65%	23.35%	9.60%	4.27%	8.85%	100.00%
2000/01	15.2	77.4	33.5	24.1	13.4	28	191.6
	7.93%	40.40%	17.48%	12.58%	6.99%	14.61%	100.00%
2005/06	15.1	96.2	36.5	32.6	18.7	17.5	216.6
	6.97%	44.41%	16.85%	15.05%	8.63%	8.08%	100.00%
2009/10	23.14	137.98	55.34	43.43	30.25	26.15	316.29
	7.32%	43.62%	17.50%	13.73%	9.56%	8.27%	100.00%
2010/11	18.7	146.72	63.39	44.09	14.33	27.17	314.4
	5.95%	46.67%	20.16%	14.02%	4.56%	8.64%	100.00%
2011/12	21.79	160.09	76.46	48.7	15.07	30.9	353.01
	6.17%	45.35%	21.66%	13.80%	4.27%	8.75%	100.00%

Source: Table 1, Chapter 1, TERI Year Book, 2015, page 3

* This comprises energy spent in miscellaneous uses and mining.

** Non-energy uses exist only for naphtha and natural gas sectors, since both these fuels are consumed as feed stock in fertilizers and petrochemicals

The energy intensity shows a cumulative declining trend of 1.3% per year between 2005-06 and 2013-14. During the same period, the emission intensity, measured in terms of carbon di oxide emission per rupee of GDP, decreased till 2009-10 and then increased till 2013-14 (Table 3). "This is due in part to the shift away from bioenergy consumption in the residential sector, the rising importance of the services sector in the Indian economy and increased policy efforts directed at end-use energy efficiency" (IEA, 2015).

The commercial energy consumption in India is highly dependent on coal. It contributes to about 41.3% in 2013-14. In the same year, the contribution of oil and gas was 38.7%.

Balance of 14.5% was electricity from nuclear, hydro and other renewable energy sources (ibid).

Table 3: Energy Intensity and Emission Intensity in India

Year	Total Commercial Energy Consumption (Peta Joules)	Mid-Year Population (million)	GDP at 2004-05 price (Rs Crore)	Energy Consumption Per Capita (MJ)	Energy Intensity (MJ/Rs)	CO2 Emission (billion Ton)	Emission Intensity (kg of CO2/MJ)
2005-06	15146	1106	3253073	13694.39	0.4656	1.3	0.0858
2006-07	16421	1122	3564364	14635.47	0.4607	1.4	0.0853
2007-08	17514	1138	3896636	15390.16	0.4495	1.5	0.0856
2008-09	18457	1154	4158676	15993.93	0.4438	1.6	0.0867
2009-10	21233	1170	4516071	18147.86	0.4702	1.7	0.0801
2010-11	21892	1186	4918533	18458.68	0.4451	1.8	0.0822
2011-12	22383	1202	5247530	18621.46	0.4265	1.82	0.0813
2012-13	23903	1217	5482111	19640.92	0.4360	1.98	0.0828
2013-14	24071	1233	5741791	19522.30	0.4192	2.07	0.0860
CAGR (%)	5.96	1.37	7.36	4.53	-1.3	5.99	0.02

Source: Energy Statistics 2015, CSO, NSO, MOSPI, Government of India, Table 6.3, page 45
Trends in Global CO2 Emission 2014 Report, PBL Netherlands Environmental Assessment Agency and EC Joint Research Center, The Hague, 2014, Table 2.2, Pages 22 and 23

Although India has large coal reserve, it is faced with poor quality (high ash content and low calorific value), inefficient and expensive mining, environmental restrictions and poor labour relation. To reduce demand supply gap of oil and gas, government has initiated steps to intensify exploration in different sedimentary basins of the country; import liquefied natural gas (LNG); and acquire equity oil and gas assets overseas. Large portion of India's hydroelectric potential remains unutilized, primarily in Northern and North-eastern region due to difficult and inaccessible potential sites, difficulties in land acquisition, rehabilitation, environmental and forest related issues, interstate issues, geological surprises and contractual issues. However, the government has taken initiative related to life extension, uprating and restoration of large hydroelectric projects. Considering the risks involved in nuclear power plants, scarcity of fuel and strong opposition from civil society and different communities, it will be an uphill task to achieve government's plan of developing huge nuclear capacity. Evacuating electricity from the generating stations and surplus locations has been an area of challenge. Open access in transmission, trading and power exchange are being used to bring competitiveness to the electricity market. Renewable energy is being promoted through a number of policy instruments.

Domestic Energy Use

Domestic consumers use energy for cooking, lighting, refrigeration, air conditioning, ventilation, entertainment, water supply, etc. The sources of energy are electricity, LPG,

kerosene and biomass. A key driver of domestic electricity consumption in both rural and urban areas has been increasing use of electrical appliances such as fans, televisions, refrigerators and air conditioners. Consequently, there is a decline in traditional use of biomass for cooking and heating.

According to 68th round NSSO study, in 2011-12, 96.1% of urban households and 72.7% of rural households use electricity as the primary source of lighting. The proportion of urban households using kerosene as primary energy source for lighting was 3.2% or less in ten out of seventeen major states. Major states with large number of urban households using kerosene for lighting include Bihar (17.2%), Uttar Pradesh (10.8%), Assam (7.9%), Gujarat (5.2%), West Bengal (5.0%), Chhattisgarh (3.6%) and Odisha (3.5%). The percentage of rural households using kerosene was as high as 73.5% in Bihar, 58.5% in Uttar Pradesh, 43.3% in Assam, 36.8% in Jharkhand, 32.3% in Odisha and 29.3% in West Bengal (ibid).

68.4% of urban households and 15% of rural households use LPG as the primary cooking energy. Similarly, 5.7% of urban households and 0.9% of rural households use Kerosene as the primary cooking energy. Firewood and chips are the primary cooking fuel in 67.3% rural and 14% urban households. 87% of Scheduled Tribe households and 70% of Scheduled Caste households in rural India use firewood, compared with 57 % of others. In urban India, Use of LPG for cooking was relatively low among Scheduled Tribes (51.6%) and also among Scheduled Castes (56.8%) compared to the all-groups incidence of 68.4%. This use is highest among the households of 'others' social group (76.2%) (ibid).

To provide clean lighting and cooking energy at the household level, Government of India has initiated schemes such as Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY) and Rajiv Gandhi Gramin Yuva LPG Vitrak Yojana (RGYLVY).

Agricultural Energy Use

In India, major commercial energy consumption in agriculture is in the form of diesel and electricity, used for irrigation pump sets, tractors and power tillers. 1,89,56,850 electric and 67,83,552 diesel pump sets were used in the country in 2013 and 2011 respectively (TERI, 2014/15). Annual sale of power tiller and tractors in 2011-12 were respectively 60,000 and 6,07,658 units. The agriculture sector consumed 11.212 MT of high speed diesel (HSD) in 2009/10 (19.9% of the total HSD consumption in India) and about 133 660 GWh of electricity was consumed in the agriculture sector in 2011/12 (17.3% of the total consumption of electricity in India). At 10% efficiency gain in pumps, there would have been an electricity savings of 13.4 billion kWh at the farmers' end. Agriculture sector also uses energy indirectly in the form of fertiliser and pesticide. Better package of practices such as System of Rice Intensification (SRI) can help reduce direct and indirect energy use and increase productivity.

Industrial Energy Use

The industrial energy use a proportion of total changed from 53.7% in 1980/81, through 53% in 1985/86, 50.4% in 1990/91, 48.6% in 1995/96, 40.4 % in 2000/01, 44.4% in 2005/06 to 46.7% in 2010/11. It indicates the declining share of industry in GDP and use of energy efficient process technology (ibid). Between 2000 and 2013, the industrial energy demand nearly doubled with primary contribution from coal and electricity to meet the growing requirements of energy intensive aluminum, steel and cement industry.

Transport Energy Use

Energy use in transportation, as a proportion of total, changed from 25.3% in 1980/81, through 23.4% in 1985/86, 22.4% in 1990/91, 23.4% in 1995/96, 17.5 % in 2000/01, 16.8% in 2005/06 to 20.2% in 2010/11 (ibid). Slow growth of mass transport, dominance of road transport and changing aspiration of people to have individual owned vehicles result in maintaining sector's share of high energy consumption over the years.

3. Electricity Uses, Scarcity and Disparity

Electricity constitutes about 15% of final energy consumption, an increase of around four percentage points since 2000. India constituting around one-sixth of the world's population, consumes about one-twentieth of global power output (IEA, 2015). As on 31st January 2016, the total electricity installed capacity in India was 2,88,005 MW with a mix of 69.7% fossil fuel fired thermal, 2% nuclear and 28.3% hydro and other renewables. In 1947, out of a total of 4182 GWh, the all India electricity consumption mix was 10.1%, 4.3%, 70.8%, 6.6%, 3% and 5.2% for Domestic, Commercial, Industrial, Traction, Agriculture and Miscellaneous respectively. In 2015, out of a total of 938823 GWh, the consumption mix changed to 23.5%, 8.8%, 42.1%, 1.8%, 18.5% and 5.4% respectively (CEA, 2015). A shift of focus from industry towards domestic, commercial and agriculture is visible.

The shifts in generating capacity addition and electricity generation from State sector to Central sector and Private sector are remarkable from 200-01 to 2014-15 (Table 4). In 2001 the installed capacity mix of State, Central and Private sectors was respectively 62.7%, 9.8% and 27.5%. In the same year the electricity generation mix was respectively 55.7%, 8.8% and 35.6%. In contrast in 2015, the installed capacity mix of State, Central and Private sectors was respectively 39.9%, 30.8% and 29.3%. In the same year the electricity generation mix was respectively 38%, 24.2% and 37.9%. Thus, states' share came down by 22.8 percentage points in capacity and 17.7 percentage points in energy generation. There is a remarkable increase in private sector share with nominal increase in central sector share.

