Energy Services to the Poor:
Are they truly subsidized?

An assessment of 'Economics and Willingness to pay'

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Vasudha Foundation

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FOREWORD

There is a popular misconception in India that the cost of subsidy to provide energy services to the poor is very heavy. Very often, it is said that the poor are not willing to pay for the services they get and the government has no option but to go on increasing subsidies since provision of energy services is seen more as a 'welfare activity' rather than an 'economic activity'. Every now and then, there are iterations of having a viable policy to ensure direct and transparent subsidies to those who need rather than to have the subsidies (mis)appropriated by others who are not the intended beneficiaries. The declared objective of ensuring a lifeline supply "ONE UNIT OF POWER A DAY PER FAMILY" appears miles away.

There is a myth that the poor are not willing to pay for the energy they consume. In a country where the number of telephone connections is more than the number of people above the poverty line, it is hard to believe that the poor would not pay for good services. Of course, there could be a fallacy in the number of telephone connections since quite a few would be owning and using more than one connection and in addition, there could be a large number of lapsed pre-paid connections in the accounting. But the fact remains that all these telephone connections are paid for by the people. There are hundreds of cellular phones even in villages that have no power connection. Innovative business models have cropped up in these places where the phones are charged by local generators, batteries and solar systems. So the myth of unwillingness/ reluctance to pay by the rural poor has to be demolished and an objective approach is called for on rural energy services.

The report prepared by Vasudha Foundation has adopted an objective approach to the issue of the ability and willingness of the rural poor for energy services. Instead of being prescriptive and judgmental in the findings, the team has held a mirror for the policy makers to see and understand the reality. The fact that a large number of villages and a huge number of households remain without energy services in States that have a concentration of coal thermal power plants, has been brought out in a pointed manner. The reality of "darkness under light" is an issue that the governments have to address with care and a positive approach. It has also highlighted the reality of energy services being provided not as a lifetime solution to livelihood issues but with a narrow objective of meeting only the lighting needs of the rural people. It might have been interesting also to assess the demand and off-take of kerosene in the rural areas that have been electrified. Possibly, this was outside the scope of the whole exercise.

I am sure that the report would enable policy makers to shift their attention and focus on "Rural Electrification" from one of a social service to one of ensuring livelihood support to the poor that will lead to economic growth as well. The report is timely and would enable the governments to revisit their policies and strategies for provision of energy services in rural areas.

Shri. V. Subramanian, IAS (Retd.)
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Executive Summary

Rural electricity supply and lack of adequate energy access by India's rural populace continue to plague the Indian Electricity Sector.

India is yet to achieve 100% electrification of all its villages, despite a number of initiatives undertaken by the Government, which includes the *Bharat Nirman* Project, a rural infrastructure initiative which started in 2005.

Under the *Bharat Nirman* Project, there is a dedicated flagship programme aimed at rural electrification, namely the "*Rajiv Gandhi Grameen Vidyutikaran Yojana* (RGGVY)". The prime objective of the RGGVY is to electrify 1.25 Lakh un-electrified villages as per the 2001 census and to provide free electricity connections to 2.34 Cr un-electrified households of people living below the poverty line (BPL).

When the RGGVY programme was launched in 2005, it estimated that the total costs of providing electricity to the 2.34 Cr BPL households would be Rs. 16,000 Cr and that this task would be completed by 2009.

However, as per the recent report from Prayas Energy Group[1], the cost estimates for providing electricity to the BPL households have tripled and are now estimated to cost Rs. 52,000 Cr. This is evident from the fact that the budgetary allocation for the RGGVY has also seen a steep rise with the budgetary allocation for 2011 was Rs. 6,000 Cr.

In the past six years, since this programme was launched, 98,000 villages and close to 1.75 Cr rural households were connected to grid supply. Despite that, even now, only 9 of the 27 Indian states can boast of 100% village electrification; with a further 8 states having more than 90% of their villages electrified.

North East States in addition to Bihar, Jharkhand, Odisha and Uttar Pradesh continue to have large number of un-electrified villages ranging from 20% to 40%. As per the statistics available from the Central Electricity Authority, as on March 2011, amongst a total of 641,000[2] villages of India, 537,947 villages have been electrified, which means 103,053 Indian villages are yet to be electrified.

In terms of household electrification, as per the RGGVY website, a total of 56% of rural households in India are deemed electrified as on March 2011.

Frequent power outages and disruptions in electricity supply have become a norm and thus, India continues to face huge energy deficits. The overall annual deficit of power is close to 86,000 Million kWh, with daily peak hours demand shortage being about 13,000 Million kWh, resulting in power outages ranging from 2-20 hours on a daily basis.[3]

An analysis of data on the 'quantity and quality of electricity supply in rural India', collected by us from select villages in four states of India reveals that, the average supply in the surveyed villages ranged from 2-6 hours, with maximum hours of supply usually being during the night time, thereby implying very little use of the electricity for the rural population.

It is interesting to note that contrary to the above stated facts, the budgetary allocation for rural electrification and for providing energy access to rural areas has seen a substantial increase of nearly 8-10% every year over the past decade.

Huge subsidies either in the form of direct subsidies or budgetary allocations or in the form of cross-subsidies have been earmarked for the sole purpose of providing energy access to the rural population at affordable prices.

The direct subsidies are provided for Kerosene and cook stoves, while there is budgetary allocations for providing free electricity to BPL families under the RGGVY programme and also for providing electricity infrastructure through Decentralised Distributed Generation (DDGs). The electricity tariffs for rural consumers, whether it is the flat monthly rate or the metered tariff is also heavily cross subsidized on paper.

[1] RGGVY_Prayas Discussion paper_July 2011

[2] Provisional Census 2011, Government of India

[3] CEA data 2009

However, almost every policy design, subsidies and budgetary allocations intended to benefit the poor, end up benefiting primarily the well-off sections of the society thereby compounding the continuously 'poor' state of India's rural energy infrastructure. The electricity tariff for rural electricity connection is one such classic case in consideration. On paper, this tariff is highly subsidized with a flat monthly tariff ranging from Rs. 60/- to Rs. 100/- per month irrespective of consumption. However, given the poor quantity and quality of rural electricity supply and the quantum of electricity consumption in rural areas, even this subsidized tariff paid by the rural consumer is almost at par with what an urban domestic consumer is paying. The case remains the same with regard to the supply of other energy fuels, such as liquefied petroleum gas (LPG) and kerosene, with the urban rich being the major beneficiaries of these subsidies with very little trickling down to the rural population.

The dogged continuation of tried and tested energy policies and systems, despite its poor results by subsequent governments (both at the central level as well as the state level) remains the core reason for these failures.

The Government had come up with guidelines for "Decentralised Distributed Generation" (DDGs) systems, for remote village electrification. The RGGVY's DDG guidelines were first issued in 2009 and later amended in 2011. These guidelines and subsequent order set aside Rs. 540 Cr towards capital subsidy for DDG in the 11th Five Year Plan.

DDG projects can be based on conventional or renewable fuels and 90% of the project cost is provided as a capital subsidy and cost of spares for 5 years after commissioning is included as project cost. As per these guidelines, the Rural Electrification Corporation (REC) will be the nodal agency for implementation and State Governments will be the owners. State Governments get to decide on the implementation agency, which can either be the State Renewable Energy Development Agency or a Central Public Sector Unit. Further, as per these guidelines, all un-electrified villages and hamlets with a population of above 100 are eligible for such projects.

However, bulk of the Rs. 540 Cr allocation for DDGs continues to be un-spent, as the progress on DDG penetration has been extremely low and slow. One of the reasons for this could be that the current guidelines are suited primarily for low capacity stand-alone systems, and there are no provisions for guaranteed grid evacuation in future if required. It is also interesting to note that there are very few takers even for the stand alone systems and the number of remote villages identified for standalone systems will also have to be reduced drastically over the years.

Distributed power generation based on locally available energy resources for both captive consumption and supply of additional electricity into the grid system can serve as an important part of the solution to such problems. But, unfortunately, both the central Government as well as the State Governments have looked at DDGs primarily as a 'remote off-grid solution'.

Further, there is an ever-increasing stress on grid supply, as the solutions for electrification and all policies governing the electricity sector are heavily centred on grid supply. The Government's argument in favour of central grid seems to be only a justification to continue with its old policies. In actuality, these policies of the government have very little argument or rationale in their favour for the purpose of rural electrification.

Some of the arguments of the government to persist with central grid centres around the issue of 'Equity', with the main line of argument being that, there needs to be no differentiation between urban and rural consumers and therefore, the mode of supply to the urban consumer needs to be made available to rural consumers as well. One main reason behind this argument is that the policy makers tend to equate 'electricity with energy services' . This distortion can be seen in almost all policies concerning rural electrification. Even the revised definition of "deemed electrified villages", continues to have this distortion by defining that, "an 'electrified village' is one, where 10% of all public spaces are lit through electricity supply".

Therefore, by this definition, even if a school and a few street lights and/or perhaps the lights of the Panchayat office are lit up, the village is then deemed electrified, and the energy needs of the villagers are considered met. This is regardless of the hours of supply or the quality of supply received by that village.

Energy requirements related to space heating and cooling, cooking, water supply and irrigation, energy for running small agro-based industries like a flour mill are all NOT an integral part of the RGGVY programme. It is therefore very pertinent to say that the RGGVY is primarily a 'lighting initiative', rather than an 'energy access' programme.

This then brings us to yet another issue, which is with regard to the 'ability and willingness to pay for energy services by rural communities'. The general belief in India is that rural consumers are unwilling to pay for energy services and that is touted as one of the reasons for very high numbers of un-electrified households even in villages which are deemed electrified. While, it is indeed 'true' that the rural consumer is hesitant to pay for electricity, it must be recognised that he is not necessarily reluctant to pay for 'energy services'.

This report carries excerpts of a national survey conducted in India on the 'ability and willingness to pay for energy services' by rural communities.

The analysis of this survey clearly gives away the writing on the wall, that these people living in rural India feel that the *subsidized electricity services* being provided to them are more often than not considered, "*unworthy of payment*", as not only is the quality of these services bad, but also that they get electricity supply at a time and hour when it serves them no purpose whatsoever.

In most cases, people opined that the electricity supply during morning and evening hours was often un-available, when the need for electricity was at its most; and in cases where there was supply available during these hours, the quantum left a lot to be desired, as it was often sufficient to light only a couple of bulbs.

On the other hand, in a number of places, rural communities were pooling their resources together to invest in one water pumping system, for which they would purchase diesel based on the usage, with the capital cost of the equipment being shared by a number of rural households. On an average, one hour of usage of a water pumping system would require anywhere between ½ litre to 1 litre of diesel, depending on the rating of the pump, which meant an expenditure of anywhere between Rs. 25/- to Rs. 50/- per hour of operation.

A little over 27% of the rural households that we surveyed under this study were "in debt", but even these households were willing to spend on diesel to meet their water pumping needs for their agricultural fields. All this in the hope that their well-watered fields would yield sufficient crops that would help them repay their loans and heavy interest rates accompanying them.

In many of these rural households, people had their electricity connections disconnected, either voluntarily or had to have their connections disconnected due to default in making payments to the electricity companies.

These households were spending on average between Rs. 200/- to Rs. 500/- per month for diesel to run the generator/pump but, they were not willing to pay Rs. 50/- to Rs. 100/- for the electricity connection. This was because, in their view, it was not worth paying for electricity, where supply did not meet their requirements and was only adding to their expenses.

We surveyed a total of 1920 households, out of which 1881 households had electricity connections. Of these 1881 households, only 677 households had power supply ranging from 20 to 24 hours a day, with the remaining 1204 households having electricity supply ranging between less than 4 hours to a maximum of 12 hours a day.

Through this survey, the respondents have categorically stated that, it is not a case of them being unwilling to pay for energy services, but, rather they have demonstrated their unwillingness in paying for services which are inadequate. But despite having said so, they have also said that, they would be willing to pay 'reasonable' charges for adequate services.

In terms of awareness, a number of rural communities were aware of alternatives such as renewable energy solutions and have also seen the benefits that rural households have gained by installing such systems. However, owing to limited cash flows, they have neither the options nor means to invest in clean energy technologies.

The fact that rural consumers are willing to pay a premium tariff, such as the price of diesel despite their 'debt' conditions, is testimony to the fact that, if there are enough demonstration projects which can cater to people's energy

needs, the willingness to pay for electricity would be there.

In the survey, we also observed that in villages where the supply of electricity was relatively better with shorter outages and better-quality supply, consumers were willing to pay for electricity. In some villages which have electricity supply for close to 12-14 hours a day and were relatively close to the main towns; people actually were satisfied and happy to pay the tariffs.

In short, the willingness to pay for electricity is highly dependent on the following:

a) Duration of outages and quality of supply
b) Regularity in supply of electricity
c) Immediate electricity connection, as against the current system, where delays in getting electricity connection sometimes range from 3 month to a few years, despite paying the initial deposit.
d) Impact of electricity supply on livelihood, education etc., which means whether the quantum and quality of electricity supply helps in meeting energy needs of the people, and not necessarily helps in only lighting a bulb.
e) Access and ownership of their own system, availability and access to credit, earlier experience with such products elsewhere – the word of mouth referrals or actually feeling the experience and; most importantly ease of daily operability of the product and provision of repair and maintenance support.

Increased consumerism in urban centres has led to the government's prioritization towards meeting electricity supply needs in urban areas, with the rural areas getting the residue if any, which will not and has not been taking care of the energy needs of rural India even where villages have been electrified.

Therefore, through our analysis in the report, we strongly advocate that the current policy and direction of the Government needs to change for equitable electricity supply across urban and rural India. Simultaneously, there is an urgent need to do a course-correction in the current implementation framework of the RGGVY programme of the Government of India. With its huge budgetary allocations, the RGGVY programme could easily help achieve not just 100% electrification of rural households but also simultaneously help ensure good quality electricity supply. The one area where RGGVY needs to definitely consider a re-look at is the 'issue of energy access'.

What also needs to change is the current stress on 'centralised grid supply', so as to ensure the co-existence of decentralised distributed generation along with the grid extension programme.

In a climate constrained world, India has the potential to follow a climate friendly development pathway, which will ensure development, while opting for a low carbon pathway.

India is currently the fourth largest carbon emitter in the world with a total emission of around 1900 MT CO_2e (Carbon Dioxide emissions), with the energy sector contributing to 67% of these emissions, amounting to 1260 MT CO_2e. The emissions from the energy sector are expected to touch the 1700 MT CO_2e mark by 2012 and may even cross the 2000 MT CO_2e, if India were to continue to persist with the current energy policies.