Table 4: Sector-wise Installed Electricity Capacity Addition and Generation

Date	Installed Capacity (MW)			Installed Capacity Share %			Gross Electricity Generation (GWh/Year)			**Electricity Generation Share %**		
	State	Private	Central	State	Private	Central	State	Private	Central	State	Private	Central
2001	63721	9936	27969	62.7	9.8	27.5	278980	43981	178243	55.7	8.8	35.6
2002	65512	10800	28734	62.4	10.3	27.4	290244	43116	184079	56.1	8.3	35.6
2003	66582	11351	29944	61.7	10.5	27.8	291360	48045	193288	54.7	9.0	36.3
2004	67505	12325	32854	59.9	10.9	29.2	304647	55372	205082	53.9	9.8	36.3
2005	69161	13718	35547	58.4	11.6	30.0	315365	58616	220475	53.1	9.9	37.1
2006	73235	14135	36917	58.9	11.4	29.7	327731	61763	234326	52.5	9.9	37.6
2007	73579	16713	42037	55.6	12.6	31.8	350844	66803	253007	52.3	10.0	37.7
2008	77523	20511	45027	54.2	14.3	31.5	368888	80932	272806	51.0	11.2	37.8
2009	79309	22879	45777	53.6	15.5	30.9	374209	89798	277160	50.5	12.1	37.4
2010	82905	29014	47479	52.0	18.2	29.8	380371	119918	299562	47.6	15.0	37.5
2011	87417	35450	50759	50.3	20.4	29.2	386037	140878	317833	45.7	16.7	37.6
2012	85919	54276	59682	43.0	27.2	29.9	409022	149803	364005	44.3	16.2	39.4
2013	89125	68859	65360	39.9	30.8	29.3	365812	233004	364906	38.0	24.2	37.9
2014	92265	84838	68126	37.6	34.6	27.8	350403	226245	384905	36.4	23.5	40.0
2015	95079	104122	72521	35.0	38.3	26.7	366803	281760	395102	35.1	27.0	37.9

Source: CEA, Ministry of Power, Government of India, 2015.

During 2014-15, country had a power and energy deficits of 4.7% and 3.6% respectively, at peak power availability of 1,41,160 MW and availability of 10,30,785 million kWh of electrical energy with a plant load factor of 64.46% (Powermin, 2016). Table 5 indicates the state-wise peak power and energy demand, supply, surplus/deficit and per capita electricity consumption in 2014-15. Although the entire country is having supply-constrained deficit in both peak power and electrical energy, North-Eastern Region has the highest deficit at 12.9% and 8.7% respectively.

Among the states, Jammu and Kashmir and Uttar Pradesh in Northern region; Telangana in Southern region; and almost all states of North-Eastern region have very high energy and power deficit. Since most of these states have high potential of electricity production, with right political will and planning, the scarcity can be controlled.

The shortage of power has its effect in creation of individualized back-up generating capacity, by domestic, commercial and industrial customers during periods of peak demand in the form of diesel generators, batteries and inverters.

Table 5: State-wise Power and Energy Demand and Per Capita Consumption (2014-15)

Region/State/System	Electricity Power Demand (MW)	Power Surplus(+)/ Deficit (-) %	Electricity Energy Demand (MU)	Energy Surplus(+)/ Deficit (-) %	Annual Per Capita Total Electricity Consumption (kWh)
Chandigarh	367	0.0	1,616	0.0	1052
Delhi	6,006	-1.3	29,231	-0.4	1561
Haryana	9,152	0.0	46,615	-0.4	1909
Himachal Pradesh	1,422	0.0	8,807	-0.9	1336
Jammu & Kashmir	2,554	-20.0	16,214	-19.1	1169
Punjab	11,534	-13.1	48,629	-1.0	1858
Rajasthan	10,642	0.0	65,717	-0.6	1123
Uttar Pradesh	15,670	-17.0	103,179	-15.6	502
Uttarakhand	1,930	0.0	12,445	-3.0	1358
Northern Region	**51,977**	**-8.3**	**332,453**	**-6.3**	
Chhattisgarh	3,817	-4.7	21,499	-1.3	1719
Gujarat	13,603	-0.8	96,235	0.0	2105
Madhya Pradesh	9,755	-0.4	53,374	-0.5	813
Maharashtra	20,147	-1.7	134,897	-1.3	1257
Daman & Diu	301	0.0	2,086	0.0	6960
Dadra & Nagar Haveli	714	0.0	5,307	-0.1	13769
Goa	501	-2.4	3,969	-0.9	1803
Western Region	**44,166**	**-2.3**	**317,367**	**-0.8**	-
Andhra Pradesh	7,144	-5.0	59,198	-4.9	1040
Karnataka	10,001	-4.5	62,643	-4.3	1211
Kerala	3,760	-4.4	22,459	-1.5	672
Tamil Nadu	13,707	-1.5	95,758	-3.1	1616
Telangana	7,884	-14.3	43,337	-6.2	1356
Puducherry	389	-10.5	2,402	-1.1	1655
Lakshadweep	8	0.0	48	0.0	657
Southern Region	**39,094**	**-5.2**	**285,797**	**-4.1**	
Bihar	2,994	-4.0	19,294	-2.8	203
DVC	2,653	-2.4	18,222	-2.7	-
Jharkhand	1,075	-1.9	7,599	-2.8	835
Odisha	3,920	-0.7	26,482	-1.6	1419
West Bengal	7,544	-0.3	47,086	-0.6	647
Sikkim	83	0.0	399	0.0	685
Andaman & Nicobar	40	-20.0	240	-25.0	361
Eastern Region	**17,040**	**-0.6**	**119,082**	**-1.6**	
Arunachal Pradesh	139	-9.4	677	-9.9	525
Assam	1,450	-13.3	8,527	-7.0	314
Manipur	150	-2.7	705	-3.8	295
Meghalaya	370	-0.8	1,930	-15.3	704
Mizoram	90	-2.2	455	-6.6	449
Nagaland	140	-8.6	688	-3.9	311
Tripura	310	-14.2	1,242	-15.6	303
North-Eastern Region	**2,528**	**-12.9**	**14,224**	**-8.7**	
All India	**148,166**	**-4.7**	**1,068,923**	**-3.6**	1010

Note: Per Capita Consumption = (Gross Energy Generation + Net Import)/Mid Year

Source: 1. For Power and Energy Demand, Load Generation Balance Report 2015-16, Government of India, Ministry of Power, CEA, Annex II and III

2. For Per capita Electricity Consumption, Unstarred Question No 897, Rajya Sabha, 07.12.2015.

The annual national per capita electricity consumption in 2014-15 stood at 1010 kWh. All the northern states, excepting UP; all the western states excepting MP; and all the southern states excepting Kerala have higher than national per capita consumption of electricity. All the eastern state, excepting Odisha; and all the north-eastern states have per capita electricity consumption much below the national average. It is because of the existence of large proportion of un-electrified households and lack of energy intensive industries. In states like Odisha, Chhattisgarh and Jharkhand, the per capita electricity consumption is at moderate level, in spite of the presence of large number of un-electrified households and below poverty line families, because of the presence of many energy intensive extraction based industries.

In different five year plans rural electrification and clean energy for cooking find their place at different degree (Table 6).

Table 6: Focus of Rural Electrification in Different Plan Period

Plan and Period	Focus of Rural Electrification	Focus on Gender Aspects
1st Five Year Plan (1951-56)	Support for irrigation Projects 1 electrified village/ 200 villages	No specific focus on Gender issues
2nd Five Year Plan (1956-61)	"Rural Electrification" declared as "special interest area" Proposed to cover all towns with a population of 10,000 or more. Only 350 out of a total of 856 were electrified	No specific focus on Gender issues
3rd Five Year Plan (1961-66)	Established "Rural Electrification Corporation" 30,000 villages electrified, against a target of 37,000 villages	No specific focus on Gender issues
4th and 5th Five Year Plan (1969-74 and 1974 - 1979)	focused on energization of pump sets Issued guidelines for village grind connectivity for all villages with a population of 5000 and above	No specific focus on Gender issues
6th, 7th and 8th Five Year Plan (1980-89 and 1992-1997)	Initiated programs of "improved chulhas or cook stoves", "Bio-gas plants" etc. Establishment of Ministry of New and Renewable Energy. Launched "accelerated rural electrification programme"	Concern on women health due to cooking
9th, 10th and 11th Five Year	Launch of *Kutir Jyoti Yojana* and the Rajiv Gandhi	Integrated Energy Policy explicitly brought gender concerns through

Plan (1997-2012)	Grameen Vidyutikaran Yojana (RGGVY)	minimum lifeline energy use for lighting and cooking.
12th Five Year Plan (2012-17)	Deendayal Upadhyay Gram Jyoti Yojana (DDUGJY) with major modifications in RGGVY (2014) Pradhan Mantri Ujjwala Yojana (PMUY) (2016)	Separation of domestic and agricultural feeders in rural area for providing round the clock and adequate electricity to domestic and agriculture sectors respectively. 50 million LPG connections in the name of women in BPL (Below Poverty Line) households.

Source: Vasudha Foundation (2010), Shifting of Goal Posts: Rural Electrification in India

Both State and National Governments have programs to accelerate the village and household electrification process. As on 1st April 2015 there were 18452 unelectrified villages in the country and Government has an ambitious target of electrifying them by 31st December 2016. Table 7 indicates the state-wise pace of household level rural electrification in the country. As on 31st May 2015, States have reported 591.7 lakh un-electrified households (UEHHs) out of total 1678 lakh rural households in the country. Goa, Gujarat, Punjab, Andhra Pradesh & Union Territories have achieved 100% electrification. 90% or more rural households are electrified in major states such as Andhra Pradesh, Tamil Nadu, Kerala, West Bengal, Haryana, Punjab, Himachal Pradesh, Uttarakhand, Goa and Gujarat. States with 75% to 90% rural household electrification include Chhattisgarh, Telangana, Karnataka, Maharashtra, Sikkim and Tripura. Among major states, 11.8% rural households in Bihar, 28.6% in Uttar Pradesh, 37.1% in Jharkhand, 47.5% in Odisha, 56.6% in MP and 63.5% in Rajasthan are electrified.

The factors of poor electrification in rural areas and low per capita consumption include lack of community consciousness and power to mobilise political will; theft of electricity, electrical conductors and coolant from transformers; administrative apathy, weak implementing agency and inability to afford high initial cost of connection and regular electricity charges.

In spite of the push from the central government with enabling legislation, financing and technical support, some of the states have a record of low rate of electrification. It can be attributed to strong agricultural lobby, political will and better governance at the state and organizational level. States with good agricultural productivity and higher per capita gross domestic product have performed well in providing electricity access. Accordingly, rural electrification performance of higher GDP states such as Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Gujarat, Punjab and Haryana are better than Moderate GDP states like Madhya Pradesh and Rajasthan. Performance of moderate GDP states are better than lower GDP states of Bihar, Jharkhand and Odisha (Krishnaswamy, 2010). Additionally, states with good track record of rural electrification had the distinction of felt

'essential need' for electricity of large number of households, consequent social security of electrical infrastructure, and reasonably higher tariff.