While India needs to reprioritize and shift considerable resources into alternative pro-poor sustainable development and low-carbon intensive energy generation, it must be acknowledged that the incremental costs of adopting this necessary approach have to be covered by technological and financial support from developed countries. This should happen as part of a multilateral approach to dealing with the global threat of climate change that does not undermine the right to development of developing countries, like India and takes into consideration the principles and realities of common but differentiated historical responsibilities and respective capabilities.

As part of aiding India's efforts to combat climate change, while substantial sums to augment the so-called price barrier and initial high subsidy support required for renewable energy solutions should come from developed nations, such efforts can also be partly met by way of financial support from a revamped Indian banking sector.

India needs to reprioritize and shift considerable resources into undertaking alternative pro-poor sustainable development through low-carbon

intensive energy generation. However, it must be acknowledged that the incremental costs for India to adopt this approach have to necessarily be covered by technological and financial support from developed countries. This should happen as part of a multilateral approach to dealing with the global threat of climate change that does not undermine the right to development of developing countries, like India; and one that also takes into consideration not only the 'principles and realities of common' but also their differentiated historical responsibilities and respective capabilities.

Srinivas Krishnaswamy
Siddharth Chatpalliwar

November, 2011

Section I

The Story of “Cost Economics”

How much does a rural Indian consumer actually pay for grid supply?

Chapter I: Introduction & Overview of the Electricity Sector

In recent times, India has witnessed a galloping rate of economic growth, and it ranks today as one of the most preferred investment destinations in the world. The Indian economy has been maintaining a growth rate of about 6% since 1997, and continued to grow at 9% even during the recent global recession.

The early 1990s saw economic liberalization, reduced controls on foreign trade, and industrial deregulation which contributed to the country's accelerated growth and facilitated the development of an open market economy. Traditionally an agricultural economy, India today has rapidly expanding manufacturing and services sectors.

Despite the development of various sectors, the one sector that has not grown to the extent it should have is the energy sector. This is despite several power sector reforms, initiatives and programmes such as aggressive plans for enhancing the installed capacity, and the *'Rajiv Gandhi Grameen Vidyutikaran Yojana'*- a dedicated flagship programme of the Government of India, that was launched in 2005- aimed at ensuring 100% rural electrification.

For India to maintain its current pace of economic growth, modest estimates suggest that its energy needs will have to grow over three times from the present levels.

India's electricity sector is currently afflicted with a number of issues such as; poor efficiency, inadequate demand side management, an unrealistic pricing system, erratic supply and high T&D losses (as much as 31% as compared to 3-4% of EU countries). The transmission network in India only delivers electricity to one out of three Indians[4]. These are some of the obstacles that could affect the trajectory of the country"s economic growth.

The goal of the programme was to cover 156 lakh households (including 46 Lakh BPL households) per year. In the last six years of the RGGVY programme, a total of 96,000 villages have been electrified and 1.75 Crore households provided with electricity connection. Even today there are over 103,000 Indian villages without electricity[5]. Also, despite 90% villages being deemed 'electrified', only 56% of the rural households today have electricity connections.

The National Electricity Policy (2005) seeks 'power for all' and envisages the per capita electricity consumption to rise to 1000 kWh by 2012[6]. This policy aims at inclusive growth of the power sector by 'providing adequate and reliable power for all' at reasonable rates.

The per capita electricity consumption of India based on 2008-09 figures was 733.54 kWh, which in itself is quite abysmal when compared with the world average of 2750 kWh in 2006[7]. Only one-sixth of Indian households using electricity consume over 100 kWh per month, compared to the average US household consumption of over 900 kWh per month.

Since the issue of low per-capita energy consumption, has a direct impact on both GDP of a country as well as the Gini coefficient (measuring inequality among people), Government of India has been trying to address this issue for a long time to improve the conditions of accessibility, availability and quality of electricity.

The issue of quality energy access continues to remain an issue plaguing rural India, with bulk of the electrified villages and households not having access to quality of supply, both in terms of hours of supply as well as the quantum of supply to meet their energy needs.

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[4] http://www.bloomberg.com/news/2011-02-21/india-coal-tax-may-be-used-to-fund-transmission-lines-for-renewable-plants.html

[5] http://powermin.nic.in/bharatnirman/pdf/Electrification_Achieved.pdf

[6] National Electricity Policy 2005. www.powermin.nic.in

[7] World Energy Outlook 2009

Access to energy has been shown to facilitate other development indicators, and the United Nations has also mandated that access to affordable, modern energy services is essential for the achievement of sustainable development and the eight Millennium Development Goals[8]:

1. **End Poverty and Hunger.** Access to energy services can help eradicate extreme poverty and hunger by promoting micro-enterprise, creating jobs, improving agricultural outputs, and making basic cooking easier and cleaner.

2. **Universal Education.** Access to adequate lighting can significantly support achieving universal primary education.

3. **Gender Equality.** Energy access can promote gender equality by decreasing the time spent on cooking, boiling water, and collecting fuel for household use – chores that usually fall on women – thereby increasing the time available to them for pursuing economic and educational opportunities.

4. **Child Health.** Basic health improvements that come with energy access can help in decreased indoor air pollution and increased water purification with access to faster boiling and purification technologies, thereby reducing child mortality.

5. **Maternal Health.** Energy access can also help improve maternal health by improving indoor air quality, reducing the intensity of household chores, and improving conditions in rural health clinics.

6. **Combat HIV/AIDS.** Improved health care facilities, including lighting, sterilization (of medical equipments) and refrigeration (of blood and medicines/vaccines) and electricity to facilitate communication (awareness in the form of Public Service Advertisements through audio/visual communication) about health issues can help combat the spread of HIV/AIDS, malaria and other diseases.

7. **Environmental Sustainability.** Cleaner energy systems and the reduction in the use of wood for heating and cooking purposes can help ensure sustainability of our forests and environmental resources.

8. **Global Partnership.** A focus on increasing access to energy services is one way to help develop a global partnership for development.

The report of the UN Advisory Group on Energy and Climate Change[9] breaks down energy access into incremental levels of:

1) Basic human needs;
2) Productive uses; and
3) Modern society needs.

'Basic human needs' is the level that is used for forecasts of costs for universal energy access. This includes "electricity for lighting, health, education, communication and community services (50-100 kWh per person per year)" and "modern fuels and technologies for cooking and heating (50-100 kilograms of oil equivalent of modern fuel or improved biomass cook stove)".

[8] UN Millennium Project. Energy Services for the Millennium Development Goals: Achieving the Millennium Development Goals. Washington, DC and New York: The International Bank for Reconstruction and Development/The World Bank and the United Nations Development Programme, 2005. http://www.unmillenniumproject.org/documents/MP_Energy_Low_Res.pdf

[9] UN Advisory Group on Energy and Climate Change. "Energy for a Sustainable Future: The Secretary-General's Advisory Group on Energy and Climate Change (AGECC) Summary Report and Recommendations," New York: April 28 2010. http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGECC%20summary%20report%5B1%5D.pdf

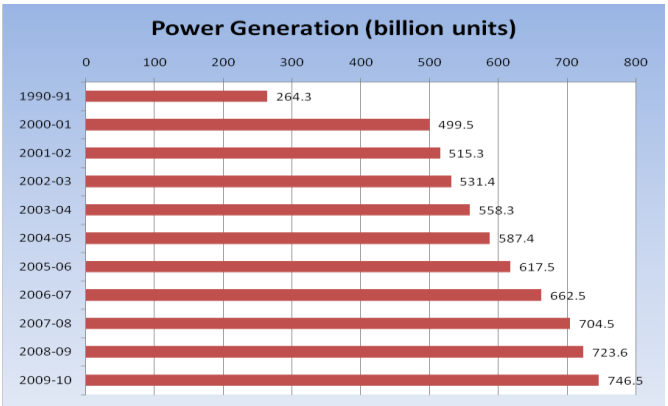
However, presently even with efforts such as the RGGVY programme, India is still very far from providing energy access to its citizens, as per the recommendations made by the UN Advisory Group on Energy and Climate Change.

India is yet to achieve its own target of 1kWh per household per day, which would amount to 365 kWh per household. Assuming, an average size of 5 people per household, the total availability per person would be 70 kWh per person per year, which would take India closer to achieving the UN recommended figure of 50-100 kWh per person per year of electricity.

Amongst other measures taken to address the issue of "energy access" and addressing the huge deficit in electricity generation, the Government of India has undertaken a massive expansion plan of generation capacity additions, with close to 70,000 MW of capacity addition being planned for the period of 2012-2017. A recent report published by *Prayas* on Thermal power plants, indicates that environment clearance has been granted for close to 193,000 MW of thermal power projects.[10]

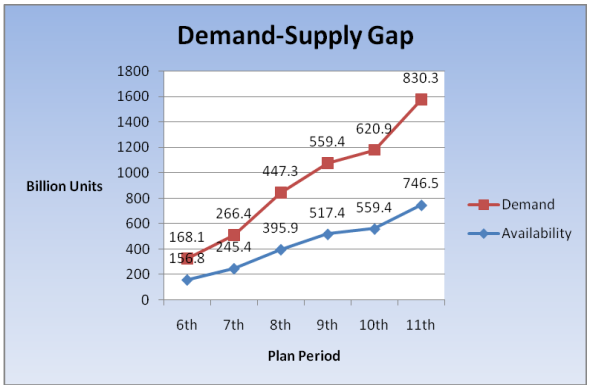
Generation capacity additions in the last decade have gone up from a mere 264 billion kWh to 745 Billion kWh in 2010 as also indicated in the figure below.

Figure 1: Generation Capacity additions over the past decade in India



However, demand has always overshot generation capacity additions. As on April 2011, the deficit in electricity generation as compared to demand was about 84 billion kWh with close to 44% of the households still not having access to electricity. This is depicted in the figure below.

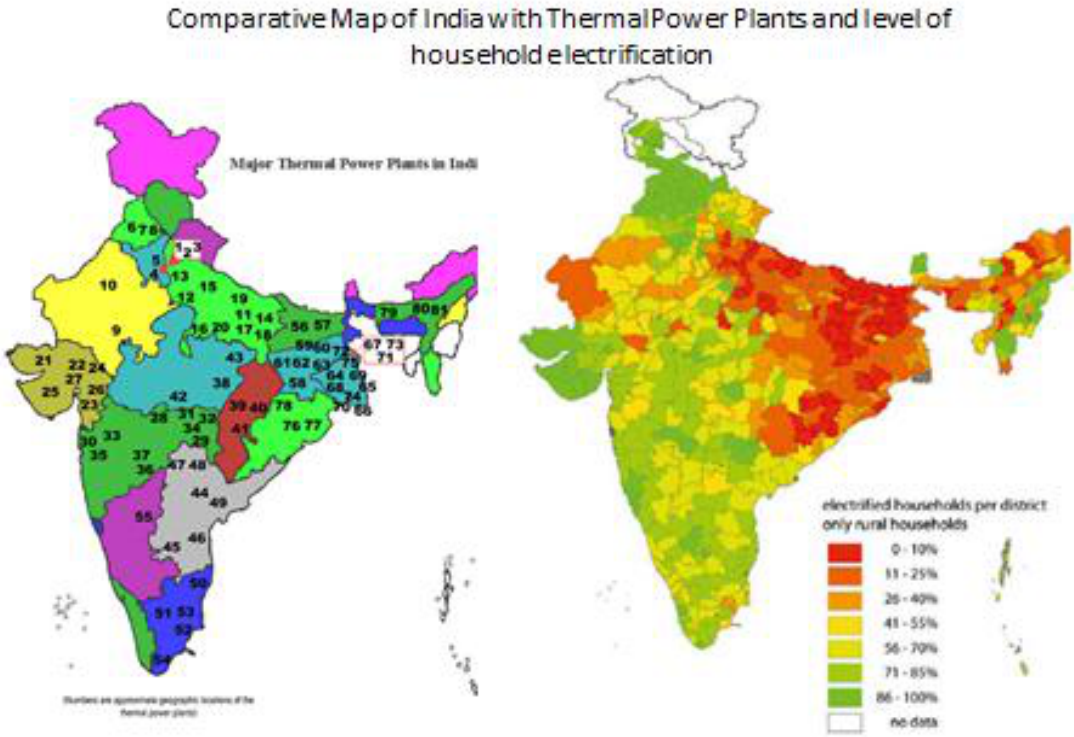
Figure 2: Demand-Supply gap over the past 6 five year plans



[10] Prayas Report titled "Thermal Power Plants on The Anvil : Implications And Need For Rationalisation", August 2011 (http://www.prayaspune.org/peg/index.php?option=com_k2&view=item&id=164:thermal-power-plants-on-the-anvil-implications-and-need-for-rationalisation)

As can be seen from the graph above, generation capacity additions have indeed increased, however, the key issue remains whether adding generation capacity alone would address the issue of "energy access".

In 2002, the total installed capacity of coal-fired power plants in India was 74,429 MW[11]. The installed capacity of coal-fired power plants increased to 96,794 MW in 2009 with the construction of new plants.[12] In addition to the 22,365 MW increase in coal generation, an additional 10,000 MW[13] of large hydropower capacity was also added between the period ranging from 2002-2009. However, during the same time period, the percentage of un-electrified households came down only marginally from 52% in 2002 to 45% in 2009[14] and; only 20,000 of the over 120,000 un-electrified villages were electrified during that period.[15]



Increased electricity generation capacity from conventional power plants, be it large hydropower or coal-fired power plants, has not sufficiently addressed the issue of electricity access for the rural poor. On comparing the above maps of India that show the locations of coal-fired power plants and the extent of household electrification, it is clear that areas with a high concentration of coal-fired power plants have a very low level of household electrification. This vividly demonstrates how the conventional power supply model has failed India's rural poor.

The questions that therefore arise are:

- Who has benefited the most from the electricity generation capacity?
- Is it that the poor cannot afford to pay for electricity services?
- Is there a lack of willingness amongst the rural communities to pay for electricity services?
- Are the services to the poor not being subsidized?
- If the energy services to the poor is being subsidized, is the subsidy not sufficient or is it not reaching them?

[11] Planning Commission, Government of India. "Sources of Electricity Supply 1985-2009."
[12] Planning Commission, Government of India. "Sources of Electricity Supply 1985-2009."
[13] Planning Commission, Government of India. "Sources of Electricity Supply 1985-2009."
[14] Rural Electrification Programme, Ministry of Power, Government of India
[15] Rural Electrification Programme, Ministry of Power, Government of India

Chapter II. Energy Sources and their Subsidies

The next two chapters of this section try to answer some of the questions emerging from the previous chapter.