Table 7: State-wise Status of Rural Electricity Supply (as on 31st May 2015)

States/UTs	Total inhabited villages as per 2011 census	Percentage of villages electrified	Un-electrified villages	Total Rural Households as per 2011 Census (lakh)	Percentage of households electrified	Un-electrified Households (lakh)
Andhra Pradesh	16158	100	0	89.97	100	0
Arunachal Pradesh	5258	70.3	1564	1.95	65.6	0.67
Assam	25372	96.8	803	53.74	34.2	35.34
Bihar	39073	95.5	1757	169.26	11.8	149.21
Chhattisgarh	19567	97.7	442	43.84	79.8	8.87
Goa	320	100	0	1.25	100.0	0
Gujarat	17843	100	0	67.65	100.0	0
Haryana	6642	100	0	29.66	90.4	2.85
Himachal Pradesh	17882	99.7	54	13.1	98.9	0.14
Jammu & Kashmir	6337	98.2	113	14.97	76.2	3.56
Jharkhand	29492	92.9	2105	46.85	37.1	29.48
Karnataka	27397	99.9	34	78.64	87.1	10.13
Kerala	1017	100	0	40.95	92.2	3.18
Madhya Pradesh	51929	97.2	1458	111.22	56.6	48.22
Maharashtra	40956	99.9	36	130.16	85.6	18.73
Manipur	2379	86.6	318	3.35	55.2	1.5
Meghalaya	6459	80.1	1283	4.22	54.0	1.94
Mizoram	704	93.6	45	1.04	66.3	0.35
Nagaland	1400	90.8	129	2.84	59.5	1.15
Odisha	47677	91.9	3878	81.44	47.5	42.78
Punjab	12168	100	0	33.15	100.0	0
Rajasthan	43264	90.4	4166	94.90	63.5	34.63
Sikkim	425	100	0	0.92	84.8	0.14
Tamil Nadu	15049	100	0	95.63	99.8	0.16
Tripura	863	97	26	6.07	77.6	1.36
Telangana	10128	100	0	52.49	86.3	7.17
Uttar Pradesh	97813	98.7	1298	254.75	28.6	181.8
UttaraKhand	15745	99.3	107	14.04	92.9	1.00
West Bengal	37463	99.99	2	137.17	94.6	7.36
Total(States)	596780	96.7	19618	1675.2	64.68	591.7
A & N Islands	396	77.8	88	0.59	-	-
Chandigarh	5	100	0	0.07	100	0
D & N Haveli	65	100	0	0.35	100	0

Daman & Diu	19	100	0	0.13	100	0
Delhi	103	100	0	0.79	100	0
Lakshadweep	6	100	0	0.03	100	0
Pondicherry	90	100	0	0.95	100	0
Total(UTs)	684	87.1	88	3.1	100	0
Total	597464	96.7	19706	1678.3	64.74	591.7

Source: https://data.gov.in/catalog/progress-report-village-electrification
http://www.ddugjy.in/

Quality of Electricity Service

The quality of power supply is assessed by the level of voltage fluctuation, frequency variation, surges, number of interruptions and the average interruption hours. The sectoral variation in quality of electricity supply and tariff in different states are presented in Table 8.

There is wide disparity in electricity service availability in different states. In Gujarat, Himachal Pradesh and Punjab round the electricity is available in rural area. In all other states, electricity supply to rural area is between 9 to 19 hours, with the median value at 11.5 hours. Hence, electricity is not available for more than 50% time. To address the issues of temporal deficit in electrical power and energy and poor quality, consumers resort to backup sources in the form of captive power generating units and batteries. Backup power is not only an example of macro-level inefficient resource utilization, but also expensive and consumes scarce non-renewable resources.

Himachal Pradesh, with low tariff could provide better quality of rural electricity service because of its huge low cost hydro-electricity source. Higher electricity availability in Gujarat and Punjab is attributed to reasonably higher tariff, demanding rural community and political will. In contrast, Madhya Pradesh, Haryana and Assam, in spite of reasonably high tariff could not ensure high availability because of poor governance and weak reform process.

Based on a study by Vasudha Foundation (2010), it is observed that people are more than willing to pay for electricity services provided it is reliable, as they see access to energy services and electricity as their doorway to a better future". Hence, while ensuring, ease of access to poor families, provision of reliable electricity can command reasonable price from the rural consumers.

Table 8: State-wise Quality of Electricity Supply (2010)

State	Supply in Rural Area (hr/day)	Lowest Domestic Tariff (Rs/kWh)	State	Supply in Rural Area (hr/day)	Lowest Domestic Tariff (Rs/kWh)	State	Supply in Rural Area (hr/day)	Lowest Domestic Tariff (Rs/kWh)
Jharkhand	11	1.5	West Bengal	11	2.27	Himachal Pradesh	24	1
Bihar	9	1.35	Madhya Pradesh	12	3.15	Punjab	24	3.11
Uttar Pradesh	13	3.45	Odisha	13	1.4	Tamil Nadu	18.7	-
Assam	11.5	2.35	Gujrat	24	2.8	Karnataka	9.5	2.1
Rajasthan	11	1.95	Haryana	11.5	2.63	Andhra Pradesh	12	1.45

Source: For Supply of Electricity - http://www.vasudha-foundation.org
For Domestic Tariff - http://www.bijlibachao.com/news/domestic-electricity-lt-tariff-slabs-and-rates-for-all-states-in-india-in-2016.html

Cost of Electricity Supply and Tariff in Different States

Electricity tariff in different states for customers in different sectors are politically determined. In most states, agriculture and domestic consumers are cross-subsidised by commercial and industrial consumers. In number of instances, to attract industries, states resort to subsidized electricity to them as well. The losses are made up from budgetary allocations and suboptimal investment in modernization, primarily in distribution and institution development. Hence, the electricity sector, owned and controlled by states, have signs of poor management. Table 9 indicates the comparative picture of cost of electricity supply and revenue received from agricultural consumers and average from all consumers (domestic, agriculture, commercial and residential). For nearly a decade starting from 2004-05, the subsidy to agriculture electricity has remained about 70%. In 2013-14, while 22% of total electrical energy was sold to Agriculture consumers, their share in the total revenue was 8%. Similarly, industrial consumers getting 29% of energy sold, contribute 41% of total revenue (PFC, 2015). As indicated in Table 10, in 2013-14, among the major states, large subsidy for electricity is provided in Jharkhand (51.4%), Bihar (39.3%), Haryana (42.3%), J&K (58.8%), Rajasthan (45.4%), Uttar Pradesh (56.5%), Tamil Nadu (37.4%) and Madhya Pradesh (41.3%). Although Electricity Act 2003 recommends gradual reduction of subsidy and Regulatory Commissions oversee its implementation, it is expected that large subsidy will increase rural consumers' access to electricity. Odisha and Chhattisgarh can increase rate of electrification, access to electricity and income generation potential in rural areas by considering higher subsidy, at least to rural consumers.

Table 9: Average Cost of Power Supply and Average Revenue

Year	Cost of Supply (Rs/kWh)	Revenue Including Agriculture (Rs/kWh)	Revenue Only Agriculture (Rs/kWh)	Subsidy to Agriculture (% of Cost)
2004-05	2.54	2.09	0.7568	70.2
2005-06	2.6	2.21	0.7636	70.6
2006-07	2.76	2.27	0.7423	73.1
2007-08	2.93	2.39	0.7727	73.6
2008-09	3.4	2.63	0.8713	74.4
2009-10	3.55	2.68	0.887	75.0
2010-11	3.98	3.03	1.1975	69.9
2011-12	4.55	3.3	1.3514	70.3
2012-13	5.01	3.76	1.4867	70.3
2013-14	5.15	4	-	

Source: 1. CEA, 2015, Executive Summary, Power Sector, Government of India
2. PFC, 2015, The Performance of the State Power Utilities for the Years 2011-12 to 2013-14

The Aggregate Technical and Commercial (ATC) Loss, an indicator of the technological and managerial capability of the distribution companies, stood at 22.7% at national level in 2013-14. In the same year, the ATC loss for Eastern, North-Eastern, Northern, Southern and western regions were respectively 38.02%, 33.94%, 24.86%, 19.08% and 18.37% (ibid).

Table 10: Average Cost of Power Supply and Revenue (2013/14)

State	Average Cost (Rs/kWh)	Average Revenue (Rs/kWh) without subsidy	Gap (Rs/kWh)	Subsidy as a proportion of Cost (%)
Bihar (NBPDCL)	4.84	2.94	-1.9	39.3
Jharkhand (JSEB)	5.52	2.68	-2.84	51.4
Odisha (CESU)	3.91	3.66	-0.25	6.4
Sikkim	3.1	3.49	0.39	-12.6
West Bengal (WBSEDCL)	4.89	4.9	0.01	-0.2
Arunachal Pradesh	8.03	1.43	-6.6	82.2
Assam (APDCL)	5.14	4.15	-0.99	19.3
Manipur	5.2	2.2	-3	57.7
Meghalaya (MePDCL)	3.39	3.21	-0.18	5.3
Mizoram	6.35	2.34	-4.01	63.1
Nagaland	4.57	1.54	-3.03	66.3
Tripura	3.74	3	-0.74	19.8
Delhi (BSES Rajdhani)	6.1	6.11	0.01	-0.2

Haryana (UHBVNL)	5.53	3.19	-2.34	42.3
Himachal Pradesh (HPSEB)	4.83	4.77	-0.06	1.2
J&K	3.2	1.32	-1.88	58.8
Punjab	4.71	3.73	-0.98	20.8
Rajasthan (AVVNL)	7.14	3.9	-3.24	45.4
Uttar Pradesh (DVVN)	6.18	2.69	-3.49	56.5
Uttarakhand	3.09	3.36	0.27	-8.7
Andhra Pradesh (APCDCL)	4.9	4.2	-0.7	14.3
Karnataka (HESCOM)	4.75	4	-0.75	15.8
Kerala (KSEB)	4.8	4.92	0.12	-2.5
Puducherry	3.82	3.6	-0.22	5.8
Tamil Nadu (TANGEDCO)	6.52	4.08	-2.44	37.4
Chhattisgarh	3.43	3.15	-0.28	8.2
Goa	3.35	3.34	-0.01	0.3
Gujarat (PGVCL)	3.17	3.57	0.4	-12.6
Madhya Pradesh (MPMKVVCL)	4.89	2.87	-2.02	41.3
Maharashtra (MSEDCL)	5.34	5.22	-0.12	2.2

Source: PFC, 2015, The Performance of the State Power Utilities for the Years 2011-12 to 2013-14

Electricity sector in many states, especially in Eastern and North-Eastern states (Table11), is in a vicious cycle because of faulty pricing, poor management and technology options chosen. Faulty pricing system leads to inadequate fund for generation, transmission and distribution infrastructure development, which results in power and energy deficit and poor quality of power. Intentionally not measuring the electricity supply at every distribution transformer end helps the vested interests in the organization, who work in connivance with the unscrupulous consumers. Consequently, consumers (from premium segment) invest in their own energy system and resist higher price for poor quality of electricity services. The situation is worrisome in states where privatization has taken place. For example, in Odisha, private electricity distribution utilities are reluctant to invest in infrastructure development and have failed in bringing down aggregate technical and commercial loss, which remained as high as 44.66% in 2011/12, 42.88% in 2012/13 and 39.19% in 2013/14; notwithstanding the vigilance and oversight of statutory electricity regulatory authority (ibid).

Unique social, economic and political factors characterize regional disparity in demand and supply of electricity and LPG. While in most of the states, domestic and agricultural consumers are underserved and unserved, in few other states their dominant influence in socio-political sphere puts them as privileged electricity customers. As Kale (2014) noted

> The process of electrification has been conditioned by social and political contexts that vary from state to state… Where rural actors, either acted on the state from the inside, through rural political coalitions or from the

outside through social movements, the state expanded rural electrification programs and lowered the cost of electricity for rural consumers. The absence of such pressures helps to account for the large swath of Indian countryside that remains unconnected to the grid... In those parts of the country that were successfully electrified, the gains were due to neither nationalist idealism nor only technocratic plans. Instead, rural electrification occurred either when rural constituencies became politically influential in state governments or when farmers mobilized to demand a larger share of development resources.

Table 11: State-wise AT&C Loss of Electricity Distribution Companies in 2013/14

Region/State	AT&C Loss (%)	Region/State	AT&C Loss (%)	Region/State	AT&C Loss (%)
Delhi	14.09	Andhra Pradesh	14.77	Arunachal Pradesh	68.2
Haryana	34.33	Karnataka	22.02	Assam	30.25
Himachal Pradesh	15.13	Kerala	22.78	Manipur	43.55
Jammu & Kashmir	49.14	Tamil Nadu	22.35	Meghalaya	35.38
Punjab	17.91	Puducherry	16.18	Mizoram	32.53
Rajasthan	26.76	**Southern Region**	**19.08**	Nagaland	38.37
Uttar Pradesh	24.65	Bihar	46.33	Tripura	27.81
Uttarakhand	19.01	Jharkhand	42.17	**North-Eastern Region**	**33.94**
Northern Region	**24.86**	Odisha	39.19	**All India**	**22.7**
Chhattisgarh	23.17	West Bengal	32.05		
Gujarat	15.93	Sikkim	71.23		
Madhya Pradesh	28.03	**Eastern Region**	**38.02**		
Maharashtra	14.39				
Goa	10.72				
Western Region	**18.37**				

Source: PFC, 2015, The Performance of the State Power Utilities for the Years 2011-12 to 2013-14

In Maharashtra, dominant sugar cane farmers and their sugar cooperatives through direct control of political power were instrumental in getting high access and quality of electricity at a low price. In Gujarat, farmers lobby could mobilise assured irrigation power and rural electrification at a fast pace. Similarly, in Andhra Pradesh, farmers' groups through indirect control of political power could ensure full rural electrification with adequate quantity and quality of electricity. In contrast, Odisha and West Bengal, with urban centric political power base, remained a laggard till today.

With the enactment of Electricity Act 2003, subsequent National policies for rural electrification, government of India's financial and technical support, and inclusion of electricity for all in the election manifesto of major political parties at both national and state level, the existence of unelectrified villages and households in the country can be solely attributed to state specific absence of political will, weak governance and

management system, low paying capacity of the household and un-demanding rural customers. High ATC losses are an outcome of the absence of political will and lack of accountability of the utilities. Both technology and institutional mechanisms are available in the country to bring down the ATC losses to a reasonable level.

Recently announced Integrated Power Development Scheme (IPDS) for the North Eastern States is aimed at reducing ATC losses by strengthening sub-transmission and distribution network; metering of distribution transformers /feeders / consumers in the urban areas; and IT enabled energy accounting / auditing system. The Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) will separate agriculture and non-agriculture feeders facilitating judicious rostering of supply to agricultural and non-agricultural consumers in rural areas and (ii) strengthening and augmentation of sub transmission and distribution infrastructure in rural areas, including metering of distribution transformers/feeders/consumers.

Government of India's Ujwal Discom Assurance Yojana (UDAY) aims at comprehensive resolution of the ATC losses and other issues faced by the distribution companies which are the weakest link in the electricity infrastructure. The objectives are to reduce AT&C loss to 15% in 2018-19; to reduce gap between Average Revenue Realized (ARR) & Average Cost of Supply (ACS) to zero by 2018-19; and to make all DISCOMs profitable by 2018-19 (Ministry of Power, 2015). It is expected that with the implementation of UDAY, information will be transparent, losses will be tracked comprehensively, corrective action will be taken through participatory process and demand side management practices will be implemented through good governance and management systems.

4. Energy Policy

A complex web of institutions steers and manages the energy sector in the country. At the helm of affairs, National Development Council articulates its vision through erstwhile Planning Commission and presently, National Institution for Transforming India (NITI Aayog) with input from different ministries. Ministry of Power, Ministry of Coal, Ministry of New and Renewable Energy, Ministry of Petroleum and Natural Gas and Department of Atomic Energy develops policies and implements the programs through the public sector undertakings, research institution, regulatory authorities and associated organisations at the national level. Ministry of Road Transport and Highways, Ministry of Railways, Ministry of Shipping, Ministry of Environment, Forest and Climate Change, Ministry of External Affairs, Ministry of Urban Development, Ministry of Water Resources, Ministry of Agriculture, Ministry of Finance and the Department of Science and Technology and State level institutions, including regulatory authorities facilitates, supports and executes energy related interventions. Coordination among different institutions at state and national level has been a major challenge in the development of energy sector. At the central level, co-ordination has been improved in 2014 by the appointment of a single Minister for Power,

Coal, New and Renewable Energy, although the individual ministries themselves continue to exist as separate entities.

Considering the role of state and federal government in energy policy making, it has been difficult to develop a coherent energy policy for the country. The central government has exclusive jurisdiction over inter-state trading and commerce, mineral and oil resources, nuclear energy, income and other central taxes. States have exclusive jurisdiction over water issues and land rights, natural gas infrastructure, and many specific areas of taxation, e.g. on mineral rights, consumption or sale of electricity, etc. Both state and central governments have jurisdiction over electricity and forestry, economic and social planning and labour relations.

Energy sector investment got the lion's share in the outlays of five year plans. Between 1975 and 2000, it remained between 25 to 28% of plan expenditure, with more than 90% of the investment in energy sector with public sector ownership (Chaturvedi, 1999).

The Integrated Energy Policy 2008, the National Action Plan on Climate Change and the co-ordination efforts of the Planning Commission in the past and NITI Ayog since 2014, and the submission of Intended Nationally Determined Contribution (INDC) on 1 October 2015 are milestones in country's energy policy. The broad aim of the policy has been provision of secured, affordable and universally available, environmental friendly energy for sustainable development. India's energy vison remains coal and renewable energy centric. The key features of country's emerging energy vision still retains its direction of big-business oriented centralized solution without focus on regional and local level sustainable energy security (Box 1). The question of reliable and affordable clean energy for the underprivileged in an empowering, sustainable and gender sensitive manner remain more in intention.

Key Drivers of Change in Energy Sector

The key drivers of change affecting energy sector in the country include fast economic growth, energy conservation and energy productivity enhancement measures, privatisation, increasing household income, fast depleting biomass resources, limited domestic reserve of oil and gas; and adverse impact on the environment of the rapidly developing urban and rural areas. The influence of civil society groups (including women's organisations) have not matched that of the bilateral and multilateral development institutions, business lobbies and the market led development agenda of the state. The policy instruments, institutions and resources (finance, human and technology) need to address issues of sustainable practices.

Box 1: Key Features of India's Emerging Energy Vision (IEA, 2015)

- A commitment to the efficient use of all types of energy in order to meet rapidly growing demand. In the power sector, the target for renewables is 175 GW by 2022 (including the expansion of solar generation capacity to 100 GW). The target for coal production is 1.5 billion Ton by 2020. Restricting fossil-fuel imports to 10%, along with energy production and generation efficiency improvement are the key to achievement of energy security objective.

- Universal access to modern energy, including round-the-clock electricity supply to all, will be focused. Energy subsidy programmes will be reoriented from price controls to direct financial transfer to the bank accounts of economically underprivileged sections of the society.

- A drive for market-oriented solutions and increased private investment (including foreign investment) in energy, both through some energy-specific reforms (e.g. to licensing regimes) and via a general drive to simplify and deregulate the business environment.

- A pledge to pursue a more climate-friendly and cleaner path than the one followed thus far by others at corresponding levels of economic development. INDC includes the twin energy-related commitments to increase the share of non-fossil fuel power generation capacity to 40% by 2030 (with the help of transfer of technology and low cost international finance) and to reduce the emissions intensity of the economy by 33-35% by the same date, measured against a baseline of 2005.

4.1 Evolution of Electricity Policy and Programs in India

Electricity policy evolution in Independent India can broadly be divided into two eras: Pre-liberalisation and post-liberalisation.

Electricity Policy in Preliberalisation Era

Before independence, the founders of modern India understood the key role that electricity can play for the development of the country. The pre-independence debate primarily focused on ownership (public vs private) of the electricity system, and the dominance of the government (Federal vs State) in controlling it. During the pre-independence era, electricity system was mostly private owned and controlled by provincial governments.