> Is the electricity and energy sector subsidized in India?
> If yes, are the subsidies actually benefiting the poor?
> What is the actual cost that India's rural poor pay for electricity services in comparison to what the urban middle class consumer pays?

This particular chapter analyses the subsidies provided by the Government of India to various sources of energy. The subsidies that we looked into are both the direct subsidy provided by the Government if any, and the indirect subsidies in the form of either a transport subsidy provided by the Railways and/or other Government Ministries/Agencies. This chapter also looks at the various programmes of the Government which could provide fiscal and other incentives for energy generation.

Subsidies for Rural Energy Access [Electricity, kerosene and Liquefied Petroleum Gas (LPG)]

The World Energy Outlook 2011[16] has computed the total subsidy to the energy sector in India. As per their analysis, the Indian electricity sector got a total subsidy amounting to USD 6.21 Billion in 2009, and USD Billion 3.87 in 2010[17]. These subsidies are largely in the form of budgetary allocations for the RGGVY programme and specifically for the supply of free electricity connection to all BPL households. However, since the electricity tariffs for rural consumers are extremely low and in some states, the extent of providing free electricity supply to rural households also extends to non-BPL families, the total subsidies for the rural electrification sector, which also includes cross-subsidies, is estimated to be in the region of USD 7-7.5 Billion[18].

The Electricity sector in India got a total subsidy amounting to USD 6.32 Billion in 2009, which increased to USD 7.5 Billion in 2010[19]. The subsidy to electricity went largely to the programmes of the RGGVY for rural electrification, which include amongst others, free electricity connection to all families who live below the poverty line (BPL).

The electricity tariff structure in India is not uniform and varies from state to state. While in some states, the non-metered tariff is on a flat rate of Rs. 30/- per month, in other states, it is as high as Rs. 100 per month.

A part of the subsidies have also gone to provide subsidized electricity to rural communities. On paper, the metered tariff for electricity services for rural consumer ranges from Rs. 0.50 per kWh to a maximum of Rs. 1.50 per kWh. The average tariff for rural consumer also factors in the free supply of electricity which is provided to BPL households.

On the other hand, for the urban domestic consumer, the average tariff ranges from Rs. 1.50 per kWh to a maximum of Rs. 3 per kWh, for basic minimum electricity consumption, and the tariff increases depending on the consumption pattern. To elaborate, for the urban consumer, for the first 50 kWh of electricity consumption per month, the tariffs range from Rs. 0.75 to Rs. 2, depending on the state and the city[20]. The average tariff for all urban centres in India for the first 50 kWh of consumption works to Rs. 1.25 per kilowatt hour. Given that most urban centres have electricity supply ranging from 12-24 hours and even assuming the minimum consumption of 50 kWh, the cost to the urban consumer works to Rs. 1.50 per kWh.

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[16] Source: http://www.iea.org/subsidy/index.html

[17] Source: http://www.iea.org/subsidy/index.html

[18] Computed from the WEO estimates with data on electricity tariffs got from the State Electricity Regulatory Commissions

[19] Report of the Expert Committee on Fossil Fuel Subsidy, 2010

[20] Central Electricity Regulatory Commission, India. "Compilation of tariffs for electricity for rural and urban households in India," 2010.

The non-metered tariff for rural consumer is irrespective of consumption and no matter what the quantum of consumption is, the monthly tariff remains constant, unless revised. But, given the average quantum of supply every day, the life style of rural communities and the electricity usage, the consumption seldom exceeds 1 kWh per household every third day, which translates to 2 kWh per household per week or about 10 kWh per household per month. Even at the highly 'subsidized' rate of Rs. 30 per month per household, the cost which the rural consumer pays works to Rs. 3 per kWh in the business-as-usual scenario, while in a 'best case scenario' of 8-12 hours of electricity supply a day at the time, when the rural consumer has real need for electricity, the cost being paid by a rural consumer could be Rs. 1.50 per kWh per day.

A good majority of the subsidy earmarked for electricity sector is supposed to be for providing free electricity connections and services to BPL families, while a portion of it is to be paid to electricity utilities to provide electricity to other rural communities at the rates mentioned above.

The electricity utilities also try to recover some of the expenditure incurred by them (which is not covered under the subsidy amount earmarked by the Government) for rural electricity delivery by charging higher tariffs from 'commercial, industrial and high consumption urban domestic consumers'. So, if that component were also to be included in the total subsidy package, then the amount would be much more than the USD 7.5 Billion which was spent by the Government as subsidy for electricity in 2010.

In addition to the subsidy provided for electricity, Kerosene is another important fuel which is highly subsidized, and is used for lighting in rural areas.

Kerosene is amongst the consumer products whose prices are set by the government. The subsidy burden can be shed by the government by reducing the subsidy allocation on kerosene, as BPL households are also getting grid connectivity under RGGVY's subsidized initiatives. This double subsidy not only places a financial strain on the government, it makes a large segment of the population reliant on a polluting fuel to meet their energy needs. The Expert Group Report on Petroleum recommends the price of Kerosene [being sold through the Public Distribution System (PDS) to the rural consumer] be raised by Rs. 6 per liter and the amount to be revised every year in step with the per capita agricultural GDP[21].

Cartoon Courtesy: Partha Borah; © Vasudha Foundation

[21] Expert Group Report on Viable and Sustainable System of Pricing of Petroleum, 2010

When a household gains access to grid electricity, the first use is for lighting, thereby replacing kerosene and biomass. However, to disguise the shortcomings of the grid, the government continues to place itself under a financial burden by providing subsidies to kerosene, LPG, and natural gas. And the gap between cost of electricity generation and cost of supply is partially covered via cross subsidization of consumers.

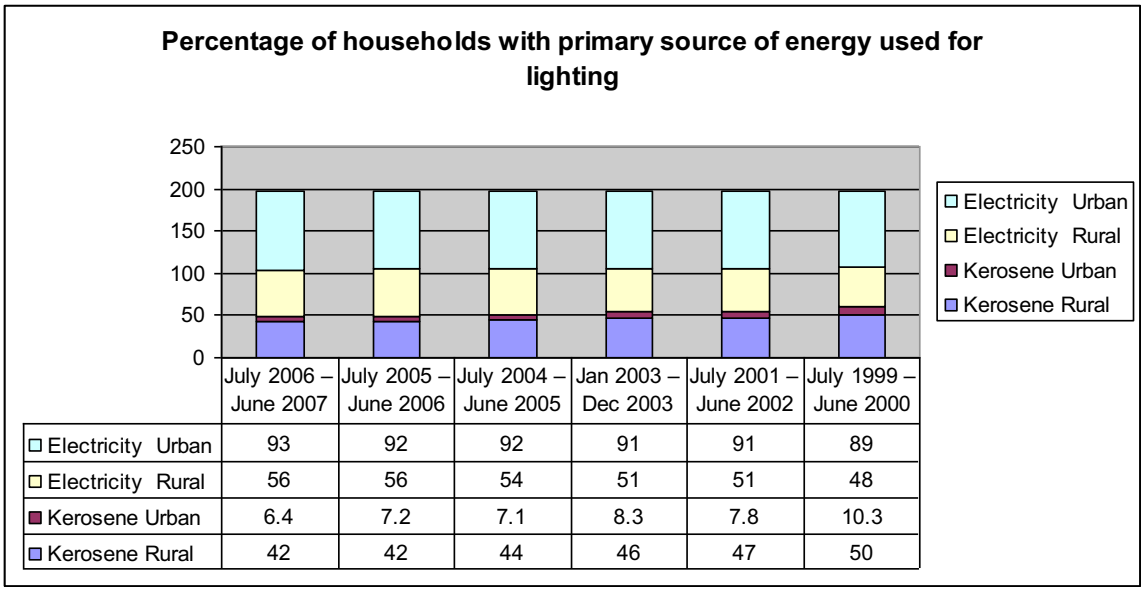
On an average, kerosene gets a subsidy ranging from Rs. 20 per litre to as much as Rs. 30 per litre. At a price of USD 75 per barrel of crude oil, kerosene should be priced and sold at around Rs. 29 per litre, while the selling price (which varies from state to state) through the PDS ranges from Rs. 9-15 per litre[22].

Liquefied Petroleum Gas (LPG) is another petroleum product which is subsidized heavily. The current price of LPG ranges from Rs.300-400 for a 14.2 Kg of domestic cylinder, which is primarily used for cooking. But at a price of USD 75 per barrel of crude oil, the actual price of a 14.2 Kg domestic LPG cylinder should be between Rs. 500-550, which means that the Government bears a subsidy of roughly Rs. 150-200 per cylinder.[23]

While the logic for the Government to heavily subsidize kerosene and LPG cylinder prices borders around its 'pro-poor policies', it should be noted that even today, only 5% of the rural consumers have access to LPG, with 50% of rural consumers using Kerosene for lighting purposes. However, it should be noted that in per capita terms, urban areas consume 20% more subsidized kerosene than rural areas. As the per unit subsidy is largely the same across rural and urban sectors, this means that urban areas receive more subsidy than rural areas in per capita terms.

The graphs below indicate the extent to which LPG is actually reaching the rural poor. It also gives an indication of how 'kerosene' is still the most preferred fuel for lighting for rural poor, despite a substantial amount being actually spent on subsidy for electricity for the benefit of the poor.

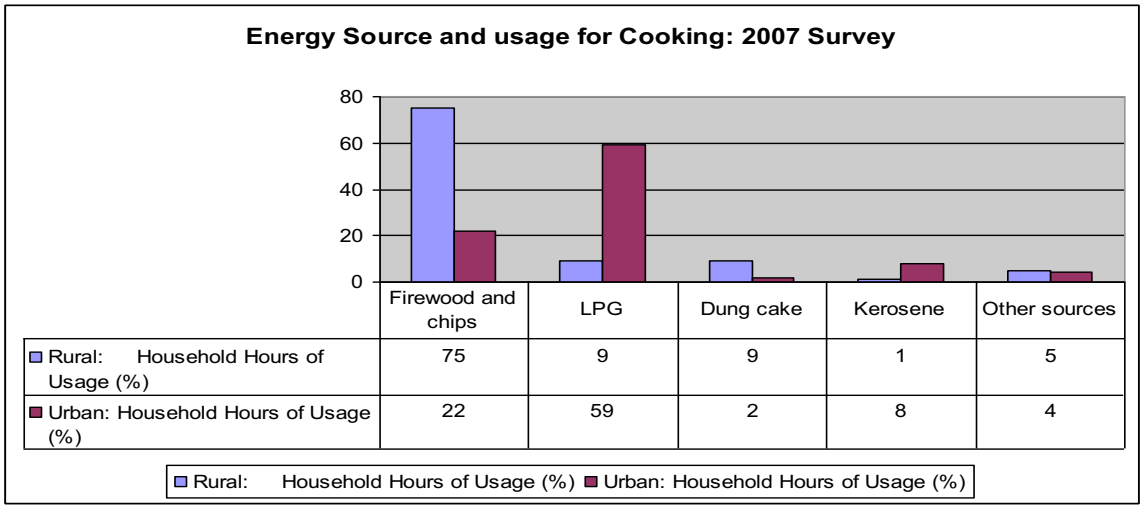
Figure 3: Percentage of households with primary source of energy used for lighting (Source: Computed based on information from NSSO and Planning Commission)



	July 2006 – June 2007	July 2005 – June 2006	July 2004 – June 2005	Jan 2003 – Dec 2003	July 2001 – June 2002	July 1999 – June 2000
Electricity Urban	93	92	92	91	91	89
Electricity Rural	56	56	54	51	51	48
Kerosene Urban	6.4	7.2	7.1	8.3	7.8	10.3
Kerosene Rural	42	42	44	46	47	50

[22] Report of the Expert Committee on Fossil Fuel Subsidy, 2010
[23] Report of the Expert Committee on Fossil Fuel Subsidy, 2010

Figure 4: Energy Source and Usage for cooking purposes: 2007 Survey
(Source: Computed based on information from NSSO and Planning Commission)



Figures 3 and 4 depict the use of various fuel sources for lighting and cooking needs. In a survey conducted by the NSSO on electricity usage in 2006-07, it was clearly indicated that the urban household spends almost double the amount spent by a rural household towards purchasing 'fuel'. It must be pointed out here that the expenses incurred on fuel need not necessarily mean a cash transaction, but this is also computed on the basis of human effort and time involved, particularly for rural households in which people spend a lot of time and energy in collecting fuel (which is in the form of traditional bio-mass such as fire-wood, wood chips, charcoal, dung cakes etc).

Table 1: Subsidies for Energy Sources
(Source: World Energy Outlook 2011; http://www.iea.org/subsidy/index.html)

Subsidy/Budgetary Allocation for Energy in India (IN USD Billion) Source: WEO 2011				
Fuel Source	2007	2008	2009	2010
Coal	0	0	0	0
Oil	17.67	32.12	11.49	16.20
Gas	2.05	4.16	2.72	2.22
Electricity	4.89	7.82	6.21	3,87*

This is direct budgetary allocations, and if the subsidized tariffs and free electricity connection costs are also factored in, the total subsidy for the electricity sector in 2010 was USD. 7.5 Billion

In the table above, as per the World Energy Outlook 2011 on the actual amount of subsidy or budgetary allocation for energy sources, indicates that the electricity sector in India received a subsidy of USD 3.87 Billion in 2010. This subsidy was in addition to the USD 16.20 Billion for Oil, of which a substantial component was for Kerosene, primarily allocated for lighting purposes in rural areas.

The total subsidy component for the Indian energy sector in 2010 alone was USD 22.29 Billion, which does not factor in either the subsidized electricity tariffs for rural consumers or the free electricity supply to rural consumers (and even non-PBL households) as is also being practiced in a number of states.

Technically, this huge subsidy should help improve the living conditions of the poor by ensuring clean and modern energy access to them. But, as can be seen from the above tables and graphs, the poor continues to depend on kerosene for lighting and on traditional bio-mass for cooking and heating purposes.

The question that now arises is that who is actually benefiting from the USD 22.29 Billion subsidy? Definitely, not the poor consumer and definitely not the rural poor consumer**.** It is estimated that 40% of the subsidies for LPG and kerosene go to the richest 7% of the population[24].

Subsidies to Petrol and Diesel:

The market prices of petrol and diesel have gone up substantially in the past few years with an average upward revision of prices at the rate of 2-3 times per year. In the last one year itself, the prices of petrol and diesel have seen an upward revision 6 times, the most recent being in September 2011.