Immediately after independence, "electricity became a conduit for the nationalist project in India, which allowed the 'sights and sounds of the nation' to invade public and private spaces alike" (Kale, 2014 pp 26). The initial conduit of electricity into rural India was for its productive impact in agro-industries and for irrigation. Subsequently, electricity access

to households followed. The Electricity Act 1948 brought the State Electricity Boards (SEBs) into existence, whose mandate was to develop generation, transmission and distribution system in the respective regions. Most of the preexisting private entities were taken over by SEBs. Electricity is included in the Concurrent List of the Constitution of India (7th Schedule, List III, Sl. 38); hence, both the state and central government own the responsibility to bring desired interventions in policies and regulations for its growth. For nearly four decades after independence, the electricity sector comprising generation, high voltage transmission and distribution gradually came to public ownership with increasing financing, share and control of Central Government in first two activities. The spread and consumption pattern in different states varied widely because of the interplay of Central and State specific political, economic, social, technological, ecological and legal factors.

From the first Five-year Plan (1951-56) onwards, the planners have taken a dominant position of centralized electricity generation, transmission and distribution, with very little encouragement for decentralized system. In 1970s and 80s, with the functioning of national level generating companies like National Thermal Power Corporation (NTPC), National Hydro Power Corporation (NHPC), Nuclear Power Corporation (NPC), Neyveli Lignite Corporation (NLC), Damodar Valley Corporation (DVC) and few others; and transmitting company Power Grid Corporation of India (PGCI), the issues of technical underperformance in generation and high voltage transmission that plagued the power sector for very long was partially addressed. However, the technical, commercial and managerial inefficiencies of power distribution which remained in the hands of State Electricity Boards could not improve because of a range of political, economic and social factors.

> Managements of SEBs were fraught with unhealthy political interference, poor workforce discipline and archaic systems. SEBs' pricing policy of subsidised (domestic and agriculture) and cross-subsidised (industry and commerce vs. domestic and agriculture) electricity supply made them financially sick, kept the electricity sector away from planned growth and brought bad management practices. To take care of the unreliable and costly electricity supply system, captive electricity generating sets have become a norm in industries, commercial establishments and agricultural sector. Thus, in addition to suboptimal investment in electricity sector, SEBs are gradually losing more and more creamy customers. The managements of SEBs, in their race to hide staggering transmission and distribution (T&D) losses (technical and non-technical), artificially increases the unmetered consumption to the priority (agriculture and rural) sector. The financial losses incurred by SEBs were made up from the state budget. With the dwindling state resources a time came when the states found it extremely

difficult to support the SEBs and they became sick one by one (Panda, 2002).

Electricity Policy in Post-liberalisation Era

Poor operating performance, lack of modernisation and skilled personnel, tariff hike of central sector plants and huge accumulation of electricity charges, incoherent subsidy policy and theft led to poor health of most SEB. To reduce the technical and commercial losses, to improve the reliability and availability of power at reasonable cost, and to make the organisations in electricity sector financially viable, Government of India in 1991 removed power from the list of activities reserved for the public sector in the Industrial Policy Resolution, 1956. Electricity Supply Act, 1948 was amended to lift many regulatory disincentives to private investment in electricity sector. Independent Central Electricity Regulatory Commission (CERC) and State Regulatory Commissions (SRCs) were created through the Electricity Regulatory Commission Act, 1998, to bring in professionalism and independence in tariff fixation. Starting with Odisha, other states unbundled State Electricity Boards into separate Generation, Transmission and Distribution companies. The amended legal framework of 1991 and 1998 facilitated private investment in generation and transmission respectively.

Starting with Odisha, the reform that was initiated in other states faced resistance from farmers, employees and different consumer groups. After nearly two decades of reform in the electricity sector, the expected benefits in the form of acceptable Aggregate Technical and Commercial (AT&C) losses, affordable tariff, high reliability, availability on demand and accessibility to economically underprivileged have not been realized significantly by all states. Governance and management of distribution companies, political will and bargaining power of consumer groups have been key factors for differential achievements.

The national level Integrated Energy Policy (IEP) implicitly or explicitly adapted the GNP maximizing paradigm to estimate energy demand rather than trying to estimate what is the least amount of energy needed to wipe out poverty, ensure energy security and how best to meet it in a sustainable manner (Sharma, nd) . The Working Group on Power in its report for Twelfth Plan (2012) had the vison "to not only increase the generation of power in the country but also to ensure that power reaches all people with particular attention to the poor and vulnerable sections of the society". The same is planned to be achieved through the emphasis on coal thermal, nuclear and renewable energy in a centralized manner. Although rural areas have context specific primary renewable energy sources, there is hardly any enabling environment for their comprehensive exploitation through decentralized solution. However, from time to time, government launched various programs for rural electrification. These include:

- Rural electrification under Minimum Needs Programme (1974)

- Kutir Jyoti Yojana to provide single point light to below poverty level (BPL) families in rural India (1988)
- Pradhan Mantri Gramodaya Yojana to electrify un-electrified villages (2003)
- Remote Village Electrification Programme through renewable energy by Ministry of New and Renewable Energy (MNRE) (2001)
- Accelerated Rural Electrification Programme (2003)
- Accelerated electrification of one lakh villages and one crore households (2004)
- Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) merged all earlier programs. The programme aimed at providing energy access to all by 2009 and at least one unit of electricity per household per day by 2012 (2005)
- Ministry of Power launched Decentralised Distributed Generation Scheme under RGGVY to electrify un-electrified villages including those receive less than six hours of electricity per day, through mini grids (2009)
- Deendayal Upadhyay Gram Jyoti Yojana (DDUGJY) with major modifications in RGGVY (2014).

The growths of the electricity followed the development agenda of the state, with increasing central control over the years in the form of financing, electricity tariff, ownership of generation and transmission system and finally through Electricity Act 2003, creating more opportunities for private sector.

Electricity Act 2003

The Electricity Act, 2003 was enacted to replace the Indian Electricity Act 1910, Electricity Supply Act 1948 and Electricity Regulatory Commission Act 1998.

The Act liberalized generation, transmission and distribution; provided penal action for theft of power and facilitated further reform measures to strengthen the sector. To ensure universal access and rural electrification, the Act provides direction through Sections 4 (National Policy on Stand Alone Systems for Rural Areas and Nonconventional Energy Systems), 5 (National Policy on Electrification and Local Distribution in Rural areas) and 6 (Obligations to supply Electricity to Rural Areas.

National Electricity Policy 2005

National Electricity Policy was developed in consultation with the State Governments, Central Electricity Authority (CEA), Central Electricity Regulatory Commission (CERC) and other stakeholders to comply the Electricity Act 2003 (Section 3). It provides guidelines for accelerated development of the power sector, providing supply of electricity to all areas and protecting interests of consumers and other stakeholders keeping in view availability of energy resources, technology available to exploit these resources, economics

of generation using different resources, and energy security issues. The objectives of the policy are:

- Access to Electricity - Available for all households in next five years
- Availability of Power - Demand to be fully met by 2012. Energy and peaking shortages to be overcome and adequate spinning reserve to be available.
- Supply of Reliable and Quality Power of specified standards in an efficient manner and at reasonable rates. Per capita availability of electricity to be increased to over 1000 units by 2012.
- Minimum lifeline consumption of 1 unit/household/day as a merit good by year 2012.
- Financial Turnaround and Commercial Viability of Electricity Sector.
- Protection of consumers' interests.

National Rural Electrification Policy, 2006

National Rural Electrification Policy was developed to comply the Electricity Act 2003 (Section 4&5). Box 2 provides the key provisions of the policy.

Box 2: Key Provisions of the National Rural Electrification Policy, 2006

- Access to electricity to all households by the year 2009, quality and reliable power supply at reasonable rates, and minimum lifeline consumption of 1 unit/household/day as a merit good by year 2012.
- Off-grid solutions for villages/habitations where grid connectivity would not be feasible or not cost effective. Remote villages with solar PV, only for lighting, will not be designated as electrified.
- State governments were mandated to develop rural electrification plan (integrated with district development plan) within 6 months of notification of the Act and intimate to the appropriate commission.
- Certification of village electrification rests with Gram Panchayat.
- State governments were mandated to set up district level committee under the chairmanship of chairperson of the Zilla Panchayat and with representations from district level agencies, consumer associations, and important stakeholders with adequate representation of women, within 3 months of notification of the Act.
- The district committee would coordinate and review the extension of electrification in the district and consumer satisfaction, etc.
- Panchayat Raj institutions would have a supervisory / advisory role.
- Institutional arrangements for backup services and technical support to systems based on non-conventional sources of energy was to be created by the state government

Source: Rural Electrification Policy, The Gazette of India, 23rd August, 2006, New Delhi

Over the years, the definition of a Village that can be called electrified has changed with changing demand of the people and policy of the government (Box 3).

Box 3: Definition of Electrified Village

Prior to October 1997

A Village is electrified if electricity is being used within its revenue area for any purpose whatsoever.

October 1997 to January 2004

A village will be deemed to be electrified if the electricity is used in the inhabited locality, within the revenue boundary of the village for any purpose whatsoever.

After February 2004

A village would be declared as electrified, if:

i. Basic infrastructure such as Distribution Transformer and Distribution lines are provided in the inhabited locality as well as the Dalit Basti hamlet where it exists.
ii. Electricity is provided to public places like Schools, Panchayat Office, Health Centers, Dispensaries, Community Centers etc.
iii. The number of households electrified should be at least 10% of the total number of households in the village.

Source: Ministry of Power, Government of India

Recent Initiatives

In December 2014, Government of India announced Deendayal Upadhyay Gram Jyoti Yojana (DDUGJY) with major modifications in RGGVY. The objective of DDUGJY is to separate the domestic and agricultural feeders in rural area for providing round the clock and adequate electricity respectively. Three-phase power to agriculture with required subsidy can be supplied in a prefixed time for a predetermined period, thus ensuring both energy and water economy. By separating agricultural feeder, 24 hour supply electricity can be provided to domestic use with right quality and quantity.- Additionally, it works to strengthen sub-transmission & distribution infrastructure including metering at all levels in rural areas. Micro grid and off grid distribution network & Rural electrification, already sanctioned under Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), are merged within its rural electrification segment.

Rural Electrification Corporation (REC), started in 1969, is the Nodal Agency for operationalization of this Scheme and the distribution companies are eligible to get support from Ministry of Power, Government of India. Grant portion of the Scheme is kept 60% for other than special category States (up to 75% on achievement of prescribed milestones) and 85% for special category States (up to 90% on achievement of prescribed milestones). The contribution of distribution company has to be minimum 10% and loan can be 30%. There is provision for additional grant subject to the conditions: timely completion of the scheme, reduction in AT&C losses as per trajectory and upfront release of subsidy by State government. All North Eastern States including Sikkim, Jammu & Kashmir, Himachal Pradesh and Uttarakhand are included in special category States.

Uphill Tasks for the future

Although the Electricity Act 2003 called for "electricity to all households by 2009" and "minimum life line consumption of 1 kWh/household/day as merit good by 2012", the country has miles to move before the said goal is realized. It is clear from the fact that as on 31st May 2015, about 35% of total rural households (59 million in number) in the country are yet to be electrified (Table 2). In today's context, rural electrification has five major facets (Garud, 2015)

- Setting up of rural electricity infrastructure
- Providing connectivity to households
- Adequate supply of desired quality of power
- Supply of electricity at affordable rates
- Providing clean, environmentally benign and sustainable power in efficient way

The technological, financial and institutional challenges still remain to be daunting. The states such as Bihar, Uttar Pradesh, Jharkhand, Odisha, MP and Rajasthan are lagging behind in empowering community and generating public opinion for the challenging task. Efforts of central government through the previous Rajiv Gandhi Grameen Vidyutikaran Yojana and the present Deen Dayal Upadhyaya Grameen Vidyutikaran Yojana (DDUGVY), Kutir Jyoti Yojana and different state initiatives (for example Biju Gram Jyoti Yojana in Odisha) indicates the political will[2]. These programs have incorporated the technological learnings from the experiences of the Government of Gujarat (Jyotigram Yojana, where domestic and agriculture feeder separation were undertaken), but lacks enabling environment for community mobilization and ownership, without which social issues of stealing of electrical conductors and coolants from transfer, theft of electricity and unholy nexus between employees and consumers will be hard to address. Additionally, in many un-electrified villages and households where, affordability and long distance distribution of small amount of consumption are factors, existing policy of centralized solution are ineffective; financially, technologically, ecologically and socially. The approach of the Ministry of Power to allow decentralized electricity system, "where grid electricity cannot be supplied" makes the effort of the Ministry of New and Renewable Energy ineffective. Decentralised system using local primary energy resources (based on solar, biomass, hydro, etc.) has the potential to get reliable clean energy, enhancing affordability and empowering community, while creating local energy market and undertaking local value addition. Unfortunately, policies favour centralized solutions that obviously tilted towards the interests of the big-business, powerful and rich. Lack of

[2] "Normally common feeder is used for agriculture and rural domestic and commercial consumers. Since, right metering system does not exist and often agriculture consumers are not metered, actual consumption and loss, and consequent subsidy estimation for the above categories become difficult. Additionally, to reduce revenue loss and manage supply deficit, utilities underserve rural feeders. "Such supply restrictions severely impact the supply and quality to the associated rural consumer base and hence the overall socioeconomic growth in the rural areas" (World Energy Council, 2012).

integration of energy policy with other welfare measures, does not enable the economically weaker sections to move up in the clean-energy spiral, without subsidy.

Government of India's plan of 24X 7 Power for All by 2019 is being implemented in a context specific manner in partnership with different states. However, for rural electrification to be effective, the community needs to be socio-economically empowered. Immediately after independence and during pre-liberalisation period, rural communities and farmers having strong political influence; as was in Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu, Kerala, Punjab and Haryana, could force the respective governments for massive rural electrification. Rural communities in these states could place themselves in a virtuous cycle of electricity enabled income generation activities (agriculture, agriprocessing, small scale industry and commerce); leading to higher per capita income; increased affordability of cleaner energy and quality of life enhancing gadgets that require electricity for their operation; and finally involvement in value added agriculture, commerce and industry. Through better governance and management of distribution utilities (both private and public), these states could reduce aggregate technical and commercial losses. Distribution companies ensured better quality electricity supply and thus, consumers were ready to pay for it. In contrast, rural consumers in Odisha, Bihar and Uttar Pradesh operated in a vicious cycle. Absence of electrification in large number of villages and poor quality of supply in electrified villages did not facilitate electricity enabled income generation activities and gadgets' use. Dissatisfied customers were reluctant to pay for the poor quality of electricity service. Few unscrupulous elements were not resisted by the community for stealing the electricity infrastructure, because most of them did not taste the benefit and visualized the potential loss. In recent times, with thrust from the government of India to complete the unfinished task of the electrification of remaining villages in few states, the uphill task is protection (from stealing) of electricity infrastructure through social pressure. Additional challenges include: initial investment, recovery of capital and operating cost, managing supply in case of shortage of power and enhancing income of consumers through sustainable income generation activities and thus, boosting the rural economy.

With technological maturity and improved financial viability of renewable energy technologies in the present market condition, there are different possibilities of decentralized DC and AC micro-grids with or without net-metering. Electricity can come from solar, biomass, wind and micro-hydro in either pure or hybrid manner. Such a system, in addition to reducing transmission and distribution losses, will provide pollution free local energy security, local value addition and local market creation while facilitating development of an empowered community.

Unfortunately, compartmental approach of working of Ministry of Power and Ministry of New and Renewable Energy may lead to missing a potential opportunity. For example,

instead of creating large scale centralised solar power stations; millions of decentralized power generating unit can feed to a "mesh grid". The mesh grid will operate like a cob-web with numerous points of small-scale generation and consumption. It will result in grid stability and other advantages as stated above. Of course, technological challenges of hybrid system operation and smart metering are to be taken care of. An enabling environment for creating a level-playing field for distributed generators is missing today. Considering the extent of positive externality that these service providers create, government needs to protect them from the threat of subsidized tariff and other enabling provisions in a convergence mode.

5. LPG Demand and Supply Situation and Level of Disparity

According to Ministry of Petroleum and Natural Gas, India has 181.9 million LPG connections as of 31st March 2015. Given that there are 246.7 million households according to 2011 Census, 73.74% had LPG connections. There is wide disparity in LPG use for cooking among states and between rural and urban area within the states.

All the Eastern and North-Eastern states (except Arunachal Pradesh and Mizoram) have very low level of LPG penetration. Among the major states, Punjab has the distinction of having highest number of LPG connections (139.55%). Bottom five states are Jharkhand (33.1%), Bihar (33.7%), Chhattisgarh (35.7%), Meghalaya (35.1%) and Odisha (32.3%) (Table 12). Weak access to LPG distributors, poor road connectivity, low capacity to bear initial cost of connection and low cash income are some of the reasons for low level of LPG usages.

LPG use in rural area in 2011/12 varies widely among states. More than a quarter of rural households in Andhra Pradesh, Tamil Nadu, Kerala, Haryana and Punjab use LPG for cooking. 10 to 20% rural households in Assam, Gujarat, Maharashtra and Karnataka use LPG for cooking. In contrast, LPG for cooking in rural households is limited to less than 10% of total in other states. More than 70% of urban households in Assam, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Rajasthan, Haryana and Punjab use LPG for cooking. Excepting Odisha and Chhattisgarh, in rest of the states, 50 to 70% urban households use LPG for cooking (Table 13).

Use of kerosene for cooking in urban households is high in Gujarat, Maharashtra, Punjab, Tamil Nadu and Karnataka. Because of easy availability of biomass (fuel wood, chips, crop residue and dung cake) and relatively low price (coupled with low purchasing power), its use is significant in rural and urban households of Assam, Bihar, Chhattisgarh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Odisha, Uttar Pradesh and West Bengal.

Table 12: State-wise Number of LPG Consumers as on 31st March 2015

State/ Union Territory	LPG Consumers as on 31 March 2015	Number of Households as per 2011 Census	Percent of Households with LPG Connections
Andhra Pradesh	11815440	12666534	93.3
Arunachal Pradesh	244245	261,614	93.4
Assam	3497667	6,367,295	54.9
Bihar	6380454	18940629	33.7
Chhattisgarh	2008339	5622850	35.7
Goa	559013	322813	173.2
Gujarat	8100759	12181718	66.5
Haryana	5310990	4717954	112.6
Himachal Pradesh	1916380	1476581	129.8
Jammu & Kashmir	2174536	2015088	107.9
Jharkhand	2047293	6181607	33.1
Karnataka	10829277	13179911	82.21
Kerala	8487215	7716370	110
Madhya Pradesh	7734329	14967597	51.7
Maharashtra	21793042	23830580	91.5
Manipur	390028	507,152	76.9
Meghalaya	188993	538,299	35.1
Mizoram	293261	221,077	132.7
Nagaland	232823	399,965	58.2
Orissa	3117055	9661085	32.3
Punjab	7548988	5409699	139.6
Rajasthan	8813142	12581303	70.1
Sikkim	157559	128,131	123
Tamil Nadu	17044036	18493003	92.2
Telangana	9271617	8358000	110.9
Tripura	450370	842,781	53.4
Uttar Pradesh	21447880	32924266	65.1
Uttarakhand	2432775	1997068	121.8
West Bengal	10454283	20067299	52.1
Andaman & Nicobar	86026	93376	92.1
Chandigarh	408309	235061	173.7
Dadra & Nagar Haveli	72139	73063	98.7
Daman & Diu	68800	60381	113.9
Delhi	6146480	3340538	184.0
Lakshadweep	4512	10703	42.2
Puducherry	374211	301276	124.2
India	**181,902,266**	**246,692,667**	73.7

Source: Indian Petroleum and Natural Gas Statistics, 2014-15, Ministry of Petroleum and Natural Gas, Economics and Statistics Division, Government of Indi, pp 48

Table 13: Inter-State Variation of LPG and Kerosene Used for Cooking by Households

States	Rural Household (%)		Urban Household (%)	
	LPG	Kerosene	LPG	Kerosene
A & N Islands	38.2	18.9	71.3	21.5
Andhra Pradesh	28.9	0.2	77.3	2.7
Arunachal Pradesh	31.4	0.9	84.1	1.2
Assam	17.2	0.3	71	5.7
Bihar	5.9	0.5	60.5	0.5
Chandigarh	75.2	22.9	75.6	13.6
Chhattisgarh	1.5	0.2	39.8	2.7
Dadra & Nagar Haveli	3.7	11.4	73.1	21.1
Daman & Diu	23.8	54.2	75.7	6.5
Delhi	92.2	0.0	85.6	1.7
Goa	66.2	16.4	90.3	2.6
Gujarat	13.9	3.5	62	10.5
Haryana	26.7	1.2	86.5	1.4
Himachal Pradesh	25.2	1.0	71.8	7.4
Jammu & Kashmir	26.5	2.2	78.3	3.9
Jharkhand	2.9	0.3	53.9	1.2
Karnataka	14.7	2	64	6.8
Kerala	30.8	0.1	55.4	0.6
Lakshadweep	3.7	2.6	45.3	16.3
Madhya Pradesh	6.2	0.5	65.2	3.6
Maharashtra	23.1	1	74.5	10.1
Manipur	34.6	0.2	64.7	0.8
Meghalaya	5.5	1.0	64.0	5.7
Mizoram	39.1	0.7	93.6	0.5
Nagaland	53.4	0.0	86.3	0.3
Odisha	3.9	0.2	43.5	4.8
Pondicherry	59.2	4.0	76.2	3.0
Punjab	30.5	2.7	75.4	10
Rajasthan	8.9	0.7	71.6	2
Sikkim	56.0	0.6	82.6	2.2
Tamil Nadu	37.2	2.5	70.9	8.5
Tripura	63.0	0.5	66.8	3.8
Uttar Pradesh	6.7	0.1	66.8	1
Uttarakhand	28.8	0.9	78.8	1.6
West Bengal	6.6	0.5	56.5	8.7
All-India	15.0	0.9	68.4	5.7

Source: NSSO Report no 567 (68th Round), 'Energy Sources of Indian Households for Cooking and Lighting, 2011-12'.