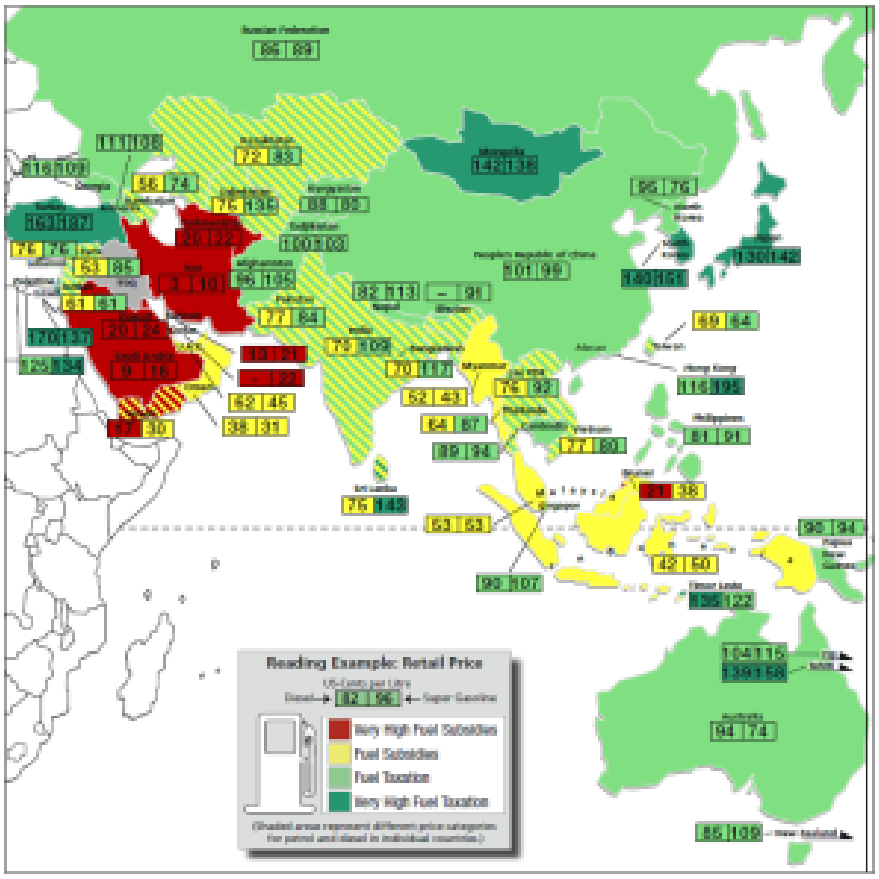
A comparison of the prices of petrol and diesel in India as compared to other 157 countries for which data is available, indicate that the prices of petrol and diesel in India is higher than 97 countries, which include almost all the Oil and Petroleum Producing Countries and the United States of America amongst others. Table 2 indicates the comparative price of petrol in India as compared to a few countries globally.

Table 2: Petrol Prices across the World
(Source: Compiled based on data on global prices of fuel from *GIZ report 2010)*

Country	$ per Gal. 2011	Rs. per ltr	% Deviation from India, 2011
Saudi Arabia	0.85	8.53	-85%
UAE	1.82	18.14	-68%
Malaysia	2.42	24.11	-57%
Hong kong	3.00	29.86	-47%
China	3.77	37.31	-34%
USA	3.99	39.64	-30%
Pakistan	4.00	39.22	-31%
Sri Lanka	4.81	47.04	-17%
Canada	5.38	53.01	-6%
South Africa	5.68	55.24	-2%
India	5.69	56.52	--
Australia	6.25	61.61	9%
Switzerland	6.58	65.57	16%
Germany	7.40	73.75	30%
France	7.51	74.84	32%
UK	8.54	85.02	50%

[24] World Energy Outlook (2007)

As is indicated in the representation below, in India there is moderate fuel taxation and the prices of diesel and (at times) petrol are subsidized.



Source: GIZ report 2010 on Fossil fuel Pricing and Subsidy

The average subsidy provided by the Government of India for Petrol, Diesel and Kerosene is USD 17.6 per person, with the bulk of the share of the subsidy going to Kerosene and LPG. The total subsidy for fossil fuel, mainly Kerosene and LPG put together stands at 1.7% of India GDP.

In India, petrol is generally not subsidized, unless the price of crude oil exceeds USD 100 per barrel. Also, up to an import price of USD 83 per barrel of crude oil, diesel is not subsidized. But, we have seen in the past, that when the price of crude oil fluctuates and breaks the USD 100 per barrel mark (and definitely cross the USD 83 per barrel mark), this ends up with diesel more often than not and sometimes even petrol being subsidized.

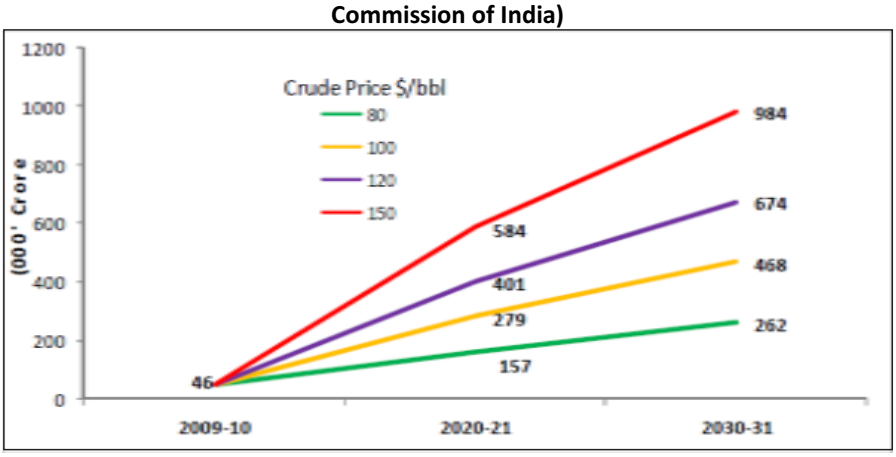
But who is benefiting from the subsidies to diesel? These subsidies are not only NOT benefiting the poor, but also affecting oil companies.

Most oil companies have huge under-recoveries, which add to their already constrained finances. At present, the under-recovery of the oil companies is being compensated based on the burden sharing mechanism between the public sector oil companies and the government[25].

Figure below shows the total under-recoveries of oil marketing companies at different levels of crude oil prices (2009-10 to 2030-31)[26].

[25] Information received on basis of RTI filed with Indian Oil Corporation Limited and Ministry of Petroleum and Natural Gas.

Figure 5: Projection of total under-recoveries of oil marketing companies at different levels of crude prices (Source: Expert Group Report on Viable and Sustainable system of pricing of Petroleum, 2010. Planning Commission of India)



S***ubsidy to Coal:***

In the present scenario, the government has categorically stated that coal will continue to remain the dominant fuel in the years to come. The insistence to not look beyond coal is highlighted in the recommendations of several committees, one of them being the 'Expert Committee on Road Map for Coal Sector Reforms'. One of the recommendations of this committee was the need to establish a 'Coal Policy' as part of the 'Integrated Energy Policy'. The committee also dismissed concerns of environmental damage and climate change on account of increased coal use as being "premature"[27]. In a situation like this, it becomes extremely difficult to establish decentralized distribution systems for improving energy access.

Today, coal and natural gas account for almost 65% of the total power generation. Hence, the strong desire to achieve energy security and energy self sufficiency is driving the government to look at all possible means to secure coal and natural gas for India"s thermal power plants.

While coal does not receive any direct subsidy or subsidies in the form of Transport Subsidy, Capital Subsidy for coal mines etc., there are some benefits which the sector automatically gets.

The followings are some of the incentives given to the coal sector, though they are not really accounted as 'subsidies':

a) Fiscal and financial incentives for setting up coal fired power plants: These vary from state to state and some of these incentives range from allotting land at subsidized cost for setting up a coal fired power plant, to a 5-7 year tax holiday period that is given in most states for power generation projects.
b) There is no service tax paid on transmission of power, as it is not a notified service under the Finance Act, 1994.
c) Customs Duty concession for importing machinery instruments, electrical equipment and appliances for coal fired power plants has been provided for.
d) The Government also provides resources where ever required such as water supply for coal fired power plants and coal washeries (if local source of water is inadequate). These resources are supplied at very subsidized rates and the range of the subsidy for these supplies varies from state to state.

[26] Expert Group Report on Viable and Sustainable System of Pricing of Petroleum, 2010
[27] Expert Committee on Road Map for Coal Sector Reforms (2005)

However, there is no subsidy provided by either the central or state government for procurement of coal *per se*. The price of coal is set up by the Coal India Limited and is usually at market prices.

There is no rail transport subsidy for coal either. In fact, transporting coal to coal fired power plants has been the biggest revenue earner for the railways. Based on information received through RTI applications, the railways during 2009-10 supplied 271.45 million tonnes of coal at an average freight rate of Rs. 602.25 per tonne. As per the explanatory memorandum of the railway budget, Rs. 16,354.65 Crore were earned by the railways from carrying coal to thermal power plants. Since the railways have the majority share (almost 51%) in the transportation of coal, the government"s Coal Distribution Policy (2007) also provides for long term supply and transport agreements with the railways.

It should also be noted that there is also a cess on coal, the amount collected from this cess is earmarked for green energy investments.

Schemes to Promote large scale Conventional Power Plants:
Some of the government policies promoting conventional power generation (both thermal and hydro) are as follows:-

New Hydro Policy, 2008:

- Level playing field for private hydro projects
- Exemption from tariff based competitive bidding up to January, 2011 to private hydro projects
- Private developers to have the facility of merchant sale of up to 40% saleable energy
- An additional 1% free power over and above 12% to be earmarked for a Local Area Development Fund
- Each project affected family (PAF) to get 100 units of electricity every month for a period of 10 years after commissioning of the project.
- Project authorities to bear 10% of the state contribution under RGGVY for electrification of the affected area.

Mega Power Project policy: introduced in 1995 for establishing a number of large power plants in India.

- Income tax holiday regime as per section 80-IA of the Income Tax Act, 1961. Power projects get deduction of up to 100% profit for any 10 consecutive years out of the first 15 years of commissioning
- Deemed export benefits
- Zero customs duty on the import of capital equipment.
- 15% price preference available to domestic bidders in case of cost plus projects of PSUs to continue. However, the price preference will not apply to tariff based competitively bid projects of PSUs.
- Benefits of the policy to be extended to supercritical projects to be awarded through International
- Competitive bidding with the mandatory condition of setting up indigenous manufacturing facility.
- Benefits of the policy that are available to Greenfield projects would also be available to expansion units (brownfield projects) even if the total capacity of expansion units is less than the threshold qualifying capacity.

Fifty Thousand Hydro Electricity Initiative:

Launched in 2003 and as the name suggests, this scheme was primarily aimed at increasing the generation capacities from Hydro sources with an aggregate capacity of generating 47,930 MW across 16 states. A total of 162 new projects were identified under this programme, of which 72 projects were prioritised for implementation in the first year and the basis of identifying these projects was based on the presumption that the cost to consumers would be well under Rs. 2.50 per kWh based on the total costs of generation from these plants.

Other incentives for conventional power are:-

- State governments generally exempt a power project from sales tax and local duties
- Long term fuel supply agreements that provide fuel at a price lower than the market price
- Loans below market rates
- Fiscal and technical incentives from state governments
- Creation of physical and social infrastructure by states for facilitating the establishment of power plants.

Subsidy to Renewable energy Technologies:

Renewable energy Technologies receive a combination of direct capital subsidies and fiscal and financial incentives. The direct subsidy is in the form of 90% capital subsidy given to renewable energy equipment for remote area electrification. There is also a smaller subsidy element of 30% for standalone renewable energy generation and for some applications. The fiscal incentives range from feed-in-tariffs for renewable energy grid supply, tax credits, generation based incentives, and also accelerated depreciation particularly for wind turbines.

Renewable energy technologies in India are the recipients of direct subsidies (both from the centre and the states). During the 10th plan period, these subsidies were also extended to stand alone off-grid systems and other renewable energy options (except wind and solar). Wind power has not been receiving any subsidy but fiscal incentives, and this is proposed to be continued during the 11th plan along with the introduction of tax credits.

The subsidies received by the renewable energy sector have attracted criticism from the Planning Commission, since it believes that it should be "linked to outcomes (energy generated) and not just outlays (capacity installed)". The Integrated Energy Policy also questions the targeting of the subsidy for renewable energy and suggests a 'Tradable Tax Credit Certificate' system, based on actual electricity certified as having been supplied. This policy also believes that renewable energy subsidies can have an adverse impact on market growth.

The Ministry of New and Renewable Energy (MNRE) in its 11th plan proposal acknowledges that there may be a case for lessening of subsidies in years to come as the sector grows, and replacing them with fiscal incentives. MNRE also realizes that subsidies need to be linked to some form of desired outcomes. A beginning in this direction has somewhat been made during the 10th plan for small hydro power, where subsidy is sought to be given only where the installed equipment conforms to international standards.

<u>Some Central level Incentives for Renewable Energy are:</u>

- Concessional Counter veiling Duty @ 5% (by way of central excise exemption) and full exemption from Special Additional Duty is provided to LEDs which are used for manufacture of LED lights and fixtures
- Customs duty exemption to toughened glass and silver paste imported for manufacture of solar cells and solar modules
- Generation Based Incentive introduced in 2009 to encourage development of wind farms. It acts as a form of tax break involving accelerated depreciation. On supply of wind generated electricity into the grid, Rs. 500 per MWh is paid to the wind farm. This incentive is limited to wind farms with a maximum aggregate installed capacity of 4000 MW.
- Soft loans from Indian Renewable Energy Development Agency (IREDA)
  Subsidized loans to companies building alternative energy plants
- As per the tariff plan notified by Central Electricity Regulatory Commission (CERC), companies investing in Renewable energy projects will get 19% pre-tax return on investment for the first 10 years of operation, while during the rest of the project's lifetime, a 23% return would be guaranteed. This is higher than the maximum return of 18.4% that thermal power units can fetch.

The government has also established two funds in recent times to provide support to renewable energy; namely, a 'Partial Risks Guarantee Fund' that will help cover banks' loan exposure to the Renewable energy industry, and a 'Venture Capital Fund' that will provide risk capital for energy efficiency businesses. Both funds were expected to start from April, 2011[28].

This report attempts to make a case for decentralized energy systems to enhance energy access to the poor and the vulnerable. The following sections will look upon the economics of conventional versus renewable power generation, and also look at 'ability and willingness to pay' for energy services in rural areas.

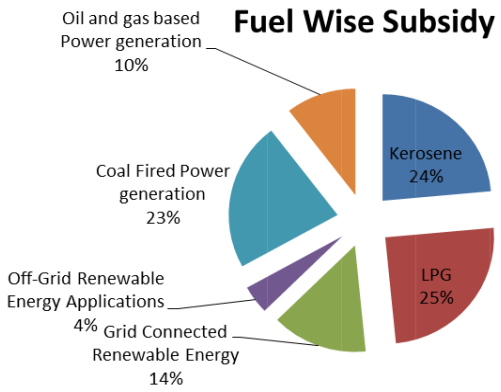
Summary and Conclusion:

To summarize, the energy sector in India attracts both direct subsidies as well as indirect subsidies which manifest in the form of tax incentives, tax rebates, accelerated depreciation, low land costs, tax holidays, exemption from import taxes, feed-in-tariffs , special or nominal rates for ancillary service usage such as water etc. **Table 3** below tries to give a 'bird's-eye view' of the direct and indirect subsidies in the form of incentives provided to the energy sector as a whole by GoI:

Fuel Source	Direct Subsidies	Subsidy Amount in 2010 (In Billion USD)	Total Amount (Computed on the basis of units in 2010)				
			Subsidized Land	Feed in Tariff	Customs Waiver on manufacturing equipment	Other fiscal Incentives	Total Subsidy
Kerosene	Yes	6.12	No	No	No	No	6.12
LPG	Yes	6.45	Nil	No	No	No	6.45
Grid connected Wind	No	Nil	Yes	Yes 1.50	No	Yes	1.50
Grid Connected Solar	No	Nil	No	1.20	0.5	0.5	2.20
Grid Connected bio-mass	No	Nil	No	Nil	No	No	0.00
Grid Connected Small Hydro	No	Nil	No	Nil	No	No	0.00
Off-Grid Renewable Energy Applications	Yes	1.12	No	Nil	Yes	No	1.12
Coal Fired Power generation	No	Nil	Yes	Nil	3.54	2.32	5.86
Oil and gas based Power generation	Yes	0.86	Yes	Nil	1.32	Yes	2.71
Total							**25.96**

[28] *The GRID: Demand, Incentives make Indian Renewables attractive*, Edward Tan, Dow Jones Commentary, 2011 http://www.bvp.com/downloads/india/india_renew.pdf

The total subsidies to the sector, if split towards various fuel-wise generation and for direct consumption for energy-related use is graphically depicted in the **Figure 6** (Source: Compiled from Budgetary and Plan Allocations 2010) below:



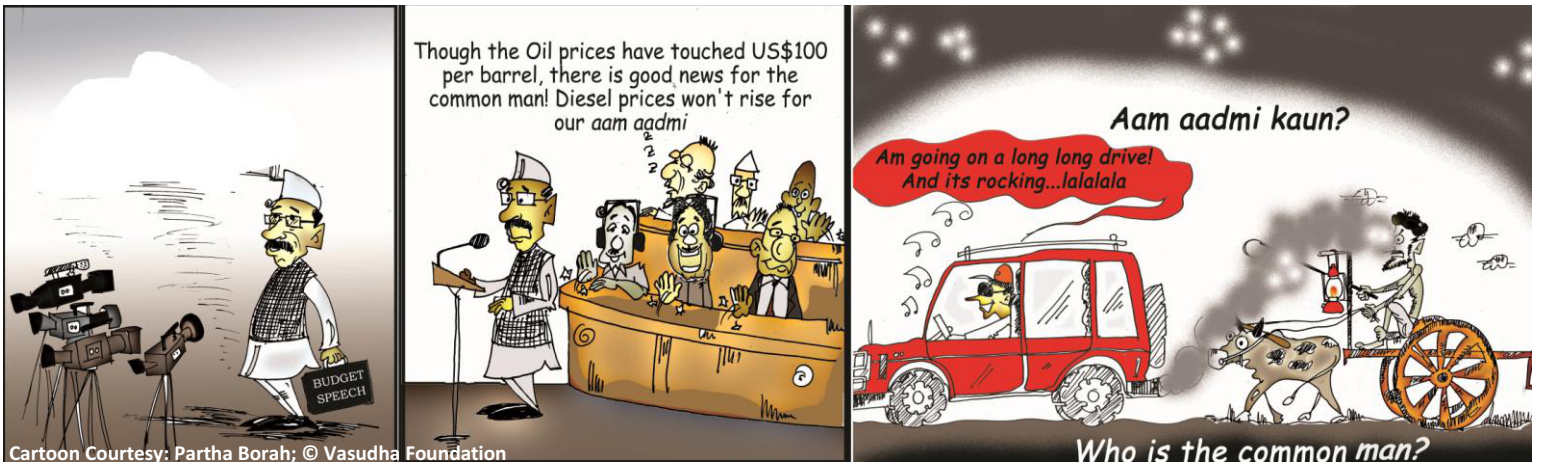
As can be seen from the above graph, Kerosene and LPG get the bulk of the direct subisides, while coal fired power generation also gets subsidies, though not direct subsidies. Off-Grid Renewable Energy applications also receive direct subsidies and so does grid connected renewable energy (i.e. if feed-in-tariff is considered as a direct subsidy).

The total subsidy for fossil fuel works to 82%, while for renewable energy applications, it is only 18%. However, the distortions in India's fuel pricing system are quite evident as LPG, kerosene and diesel consumers are subsidized, but with the bulk of subsidies going towards the benefit of the Urban Middle Class.

According to Dr. Kirit Parikh, removing distortions is important for energy efficiency and choice of fuels; however, it may not necessarily lead to lower consumption of fossil fuels[29]. Due to the large difference in the prices of diesel and kerosene, the subsidized kerosene is used for adulterating diesel. If kerosene is not subsidized by the government it would prevent the adulteration of diesel while also leading to excessive diesel consumption.

As mentioned in the 'Expert Group Report on Viable and Sustainable System of Pricing of Petroleum (2010)', subsidizing domestic consumers also did not incentivize them to economize on use of petroleum products. Rather, as prices remained low, and personal incomes rose, the demand for petroleum products such as petrol and diesel recorded double digit growth – higher than the GDP growth. Continuation of the present policies is not viable, particularly once oil prices rise again. The committee sought a long term pricing strategy which would not only limit the fiscal burden on the government but also keep the domestic oil industry financially competitive.

[29] *How much does India subsidize fossil-fuels?* By Kirit S. Parikh, September 2010, http://www.indiapolicyforum.org/node/28



Cartoon Courtesy: Partha Borah; © Vasudha Foundation

Chapter III: The Cost Economics

How much does a Rural Consumer actually pay for electricity?

Another prominent feature of India's electricity sector is the disparity between urban and rural consumers in terms of consumption, access, and reliability of supply. Major cities in the country have access to 24 hour power supply, with notified power outages. On the other hand, in rural areas and small towns the power supply is fairly erratic and this has an effect on the level of consumption and access.

Despite the fact that rural India has a much higher geographical area and is home to more than 70% of India's population, the electricity consumption of urban population is approximately 17 Billion kWh, more than the consumption of the rural population[30].

To improve the energy needs of the poor and to make a case for decentralized renewable energy systems, while grid extension continues, it is important that the economics and pricing of conventional power generation is looked into closely. The key to comprehend all of this lies in our understanding of the term 'economics' not in the conventional sense but in the context of energy access.

While looking at the economics of power generation we factor in not just the fuel costs and capital equipment but also tariffs, generation, transmission, and distribution costs for both centralized fossil fuel and decentralized renewable energy systems. While looking upon systems as diverse as these it is obvious that they will have different tradeoffs. But the key factor is how effectively and how efficiently do they end up providing electricity to the end consumers. The consumers are only concerned with the price paid directly for each kilowatt-hour and not the costs linked with generation. On the other hand the producers of electricity are concerned about the costs of generation and supply, and these may differ completely from the end consumers.

While studies have been done on the transmission costs and factoring these into the final costs of distribution, there haven't been any thorough studies on the total generation costs taking into account subsidies and other benefits.

The methodology employed in this report to develop an understanding of the aforesaid economics is based on desk research and filing of RTI applications with several ministries. A total of six states were identified, three states having progressive rural electrification programmes and three having relatively poor electrification.

The identified states were Karnataka, Kerala, Haryana (states having progressive rural electrification programmes), Orissa, Bihar, and Jharkhand (states lagging in rural electrification). We looked upon the capital costs involved in establishing coal, oil, and gas fired power plants; as well as solar photo-voltaic, bio-gas, and wind-based plants. We also studied both direct and indirect subsidies given to conventional fuels, fossil fuel based power plants and renewable energy systems.

Transmission, distribution, and operating costs for centralized grid systems were received from the respective electric utilities through filing of RTI applications. Since the utilities in Orissa are privately-owned (Reliance Power) they do not fall under the purview of the Indian Right to Information Act and hence, information could not be procured from them. Costs of fuel and subsidies were also determined by filing RTI applications with Coal India Limited and the nationalized petroleum companies.

A look at the tariff structure for electricity in various states reveals that there exists a stratified tariff structure containing both metered and non-metered consumers within the domestic and agriculture supply category. The disparity between the metered and the non-metered consumers is wide enough, where the non-metered consumers pay less for consuming more power than the metered consumers. For example in Haryana, the charges in the agricultural supply category for Metered Supply (Agricultural tube

[30] 'Shifting of Goal Posts', A Report by Vasudha Foundation (2010)

well pump sets) are 25 paise per unit along with a monthly minimum charge of Rs. 200 per BHP. Whereas, for non-metered consumers within the same category, the charges are a flat Rs. 35 per BHP per month! Therefore, people opt for non-metered pump sets, which contribute heavily to energy losses for the distribution company.

The table[31] below lists the approximate base tariffs for metered domestic consumers (in urban areas) in several states:

Table 4: State-wise list of approximate base tariffs for urban domestic consumers (metered)
(Source: Tariff data from Electricity Regulatory Commissions in the states)

States				Base Tariff Slab (Rupees/kWh)						
	Per Unit	0-25 units	0-30 units	0-40 units	0-50 units	0-60 units	0-100 units	0-120 units	0-150 units	0-200 units
Arunachal Pradesh	3.45									
West Bengal		2.27								
Karnataka			2.10							
Jammu & Kashmir			1.00							
Kerala				1.55						
Haryana				2.63						
Sikkim					0.60					
Bihar					1.35					
Mizoram					1.45					
Andhra Pradesh					1.45					
Rajasthan					1.95					
Gujarat					2.80					
Madhya Pradesh					3.15					
Goa						1.00				
Orissa							1.40			
Chhattisgarh							1.80			
Uttarakhand							2.20			
Meghalaya							2.35			
Manipur							2.60			
Maharashtra							2.75			
Punjab							3.11			
Assam								3.00		
Himachal Pradesh									1.00	
Jharkhand										1.50
Uttar Pradesh										3.45
Delhi										2.45

The above tariffs are only indicative and do not display installation charges, fixed charges, the monthly minimum charges, and the sanctioned loads for the base tariff slabs; as these tariffs differ from state to

[31] Tariff data from Electricity Regulatory Commissions in the states, data for Nagaland and Tripura could not be found hence they have not been included here. The costs do not include installation and other miscellaneous charges.

state. A quick glance at these tariffs shows that states with poor rates of electrification (Bihar and Orissa) have tariffs similar to Jharkhand, which has the lowest tariff in terms of per unit consumption.

Whereas the states of Haryana, Kerala, and Karnataka; having the highest levels of electrification in the country also have the highest tariffs in terms of per unit consumption. This implies that people would be willing to pay for electricity if quality supply is guaranteed to them. Therefore, assuming monthly minimum consumption of 30 units and doing some basic calculations (adding fixed and monthly minimum charges) we discover that the electricity bills in Bihar and Jharkhand would be less than half of what they would be if the same amount was consumed in the states of Haryana, Karnataka, and Kerala.

Tariffs like these indicate large cross-subsidies, as certain consumers end up paying much more than the cost of supply. Subsidized tariffs lead to an incessantly high demand for power, which in turn places a large burden on the system's supply capacity. In Haryana, the running hours for metered and non-metered tube wells have been set at 4.8 hours/day by the Haryana Electricity Regulatory Commission. In addition, the non-metered consumers being billed on a flat rate basis are also inconsiderate about the efficiency of pump sets. This results in over-irrigation and over-drawing of power, thereby placing a greater burden on the grid.

Agricultural consumption which accounts for roughly 10% of the total power consumption is generally not metered. This has provided a cover for others to pilfer electricity, and this pilferage may account for up to 15% of the power consumption. If these consumers are charged full price then their consumption would decrease. Nevertheless, metering is resisted by the politically powerful farmers who fear that it would lead to higher prices.

There is an even greater incongruity among the states when it comes to tariffs targeting various classes of customers. For example, in Bihar- *Kutir Jyoti* connections, domestic consumers, non-domestic consumers, and privately owned agricultural pump sets in rural areas, are not metered. While in Orissa, *Kutir Jyoti* consumers (irrespective of rural/urban) pay Rs. 30 as a fixed monthly charge for keeping consumption under 30 Units/month. The Jharkhand State Electricity Board despite the tariff being set at Rs. 30 per month, has been arbitrarily overcharging *Kutir Jyoti* consumers (un-metered)[32].