Electricity and kerosene use for lighting in rural area in 2011/12 varies widely among states. Because of unavailability of electricity and unaffordability to have it, about or more than 30% of rural households in Assam, Bihar, Jharkhand, Odisha, Uttar Pradesh and West Bengal use kerosene for lighting. Situation is worse in Bihar where about three quarter of rural households resort to kerosene for lighting. Similarly, among all the states, Bihar (17.2%) and Uttar Pradesh (10.8%) have the highest proportion of urban households using kerosene for lights (Table 14).

Table 14: Inter-State Variation of Electricity and Kerosene Used for Lighting by Households

States	Rural Household (%)		Urban Household (%)	
	Kerosene	Electricity	Kerosene	Electricity
A & N Islands	8.8	90.0	0.1	99.8
Andhra Pradesh	2.1	97.6	1.1	98.5
Arunachal Pradesh	18.3	65.7	1.5	95.6
Assam	43.3	55.3	7.9	89.7
Bihar	73.5	25.8	17.2	81.2
Chandigarh	0.0	99.1	0.4	99.6
Chhattisgarh	13.8	85	3.6	93.1
Dadra & Nagar Haveli	1.1	97.7	0.3	99.7
Daman & Diu	.0	100.0	0.0	100.0
Delhi	.0	100.0	.0	98.8
Goa	1.8	98.2	0.2	99.8
Gujarat	6.4	93.2	5.2	94
Haryana	1.5	95.1	0.1	97.9
Himachal Pradesh	1.1	98.3	0.7	90.7
Jammu & Kashmir	3.0	96.5	0.5	98.7
Jharkhand	36.8	62.1	2.6	96.4
Karnataka	4.5	95.2	1.2	98.6
Kerala	3.3	96.2	1.4	97.3
Lakshadweep	0.0	100.0	0.0	100.0
Madhya Pradesh	15.2	84.5	1.7	98
Maharashtra	9.9	88.8	0.8	98.9
Manipur	11.9	85.0	1.4	96.7
Meghalaya	15.2	84.0	1.5	97.5
Mizoram	6.3	84.3	0.7	98.3
Nagaland	.8	98.4	0.5	98.5
Odisha	32.3	67.6	3.5	96.2
Pondicherry	0.2	99.8	0.8	99.2
Punjab	1.5	97.4	0.5	98.4
Rajasthan	21.6	77.7	1.7	97.7
Sikkim	1.9	98.0	0.3	99.7
Tamil Nadu	3.1	96.9	1	98.8
Tripura	17.8	82.0	1.3	98.1
Uttar Pradesh	58.5	40.4	10.8	88.1
Uttarakhand	2.6	97.0	0.8	99.2
West Bengal	29.3	70.2	5	94.5
All-India	26.5	72.7	3.2	96.1

Source: NSSO Report no 567 (68th Round), 'Energy Sources of Indian Households for Cooking and Lighting, 2011-12'.

Pradhan Mantri Ujjwala Yojana

Pradhan Mantri Ujjwala Yojana (PMUY) launched on 1st May 2016 is aimed to provide 50 million LPG connections in the name of women in BPL (Below Poverty Line) households across the country. The objectives of the scheme are empowering women and reducing the serious health hazards (including death) associated with cooking based on fossil fuel for women and children. The scheme is being implemented using the money saved in LPG subsidy through the "Give-it-Up" campaign. The scheme provides financial subsidy of Rs

1600/LPG connection and has the provision of EMI facility for meeting the cost of stove and refill. With the completion of the three-year scheme in 2018-19, the number of non-LPG-user-households in the country will be halved.

The key drivers of LPG diffusion in the country include push from the natural gas companies, multilateral and bilateral financial institutions, increased literacy, income and aspirations of rural community, demand for clean energy from the vocal sections of rural and urban households who are vote banks for the political parties, and government's development agenda.

6. Women and Inclusive Energy Use Policies and Their Results

United Nations' sustainable development goal 7, calls for ensuring access to affordable, reliable, sustainable and modern energy. The Sustainable Energy for All (SE4All) is planned to be met by 2030 by interlinking three global targets such as:

- Ensuring universal access to modern energy services;
- Doubling the global rate of improvement in energy efficiency; and
- Doubling the share of renewable energy in the global energy mix.

As recommended in the guidance note to gender equality, women's empowerment and sustainable energy, "women can be powerful actors for change in the transition to sustainable energy and that their involvement in the design, distribution, management and consumption of sustainable energy solutions is a critical pathway for reaching the MDGs as well as the objectives of the SE4ALL initiative" (UNIDO, nd).

The Integrated Energy Policy (IEP) of 2005, articulated by the Planning Commission had the broad vision to "reliably meet the demand for energy services of all sectors including the lifeline energy needs of vulnerable households, in all parts of the country, with safe and convenient energy at the least cost in a technically efficient, economically viable and environmentally sustainable manner. Under 'household energy security', IEP specifically addressed the issue of providing electricity and clean fuel to all, particularly rural households. The policy took note of gender issues explicitly.

> …given the fact that women and the girl child carry most of the burden of the drudgery of gathering fuel wood, agricultural wastes and animal dung and also bear the brunt of the indoor air pollution; the urgency to meet the challenge should be high, if we are to achieve universal primary education for girls, promote gender equality and empower women. The considerable effort spent on gathering the bio-mass and the cow-dung & preparing the same for use is not priced into the cost of such energy. These fuels create smoke and indoor air pollution and are inconvenient to use. They have

> adverse impact on the health of people, particularly women and children. Easy availability of a certain amount of clean energy, required to maintain life, should be considered as a basic necessity… (IEP, 2005)

IEP considered providing subsidized lifeline electricity and LPG supply to vulnerable households (30% of India's total households) at 1 kWh/day and 8 LPG cylinders/year and another 20% households at 6 LPG cylinders/year. It suggested that the "benefits in empowerment, health, environment and reduced pressure on deforestation and hence the water table and soil erosion are well worth the cost – even without considering the benefits from the likely increase in productivity of rural India" (ibid).

For ensuring energy security at local level, IEP recommended off-grid and decentralized power generation (biomass gasifier, etc.) with separate tariff policy and productive use of electricity; financing community sized bio-gas plants; improving the efficiency of domestic challahs & lanterns and ventilation in the cooking area of the dwellings; planting village woodlots to reduce drudgery; women clean energy entrepreneurship development; and supporting women's groups in energy co-operative formation and management. Rural energy market development was also recommended.

In spite of the recommendations under IEP, in India, 67.4% of households depend on solid biomass (firewood, crop residue, cow dung cake, coal, lignite, and charcoal) as the fuel for cooking (Census of India 2011). More than 31% of households lack the access to proper kitchen and cook inside the house; this exposes women and children to health risks. Lack of access to and affordability of adequate amount of clean energy affect women and men differently because of gender division of work in family. Since women generally collect fuel for cooking, they have to go through the drudgery of collection of fire wood and transportation from long distance, spend significant amount of time and get exposed to harmful smoke in cooking process that results in pulmonary disorders. The main health problems related to fuelwood use include, physical strains as coughing, backache, headache, neck ache, bruises, wild animal and snake encounters and burning eyes (Parikh and Sharma). The scale of problem is visible from the fact that as on 31st March 2015, there are 64.8 million households in the country who do not have LPG and mostly use firewood for cooking. As on 31st May 2015, there are 59.17 million rural households who do not have electricity and have to depend on kerosene for lighting. Unfortunately the energy planners in the country did not give adequate attention in mainstreaming gender in energy planning.

Rural households have ability to pay for smokeless chullah, but they lack willingness to pay. The fuel choice made by a household is governed by a mix of factors including ease of availability, substitutability with existing fuel; usability with existing utensils and

appliances, ability and willingness to pay; extent of fit within the socio-cultural structure of the society.

Based on the study of rural energy access and inequalities from an analysis of NSS data between 1999/2000 to 2009/10, it is observed that the transition witnessed in lighting fuel usage is not replicated in the case of cooking fuels because of gender and context specific energy resource availability and socioeconomic factors. In the case of electricity, as incomes rise, the level of energy inequality decreases in India. Whereas, for both biomass and petroleum products, energy inequality increases with an increase in income (Aditya, et al, 2012).

> This could be due to the fact that higher income households have a larger set of choices in terms of the fuel basket they can choose from whereas the lower income households depend on more or less the same kind fuel sources given their income constraints and lack of choice among different fuel types due to availability and affordability constraints. This indicates that while we would expect households to shift to cleaner fuels as incomes increase, it is not the case, as we find that for the richest households, the Gini coefficient is the highest, indicating considerable variations in energy consumption patterns among these households. Thus, this indicates that the energy consumption patterns are governed not just by income but a range of other factors such as social and cultural differences (ibid).

The electricity connection to a household depends on the influence, availability of electrical appliances and paying capacity (initial one-time connection cost and regular electricity charges): primarily factors of household income and affordability. In contrast, the cooking energy used is dependent on access to local natural resource endowment and women's influence in decision making at household level and "other factors defined by certain socio-cultural contexts that a society lives in and has evolved from" (ibid).

The "gender-based empowerment, the needs of women and their access to and control over energy resources are seldom considered in India's energy development planning" (Parikh and Sangeeta, 2008). Given the fact that traditional biomass energy constitutes 28% of total energy consumption in the country, and only 2% of $100 billion energy sector (coal, oil, gas, nuclear and renewable) investment in 11th Plan (2007-12) was spent on its management and conversion, the missing gender concern in national energy planning is clear (ibid). Key findings and recommendations from the gender audit of the National Energy Policy in India: Programs of the Ministry of New and Renewable Energy are presented in Table 15.

Table 15: Gaps and Recommendations for Gender Sensitive Energy Policy in India

Gaps in Energy Planning	Recommendations
Reorienting monitoring and evaluation protocols to reflect gender concerns in energy programmes • In spite of the importance of biomass in energy mix of the country, the level of national investments in the management and conversion technology of traditional biomass is limited and no ministry has a mandate to ensure its sustainable supply. • Lack of technical capacity, finance, land ownership and equal say at household level are the key barriers to women's participation in renewable energy projects. • Difficulty in fixing accountability in the absence of gender-disaggregated data for energy policy intervention	• Using strategic gender indicators for ministerial programme cycles. • Clear articulation of gender goals in the preparation of energy programmes • Use of Gender budgeting to assess how each ministry uses its financial resources to address women's practical and strategic energy needs
Linking women's empowerment with energy development • 12.7% to 20% of the budget outlay of the MNRE's 10th Five Year Plan addressed women's specific energy needs. The energy programmes for women have failed to recognise the potential contribution that energy services could make to women's empowerment within a socioeconomic context, and been limited to meeting their immediate needs for cooking and lighting.	• Setting up a monitoring mechanism for creation and fund utilization for gender specific programmatic goals and activities • Creating mechanisms to incorporate best practices in MNRE programmes and planning processes. • Publishing annual report that shows the benefits of energy systems in improving women's social status, increasing their employment and their decision-making within communities and households, and the percentage of energy assets managed and owned by women.
Inter-ministerial coordination • Lack of inter-ministerial coordination for household clean-energy security supply chain (Electricity, Kerosene and LPG: Ministry of Power and the Ministry of Petroleum and Natural Gas; and Biomass: MNRE, Ministry of Environment and Forests, the Ministry of Rural Development and the Ministry of Agriculture).	• Developing inter-ministerial working relationship for gender-responsive programmes. • Mandating MNRE's Gender Budgeting Cell (GBC) to collaborate and advise GBCs in other ministries for integrating energy in their gender budget programmes. • Developing capacity building programmes within each ministry on understanding and using gender budgets.
Making cooking fuel available within one	• Establishing goal for fuelwood plantations

kilometre of rural habitations • 'Access to fuelwood plantations within one kilometre of all habitations' as biomass fuels are likely to remain the primary fuels for process heat and cooking for years to come. • Fixing similar targets for other clean and affordable forms of cooking energy in order to reduce women's drudgery, the time they lose in gathering fuel and the health impacts of indoor air pollution.	within one kilometre of all habitations and strengthening access to LPG, kerosene and biogas. • Establishing context specific mechanism for cooperating among various ministries in operationalising above goal. • Financing and capacity building support to women's groups and community based institutions in organising fuelwood plantations at the village level. • Participation of Women's groups in energy policies and programmes and their implementation.

Source: Adapted from Parikh, J and Sangeeta, K. (2008)

Planning Commission (2014) in its evaluation of the implementation of RGGVY observed the positive impact of rural electrification on women in households. With the availability of electricity, women could easily perform household chores in the evening, get additional income from different productive activities at home without migrating to other areas, reduce drudgery at work, improve health condition, feel safe while venturing outside after sunset, protect themselves from wild animals, communicate well through mobile telephones, entertain, broaden worldview and get aware of government programs through television.

'The National Policy for Women 2016: Articulating a Vision for Empowerment of Women' has addressed the gender specific issues of energy, under 'Environment and Climate Change', in the following manner.

> All aspects of energy-planning and policy making must include gender dimensions and actively advance women's leadership… Women participation will be ensured in the efficient use and spreading the use of solar energy, biogas, smokeless chulas and other technological applications to have positive influence on their life styles and a long term impact on meeting sustainable development goals…Environmental friendly, renewable, non-conventional energy and green energy sources will be promoted and made affordable and accessible to rural households for their basic household activities.

5. Concluding Remarks

Geographical distribution of primary energy in India is not uniform. Coal is concentrated in the Eastern region states of Chhattisgarh, Jharkhand, Odisha, West Bengal and the

neighbouring regions in Andhra Pradesh, Madhya Pradesh and Maharashtra. Large deposit of Lignite is available in Tamil Nadu, Rajasthan and Gujarat. Oil is available in Assam and Western Offshore, while gas is found in both Eastern and Western Offshores. Large hydro potential exists in Himalayan region states in North and North-East. Wind potential is high in the Southern states of Andhra Pradesh, Tamil Nadu and Karnataka, and Western state of Gujarat. Excepting desert area of Rajasthan, biomass is abundantly available all over the country. Almost all the states have huge solar energy potential.

India's primary energy demand is met by about 65% commercial and 35% non-commercial energy. The commercial energy is met primarily by coal (41%), Oil and Gas (39%) and balance from nuclear, hydro and other renewable sources. Non-commercial energy is mainly from biomass (crop-residue, wood, chips and dung cake). Bulk of commercial energy is used in Industry (45%), Transport (22%) and Building (14%) sectors. Considering the negative environmental consequences of fossil fuel (coal, oil and gas), large scale exploitation of hydro-potential and nuclear energy, country has taken a strategic change in direction towards solar energy centric renewable energy.

While, industrial and transport energy demand is skewed towards concentrated industrial hubs and urban centres, whose spatial distribution is not uniform because of economic, political, social and 'unavoidable' geographical factors; the demands from residential sector is primarily constrained by socio-economically nourished political factors.

In its pursuit to provide clean energy, country has made tremendous progress over the years. But demand-supply gap for electricity, oil and gas persists. In 2014-15, entire country had an electric power deficit of 4.7% and electric energy deficit of 3.6%. Stark regional disparity in use of electricity and LPG are visible across the country. States with huge energy reserve, unfortunately, have lower use of clean energy. The coverage of household electrification and annual per capita electricity consumption of Eastern and North-Eastern states are at the bottom in the country. Similar situation is observed for household LPG connection. In 2014-15, the annual per capita electricity consumption in the country was 1010 kWh. During the same year, corresponding figures for eastern region states comprising Bihar, Jharkhand, West Bengal, Sikkim and Odisha was 203, 835, 647, 685 and 1419. This is in spite of the fact that excepting Sikkim and Bihar, all other states have electric energy intensive extraction based industries. Similarly, annual per capita electricity consumption of all the North-Eastern states remained between 295 and 704. Other major states that have low per capita electricity consumption include Uttar Pradesh (502), Madhya Pradesh (813) and Kerala (672).

As on 31st May 2015, there were 59.17 million un-electrified households in the country. Only Uttar Pradesh and Bihar contribute to 56% and when Assam, Jharkhand, Odisha and Rajasthan are added, together they share 88% of unelectrified households in the country.

The quality of electricity supply to rural households shows wide disparity among the states. In Gujarat, Himachal Pradesh and Punjab round the clock electricity is available. In all other states, daily electricity supply varies from 9 to 19 hours, with median value of 11.5 hours. Since, rural domestic and irrigation electricity supply is often the last priority in the merit-order dispatch; it is possible that the villagers might not be getting electricity service in the peak evening hour, when they need most.

As on 1st October 2015, there were 191 million LPG consumers in the country, with an average of 69.9% households having connections. Eastern region states, North-Eastern region states, Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Gujarat and Rajasthan had fewer connections than national average. Percent of households having LPG connections in Jharkhand, Bihar, Odisha and Chhattisgarh were 31.5, 31.8, 32.6, and 33.5 respectively.

Role of clean energy in quality of life improvement and overall human development is well articulated in the plan and policy documents of national and state governments. However, the financial, technological and institutional challenges to provide clean electricity are daunting.

For rural households to avail reliable electricity service, the challenges of initial investment, recovery of capital and operating cost, managing supply in case of shortage of power and enhancing income of consumers through sustainable income generation activities need to be addressed. Financially unviable subsidized electricity service, in spite of its political expediency, cannot be a long-term solution. Transition to electricity is contingent upon household income level. Without a comprehensive strategy for household income increase and assurance of regular income, government program of even giving free connection will not be of use, since they may not be in a position to pay regular electricity bill.

With technological maturity and improved financial viability of renewable energy technologies in the present market condition, there are different possibilities of decentralized DC and AC micro-grids with or without net-metering. Electricity can come from solar, biomass, wind and micro-hydro in either pure or hybrid manner. Such a system, in addition to reducing transmission and distribution losses, will provide pollution free local energy security, local value addition and local market creation while facilitating development of an empowered community.

Government of India's plan of 24X7 Electric Power for All by 2019 is being implemented in a context specific manner in partnership with different states. Effectiveness of such

initiative is contingent upon community vigilance against theft of electricity infrastructure and electric energy. Unless political will and empowered communities are in place, long term clean energy security cannot be realized.

Suggestions for women-inclusive modern energy policy in remote areas

In India, the upward movement in the clean energy ladder from Kerosene to Electricity for lighting is primarily due to accessibility and affordability criteria. There is no specific evidence of women-specific consideration at household level relating to drudgery reduction or quality of life improvement. Whereas, transition to cleaner cooking fuel, say from biomass to LPG, has significant consideration related to gender and context specific energy resource availability and socio economic factors. Hence, to ensure gender sensitive energy policy in the country, there is a need for reorienting monitoring and evaluation protocols to reflect gender concerns in energy programmes, linking women's empowerment with energy development and making cooking fuel available and affordable (through sustainable livelihood security) within the proximity of the habitation.

Given the availability of matured renewable energy technology endowment in the country, rural areas are uniquely positioned at this time to have clean energy security at remote locations. The issue is problem of last mile. Hence, appropriate institutions must be brought in, with or without market mechanism that can bridge the gaps in technology supply chain, social financing and assurance of primary energy availability. For example, available solar energy operated lights and fans for utilitarian needs and income generation programs are currently financially viable. In number of instances, biomass-fed smokeless cook stoves, solar cookers and biogas-fed cook stoves fail to pick up due to weak supply chain, lack of skilled women work force and lack of social financing. Such institutional gaps need to be bridged while implementing clean energy-based sustainable livelihood security in a decentralized manner.

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