The table below lists the approximate base tariffs for metered and unmetered domestic consumers (in rural areas) in several states:-

Table 5: State-wise list of approximate base tariffs for Rural consumers (metered and un-metered consumers) (Source: Tariff data from Electricity Regulatory Commissions in the states)

State	Base tariff for Rural Consumers (Rs./kWh)
Arunachal Pradesh*	Rs. 2.30/kWh
West Bengal	Rs. 2/ kWh
Karnataka*	Rs. 2/kWh (0-30 units)
Jammu & Kashmir	Metered Rs. 1/kWh (0-30 units), unmetered Rs. 65/- for ¼ KW
Kerala*	1.55/kWh (0-40 units)
Haryana*	Rs. 2.63/kWh (0-40 units)
Sikkim*	Rs. 0.60/kWh (0-50 units)

[32] http://jserc.org/pdf/orders/case_no_28_2010.pdf

Bihar	Unmetered Rs. 35/month, metered consumer Rs. 1.2/kWh
Mizoram	Metered Rs. 1/kWh (0-30 units), unmetered Rs. 20/month
Andhra Pradesh*	Rs. 1.45 (0-50 units)
Rajasthan	Rs. 1.95/kWh (0-50 units)
Gujarat	Rs. 1.50/kWh (0-30 units)
Madhya Pradesh	Metered Rs. 3.15/kWh (0-50 units), Unmetered Rs. 3/kWh (0-30 units)
Goa*	Rs. 1/kWh (0-60 units)
Orissa	Unmetered Rs. 30 for 1 KW, metered consumers Rs. 1.40 (0-100 units)
Chhattisgarh*	Rs. 1.80/kWh (0-100 units)
Uttarakhand	Metered Rs. 1.50/ kWh, unmetered Rs. 120/connection for hilly areas and Rs. 250/connection for other areas
Meghalaya	Metered Rs. 1.70/kWh, unmetered Rs. 60/connection/month
Manipur*	Rs. 2.60/kWh (0-100 units)
Maharashtra*	Rs. 2.75/kWh (0-100 units)
Punjab*	Rs. 3.11/kWh
Assam	Rs. 2.35/kWh (Jeevan Dhara category of consumers allotted 1kWh/day)
Himachal Pradesh	Rs. 0.70/kWh (0-50 units)
Jharkhand	Metered Rs. 1.10/unit, Unmetered Rs. 72/connection/month
Uttar Pradesh	Unmetered Rs. 125/connection/month, metered Rs.1/kWh
Delhi	Unmetered Rs. 175/month, metered Rs. 2.45/kWh (0-200 units)

**** These states do not have separate tariffs for rural consumers (both metered and unmetered)***

Since the time taken to install a metered connection is quite long, most rural consumers prefer to take a non-metered connection. Assessing a non-metered connection along with the quality and duration of supply would suggest that the flat tariff being paid is not proportionate with the electricity supply.

In most rural areas the situation is such that electricity is supplied for approximately 6-8 hours per day; in such circumstances it is safe to say that the average tariff comes out as higher than what an urban consumer would be paying for the same duration of supply. The only respite for a rural consumer would be the metered connection, which due to its lower tariff would be cheaper than an urban metered connection.

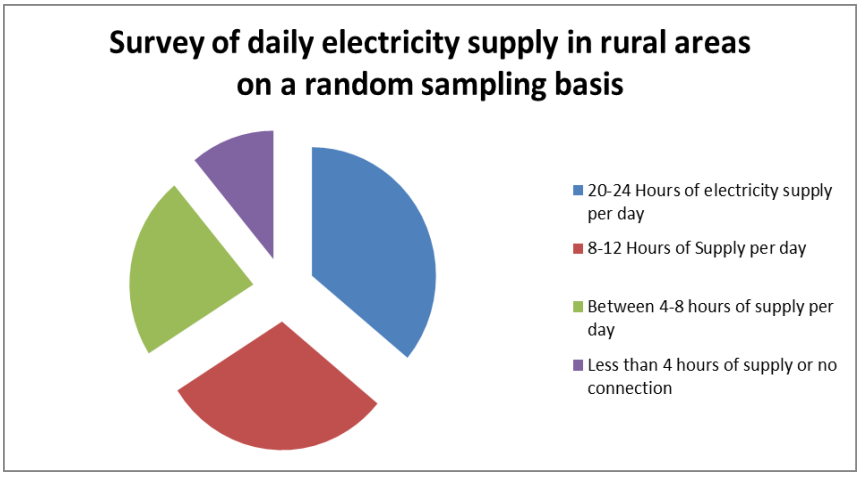
The survey on the ' ability and willingness to pay for energy services' also surveyed on the quality of electricity supply in rural areas. The survey covered a total of 240 villages covering 16 districts of 8 states of India. The states covered in the survey are Haryana, Uttarakhand, Jharkhand, Orissa, Karnataka, Kerala, Maharashtra and Gujarat.

The extent of electrified villages in the above states and the extent of village electrification in each of the survey districts are as follows:

Table 6: Survey details on quality of supply of electricity
(Source: Compiled from Synovate survey findings)

State	Status of Village Electrification	District 1 Surveyed	Status of district village electrification	District 2 Surveyed	Status of district village electrification
Haryana	100%	Kurukshetra	100%	Rewadi	100%
Uttarakhand	97%	Pauri	94%	Almora	99%
Jharkhand	61%	Gumla	45%	Devgarh	55%
Odisha	76%	Anugul	70%	Khorda	60%
Karnataka	100%	Dharwad	100%	Uttara Kannada	100%
Kerala	100%	Kannur	100%	Idukki	100%
Maharashtra	98%	Nasik	100%	Sangli	99%
Gujarat	100%	Panchamahal	100%	Junagad	100%

Figure 7: Daily Electricity Supply data
(Source: Compiled from Synovate survey findings)



A total of 30 villages in each of the districts were surveyed, covering a total of 1920 households.

Of the 1920 households surveyed, 1881 households had electricity connection, with only 108 households not being connected to the grid supply.

36% of the total surveyed households received electricity supply for 20 to 24 hours, while

30% of the households get less than 12 hours of electricity supply, 23% of the households were getting less than 8 hours of supply and the balance of 11% had either no electricity supply or were getting just less than 4 hours of supply every day.

The villages which had 20 to 24 hours of supply were located in the state of Kerala, Gujarat and Haryana, while those getting less than 12 hours of supply were located in the state of Maharashtra, Uttarakhand and Karnataka. Villages which were getting less than 8 hours of supply or no supply were found located in the state of Odisha and Jharkhand.

Table 7: Overview of the electricity consumption pattern in villages surveyed
(Source: Compiled from Synovate survey findings)

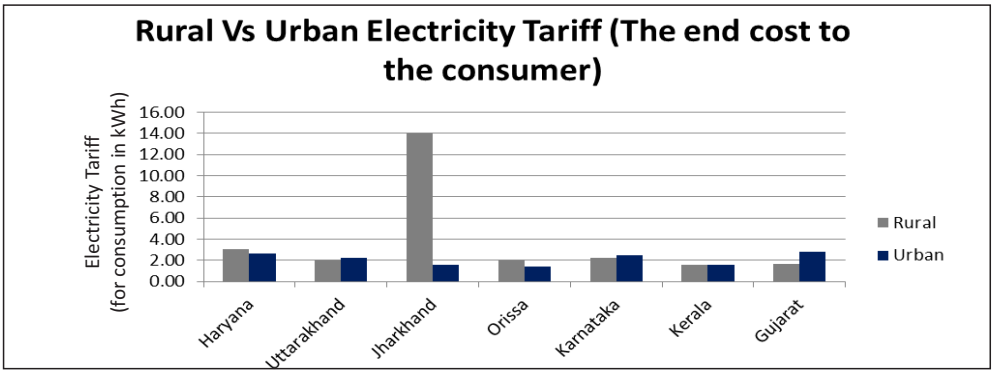
State	Status of Village Electrification	District 1 Surveyed	Electricity consumption pattern	District 2 Surveyed	Electricity consumption pattern
Haryana	100%	Kurukshetra	1 kWh per day = 30 kWh per month	Rewadi	1.5 kWh per day = 45 kWh per month
Uttarakhand	97%	Pauri	1 kWh per day = 30 kWh per month	Almora	2 kWh per day = 60 kWh per month
Jharkhand	61%	Gumla	1 kWh for a week = 5 kWh per month	Devgarh	1 kWh for a week = 5 kWh per month
Odisha	76%	Anugul	3 kWh per week = 15 kWh per month	Khorda	3 kWh per week = 15 kWh per month
Karnataka	100%	Dharwad	2 kWh per day = 60 kWh per month	Uttara Kannada	2.5 kWh per day = 75 kWh per month
Kerala	100%	Kannur	3 kWh per day = 90 kWh per month	Idukki	3 kWh per day = 90 kWh per month
Maharashtra	98%	Nasik	No data	Sangli	No data
Gujarat	100%	Panchamahal	3 kWh per day = 90 kWh per month	Junagad	3 kWh per day = 90 kWh per month

Based on the survey and the actual tariff, we also compared the exact cost paid by the rural consumers in comparison to the urban consumers. The next table gives us an overview of the cost of electricity for rural consumers in the surveyed villages.

Table 8: Electricity Tariff Comparison in surveyed areas between Urban and Rural Electricity Consumers (Source: Synovate Survey)

State	District	Electricity consumption pattern	Rural Electricity Tariff	Average cost per kWh for the rural consumer	Comparative Consumption at that cost by Urban Consumers (for 30 kWh)
Haryana	Kurukshetra	30 kWh per month	Rs. 2.63 kWh up to 40 kWh	Rs. 3.10	Rs. 2.63
	Rewadi	45 kWh Per Month	Rs. 2.63 kWh up to 40 kWh	Rs. 3.10	Rs. 2.63
Uttarakhand	Pauri	30 kWh per month	Rs. 120 per month	Rs. 2.00	Rs. 2.20
	Almora	60 kWh per month	Rs. 120/- per month	Rs. 2.00	Rs. 2.20
Jharkhand	Gumla	5 kWh per month	Rs. 72/- per month flat rate	Rs. 14.00	Rs. 1.60
	Devgarh	5 kWh per month	Rs. 72/- per month flat rate	Rs. 14.00	Rs. 1.60
Odisha	Anugul	15 kWh per month	Rs. 30/- per month	Rs. 2.00	Rs, 1.40
	Khorda	15 kWh per month	Rs. 30/- per month	Rs.2.00	Rs. 1.40
Karnataka	Dharwad	60 kWh per month	Rs. 2/- per kWh up to 30 kWh per month and Rs. 2.50 from 30 to 60 kWh	Rs. 2.25	Rs. 2.50
	Uttara Kannada	75 kWh per month	Rs. 2/- per kWh up to 30 kWh per month and Rs. 2.50 from 30 to 60 kWh and Rs. 30 from 60 and above	Rs. 2.25	Rs. 2.50
Kerala	Kannur	90 kWh per month	Rs. 1.55 per kW up to 40 kW and Rs. 2/- from 40 to 100 kWh	Rs. 1.55	Rs. 1.55
	Idukki	90 kWh per month	Rs. 1.55 per kWh up to 40 kWh and Rs. 2/- from 40 to 100 kWh	Rs. 1.55	Rs. 1.55
Gujarat	Panchamahal	90 kWh per month	Rs. 1.50 per kWh up to 30 kWh and Rs. 2/- from 30-100 kWh	Rs. 1.66	Rs. 2.80
	Junagad	90 kWh per month	Rs. 1.50 per kWh up to 30 kWh and Rs. 2/- from 30 to 100 kWh	Rs.1.66	Rs. 2.80

Figure 8: Rural Vs Urban tariff
(Source: Synovate Survey findings)



With the exception of rural consumers in the states of Gujarat, Uttarakhand and Karnataka, the cost of electricity paid by the rural consumers in other states was found to be typically more than what the urban consumer pays. In the case of Uttarakhand and Karnataka, the cost which the rural consumer pays is marginally less than what the urban consumer pays, while it is substantially less in the case of the rural consumer of Gujarat. On the other hand, in some states, particularly, Jharkhand, the rural consumer typically pays 8 times more than what the urban consumers pays, while in the state of Odisha, despite the fact that on paper the rural consumer tariff is really low at just Rs. 30 per month, the actual cost of service per kWh to the rural consumer works to Rs. 2 per kWh as against the tariff of Rs. 1.40 per kWh that an urban consumer pays.

Table 9 below gives an comparison of the approximate total cost to both the rural as well as the urban consumer for a consumption of 30 kWh of electricity per month. From an analysis of the figures in Table 9, it is very clear, that In almost all the states, despite the fact that the tariffs for rural consumers are highly subsidized on paper, the end cost of service for the rural consumer is similar in most states to what the urban consumer pays.

Table 9: Comparison of approximate tariffs paid by rural and urban consumers for 30 units consumed
(Source: Computed based on Electricity Regulatory Commission tariff data and survey details)

States	Urban (in Rs.)	Rural (in Rs.)
Arunachal Pradesh	103.5	103.5
West Bengal	70	60
Karnataka	63	60
Jammu & Kashmir	30	30 (Metered), 65 (unmetered)
Kerala	46.5	46.5
Haryana	78.9	78.9
Sikkim	18	18
Bihar	40.5	36(metered), 35/month (unmetered)
Mizoram	43.5	30 (metered), 20/month (unmetered)
Andhra Pradesh	43.5	43.5

Rajasthan	58.5	58.5
Gujarat	84	45
Madhya Pradesh	94.5	94.5 (metered), 90 (unmetered)
Goa	30	30
Orissa	42	42 (metered), 30 (unmetered for 1 KW)
Chhattisgarh	54	54
Uttarakhand	66	45 (metered), unmetered Rs. 120/connection for hilly areas and Rs. 250/connection for other areas
Meghalaya	70.5	51 (metered), 60/month (unmetered)
Maharashtra	82.5	82.5
Punjab	93.3	93.3
Assam	90	70.5
Himachal Pradesh	30	21
Jharkhand	45	33 (metered), 72/month (unmetered)
Uttar Pradesh	103.5	30 (metered), 125/month (unmetered)
Delhi	73.5	73.5 (metered), 175/month (unmetered)
Manipur	78	78

Chapter IV. Conclusion and Summary

1. Indian economy has been growing at a fairly rapid pace, particularly in the last decade. However, the electricity sector has not kept pace with the rapid growth of the economy.

2. India continues to be a power deficit country with an overall deficit of close to 86,000 Million kWh and with a peak demand shortage of 13,000 Million kWh. Power outages range from 2-20 hours on a daily basis, with rural areas getting the least supply with power cuts in there ranging from 14-16 hours on a daily basis.

3. Coal continues to be the mainstay of India's electricity generation and the share of coal and other fossil fuel in the energy mix is about as high as 70%.

4. There continues to be a big gap between urban and rural electricity and energy infrastructure with centralized grid supply being the main source of electricity supply to both urban and rural areas.

5. In addition to there being a huge gap in development between urban and rural areas, there is also a lack of uniform development of states. While some states have had a high level of development, other states have shown a very poor rate of growth and this has had its impact on energy and electricity sectors too.

6. India's per-capita electricity consumption is less than one-fifth of the world average of 2,596 kWh. Only one-sixth of Indian households with electricity consume over 100 kWh per month, compared to the average US household consumption of over 900 kWh per month.

7. Traditional bio-mass is still the main source of energy supply in rural areas with Kerosene also being used as the main source of lighting in rural areas, in addition to being used as a cooking fuel.

8. The price for electricity services paid by the rural consumer is more or less the same as what the urban consumer pays. If the cost incurred on Kerosene too is factored in, the rural consumer pays double the cost incurred for lighting, as compared to what a urban consumer would pay for the same amount of lighting.

9. A brief analysis of the villages electrified through grid and non-grid systems and comparative analysis of the amounts actually spent by the respective ministries reveals that the costs for both are more or less the same. This is authentication to the fact that the contention that 'grid power is cheaper' is actually a myth.

10. There is a huge subsidy outlay for some of the energy fuels, aimed primarily at ensuring energy access to the poor. But, bulk of these subsidies is actually benefitting the Urban Middle Class, while a very small and negligible percentage of the subsidy is actually addressing the issue of 'energy access' for the poor.

11. There are subsidies provided for 'Electricity' to ensure that consumers are not charged heavily and similarly, subsidies are also provided for Kerosene. Since the quality of electricity supply is poor, Kerosene is still the dominant fuel for lighting purposes in rural areas. So, this is a classic case of dual subsidies, with benefits of the subsidies not really reaching the targeted masses. There is therefore, the need to rationalize subsidies and also rationalize the prices of fuel for energy.

14. There has been considerable investments made towards improving electricity generation with a further 70,000 MW of generation capacity addition planned during the period 2012-2017. Close to 193,000 MW of coal fired power plants have been granted 'environment clearance' and are in the pipeline of being set up. But, what needs to be looked at is that even in the past, mere adding of conventional power plants has not really addressed the issue of 'energy access'. There is a need to adopt a more coordinated approach with the various Ministries and Departments working together, to ensure that 'access to energy' is accorded the priority it deserves.

SECTION 2 - Ability and Willingness to pay for energy services

Cartoon Courtesy: Partha Borah; © Vasudha Foundation

Findings of a National Survey

On

Assessment of People's Sentiments on Paying for Energy Services

Introduction: Background and Methodology of the Survey

Synovate Ltd. was commissioned to conduct a survey on "Ability and Willingness to Pay for Energy Services in Rural India". This field survey was carried out to primarily assess and generate information about people's willingness to pay for electricity. The household questionnaire (attached in Annexure 2) is the sole basis of collecting responses from the rural households. It is an extremely detailed questionnaire comprising of almost 100 questions pertaining to the various relevant chapters of this report.

The survey findings presented in this report aims to serve as an advocacy brief, to counter the possible myth by Government and Decision Makers, that people only want free electricity. The underlying hypothesis being that, if people are provided with the optimum quality and quantity of energy services, then they would be willing to pay for these services instead of craving for free electricity.

Research Objectives

The survey was carried out among rural households to obtain the following information:

- To assess the perceived need for energy services
- To find out the level of accessibility and the perception of quality of the existing energy services
- To understand the level of satisfaction with the available services
- To determine the ability to pay for different energy services
- To assess the willingness of the people to pay for different energy services and to identify determinants for such willingness to pay

Methodology

Geographical Coverage and Sample Size

Two stage stratified sampling was used. The following formula was used to arrive at the sample size. This sample size provides estimates that can be read within a range of +/-10 % at 95% level of confidence.

$$N = \frac{Z^2 \times P \times (1-P) \times D \times 1.1}{E^2}$$

Where:

N - Sample Size

Z - Z score for 95% confidence level = 1.96

P - Anticipated proportion which is a conservative estimate) = 0.50 (In absence of baseline this can be considered as 0.50

D - Design Effect = 2 (For Cluster Sampling)

E - Precision =10%

By substituting for the values of the different variables, the sample size (N) came out to be 211. To ensure adequate representation in each cluster, the sample size for each state was rounded off to 240. This sample size of 240 was distributed across 30 villages selected in two districts. Further, the 30 villages were selected using PPES (probability proportionate to estimated size) method.

Sample size distribution across zone, states, and village level is summarized below.

Table 10: Distribution of Sample Proposed

Zone	States	No of districts	Number of villages	Sample Size per state
North	Haryana	2	30	240
	Uttarakhand	2	30	240
South	Kerala	2	30	240
	Karnataka	2	30	240
East	Jharkhand	2	30	240
	Orissa	2	30	240
West	Maharashtra	2	30	240
	Gujarat	2	30	240
	Total	16	240	1920

A multi stage cluster sampling methodology was followed, which is as explained below:

Selection of district - In each state, two districts were randomly selected in consultation with Vasudha Foundation. In absence of any comprehensive data on the percentage of electrification at district and then village level, this selection was done randomly.

Selection of villages - In the two selected districts, 30 villages were selected using the PPES method. First of all, all villages in the district were listed as per their order in the census list. Then the sampling interval was calculated, and the first village was selected using a random number. Subsequent villages were selected using the sampling interval.

Selection of households - In each selected village, the team drew a lay out map and met the village *sarpanch* (village head) and other senior members to understand the village constitution. Based on the constitution, the village was divided into four segments and from each segment two households were selected.

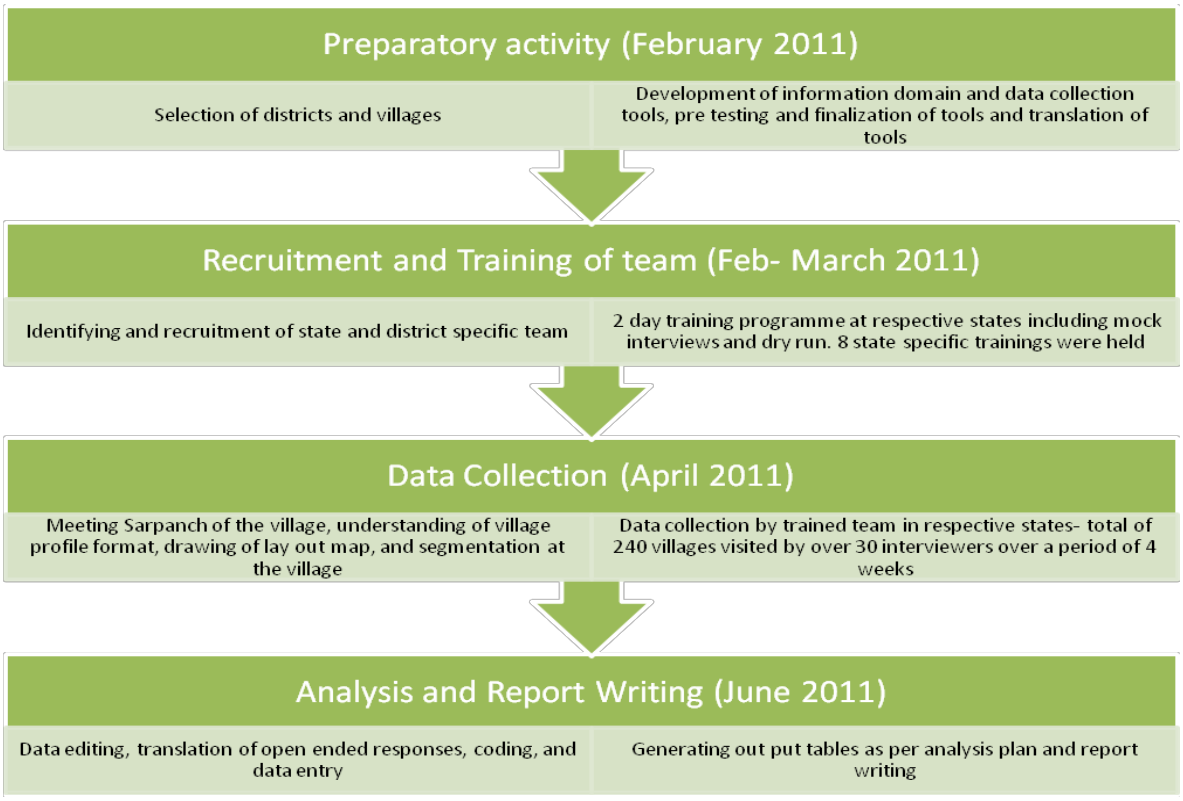
For selection of these two households, the interviewer went to the centre of the segment and used a pencil tied to a thread and spun the pencil to determine the direction of starting point. From the starting point, the interviewer went to the nearest household for selection of households meeting the eligibility criteria (land ownership).

Table 11: Sample distribution across land ownership

Village	Rural Households				Total
	No agricultural land	Irrigated /non irrigated land less than 1 acre	Irrigated /non irrigated land 1-5 acre	Irrigated land 6+ acres	
Number of households per village	1	3	3	1	8
Number of households per state	30	90	90	30	240

Study process

The study was carried out across 8 states, 16 districts, and 240 villages over a period of 3 months. The flow chart below summarizes the study process.



Scope and Limitations

This study extensively presents the findings of community's perceptions, and their feedback on existing services. However, due to time and field constraints, triangulation or validation of data collected with regards to electrification status of the villages, i.e. when it was electrified, provider of service etc. could not be collected.

Another limitation observed by the study team was absence of comprehensive collated data on rural electrification in the country. Owing to this, the villages were selected through a systematic random selection method called PPES. Further, availability of electricity could also not be used as a variable for selection of the villages.

Organization of the field survey report

The report is organized into the following five chapters which are in line with information areas and enquiry during the survey.

1. Profile of the households
2. Current Electricity Access and Consumption patterns
3. Households not having electricity connection
4. Willingness to have an electricity connection
5. Conclusion

Chapter I. Profile of the Households

This chapter presents the brief socio economic profile of the households surveyed.

Sample distribution of households surveyed

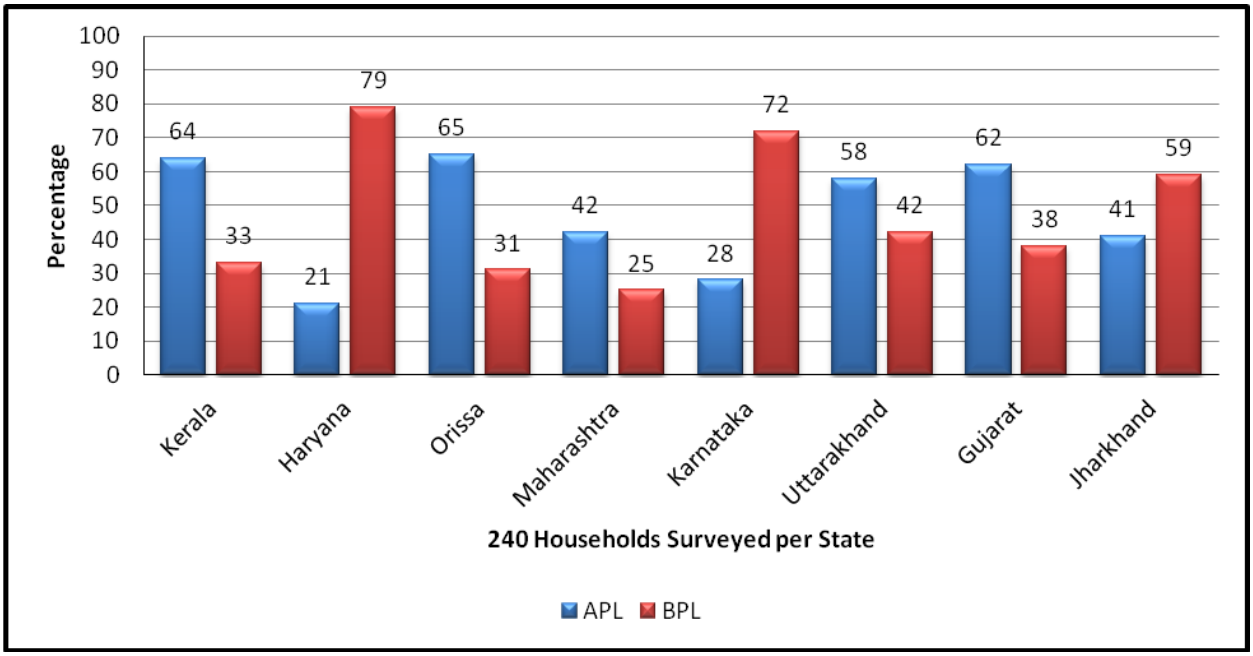
The survey was carried out in 8 states, and it covered 240 villages comprising 1920 households.

Category of households

One of the most important variables to assess the economic status of the household is the card ownership that classifies them into Above the Poverty Line (APL) or Below the Poverty Line (BPL) gradation depending upon their socio economic status. An equal number of households representing APL and BPL constituted the surveyed households. Of the 1920 households surveyed, an equal proportion (47%) belonged to APL and BPL category of households. 2 per cent of the household had other cards, while the remaining 4 per cent households did not disclose their card ownership.

The State wise distribution of households (as shown in the corresponding graph) indicates that majority of households in Haryana (79%), Karnataka (72%) and Jharkhand (59%) represented the BPL category.

Figure 9: State-wise distribution of APL and BPL households*



(Note*: all numbers don't add up to 100%, since some households refused to divulge which category they come under, while a few households also had other cards)

Type of house

As per the survey, majority (97%) of the households in the villages were self owned, while the remaining 3 per cent were rented premises. A fraction over one third stayed in *kuccha* houses, where as majority had cemented *pucca* house.

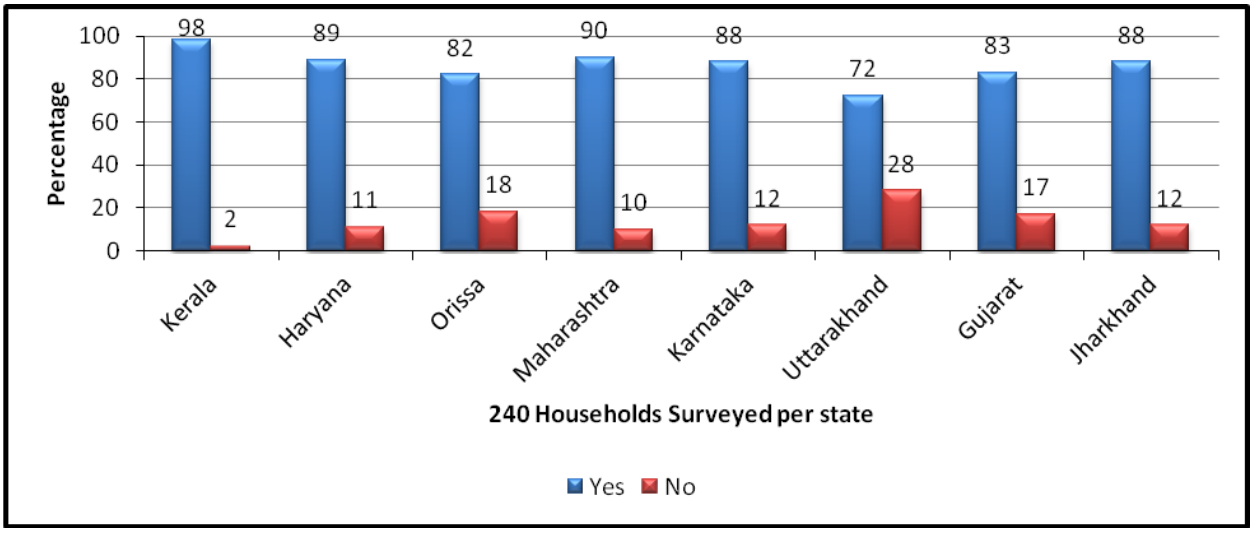
As expected households with land more than 5 acres owned maximum percentage of cemented house in comparison to *kuccha* house. Importantly of the households that were not electrified, three fourth were *kuccha* houses.

Land ownership

Land ownership is one of the primary indicators of economic status of the households. In rural households in India, agriculture is still the predominant source of livelihood, and therefore during the survey, enquiry was made about land ownership.

Among the surveyed households, majority (89 %) reported ownership of land. The remaining households had no land of their own. The state wise land ownership comparison graph below indicates that relative land ownership was least in the state of Uttarakhand, followed by Orissa. Kerala had the majority of households owning land of their own.

Figure 10: State-wise land ownership of the surveyed households

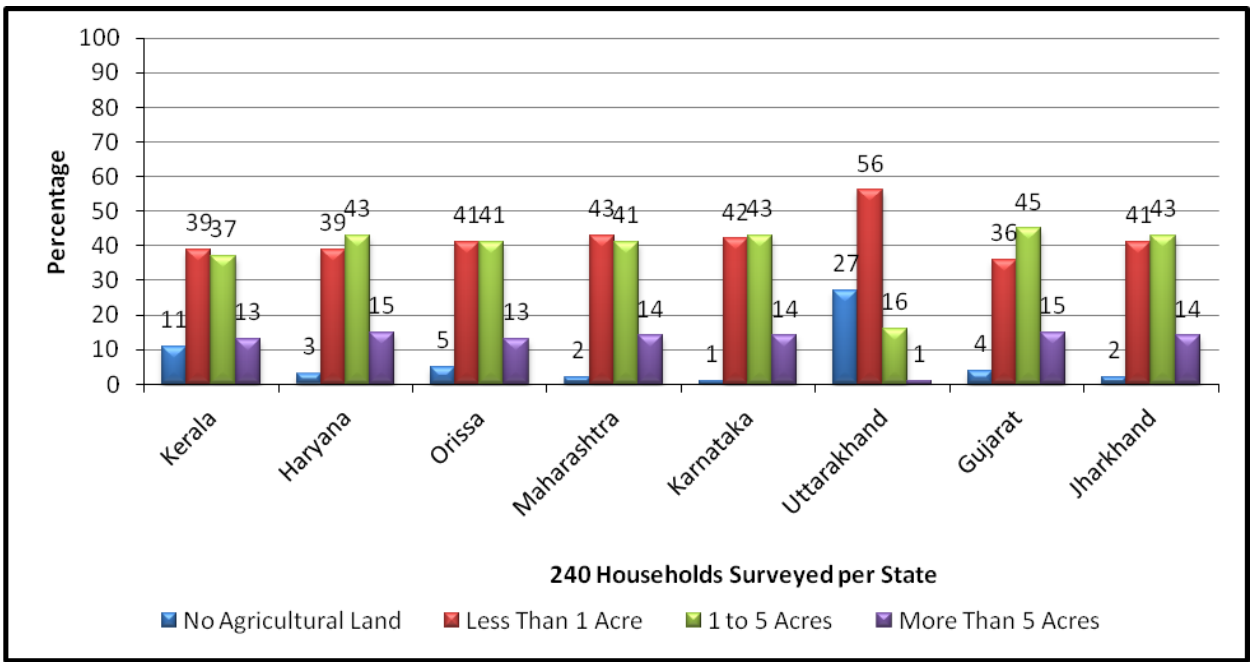


Following are some of the pertinent statistics for the households who owned land (as depicted in graph showing ownership of agricultural land among surveyed households):

- 6 per cent of the households did not own agricultural land. 13 per cent owned more than 5 acres of land, and the rest 81 per cent owned less than 5 acres of land.

- 42 per cent of the households had ownership of less than an acre of land.

Figure 11: Ownership of agricultural land among surveyed households



Irrigated Land

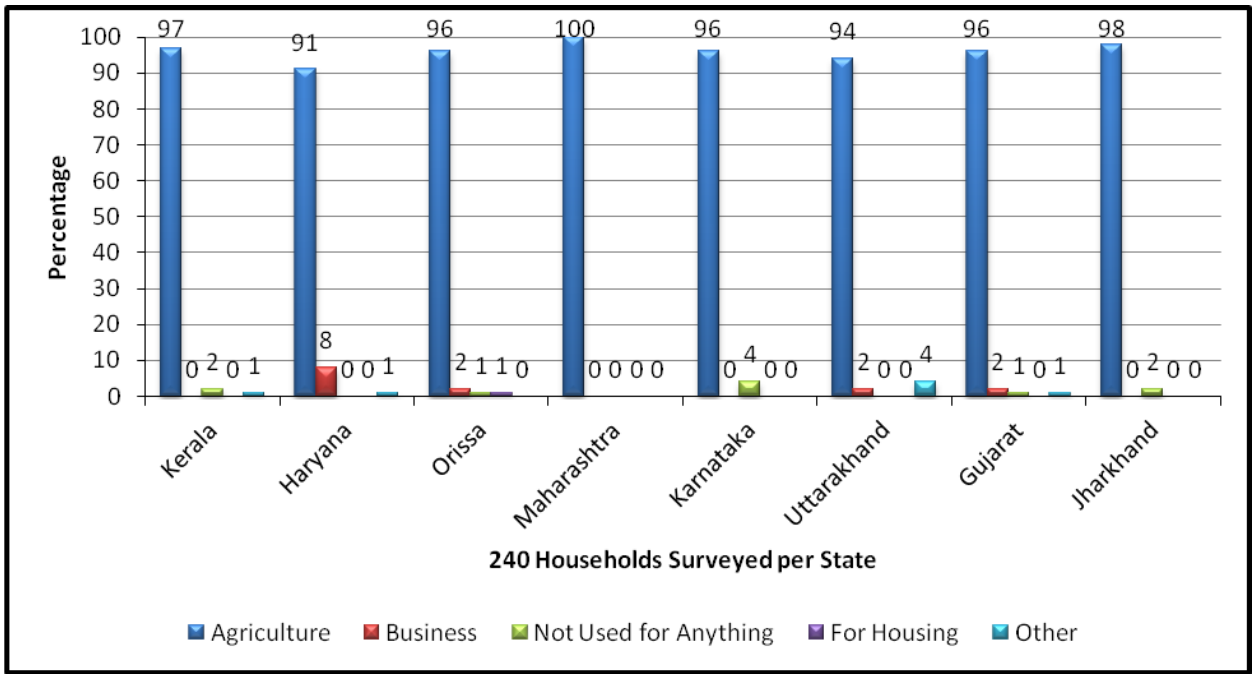
- It was found that more than half (56%) had irrigated land (fully or partly irrigated), and the remaining 44% households possessed non-irrigated land.
- Further, it was observed that people with larger land ownership had more irrigated land (for more than 5 acres of land 58% land was irrigated, where as only 10% land is non-irrigated).
- For those households that owned less than 1 acres of land, the percentage of irrigated and non irrigated land was approximately similar (44% irrigated and 42% non-irrigated).

Use of land

Land in the villages is predominantly used for agriculture and residential purposes. The graph below shows how the rural households are dependent on their land for their livelihood.

Majority of the households used their land for agriculture. Only in Haryana, a small percentage of the households utilized their land for business purposes. It was also observed that the majority of land that was not used for anything comprised of extremely small patches i.e. less than 1 acre of land.

Figure 12: Purpose of using the land



Irrigation and source of energy for irrigation

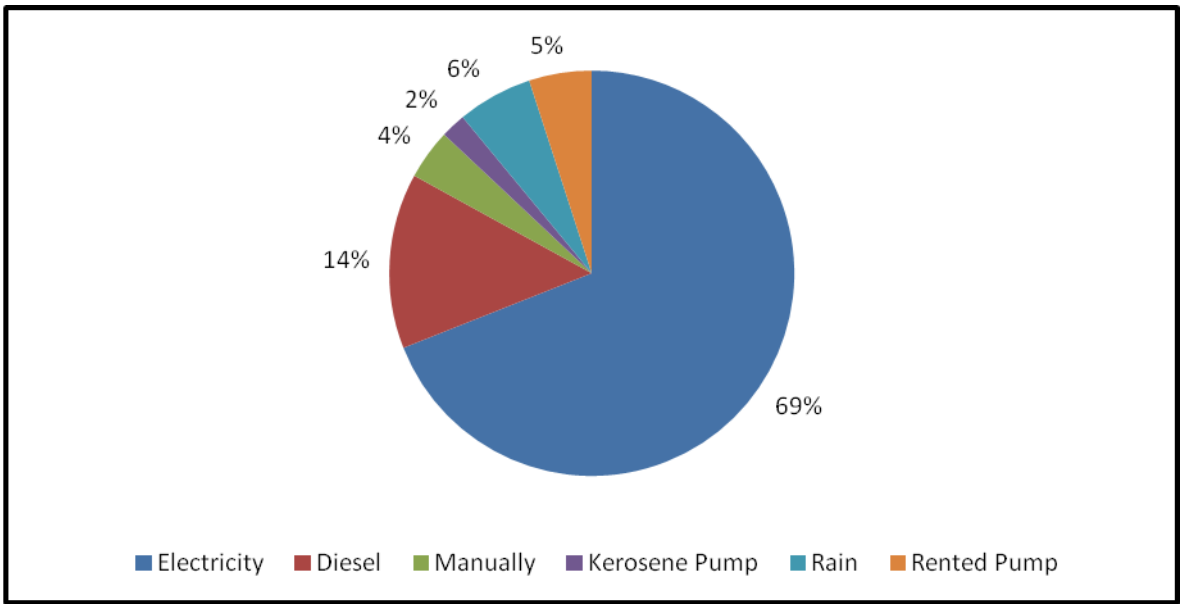
For the rural households, wells (43%) and tube wells (30%) were identified as the two major sources of irrigation. Dependency on rain, rivers, stream water, canal, and private irrigation methods comprised the other sources of irrigation.

The difference in sources of irrigation was quite evident between electrified and non electrified villages. In electrified villages, 32% households depended on tube well for irrigation, but only 7% used tube wells in non electrified villages. Similar difference was also observed between households that were electrified and un-electrified.

Households were also enquired about the energy sources that they used for irrigation, and electricity and diesel were found to be the predominant sources. Electricity and diesel usage was found out to be 69% and 14% respectively.

Some important and obvious differences in irrigation energy sources were observed for electrified and un-electrified villages and households. Manual methods of irrigation were primarily adopted by 44% of un-electrified villages and 34% of un-electrified households. On the contrary, access to electricity led to electricity and diesel being used as the primary sources of energy for irrigation in electrified villages and households (76%). Also, rented pumps were identified as an important source of irrigation for non electrified villages and households.

Figure 13: Energy sources used for irrigation

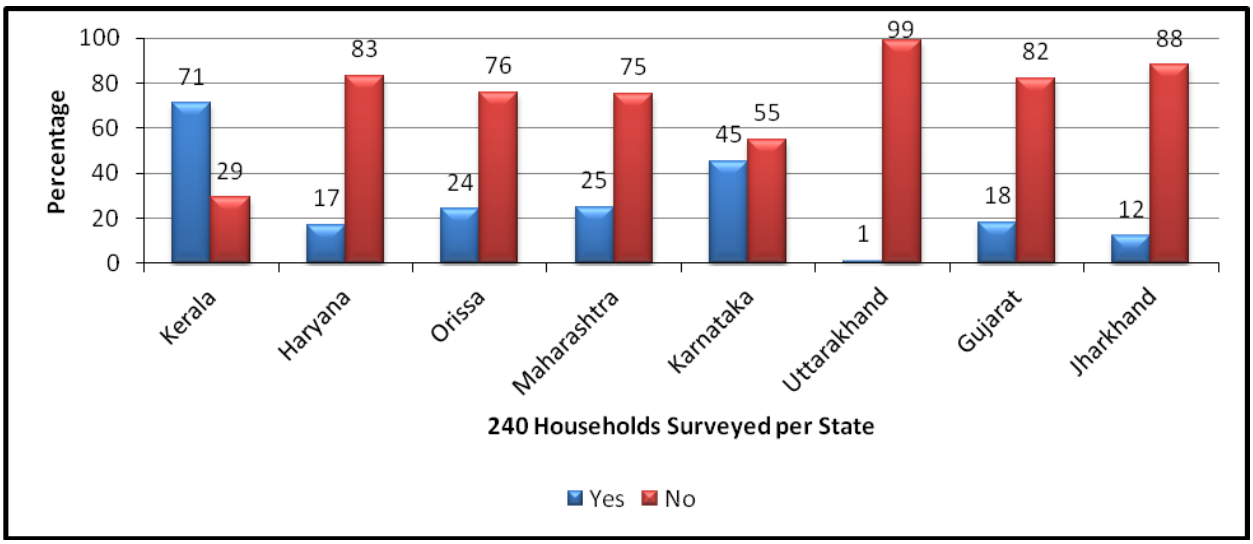


Debt in the households

Approximately 27% of the total households were found to be in debt, with the majority of them being from the southern states of Kerala and Karnataka. Households in Uttarakhand were primarily debt free. An interesting fact was observed that more households in electrified villages were in debt as compared to households in un-electrified villages.

It was also found out that landholding size was an extremely important determinant of debt. Households owning more than 5 acres of land were found to be more in debt relative to those having less than an acre of land, or the ones having no land at all. Majority of those households who were in debt cited agricultural related needs as reasons for debt.

Figure 14: Households in Debt



Chapter II. Current Electricity Access and Consumption patterns

This chapter presents the findings relating to electrification of villages, state wise distribution of households having access to electricity, details of the electricity providers, cost incurred for electric connections, and electricity supply. Out of 240 villages surveyed across eight states, majority of the villages were found to be electrified. Jharkhand had the least number of electrified villages.

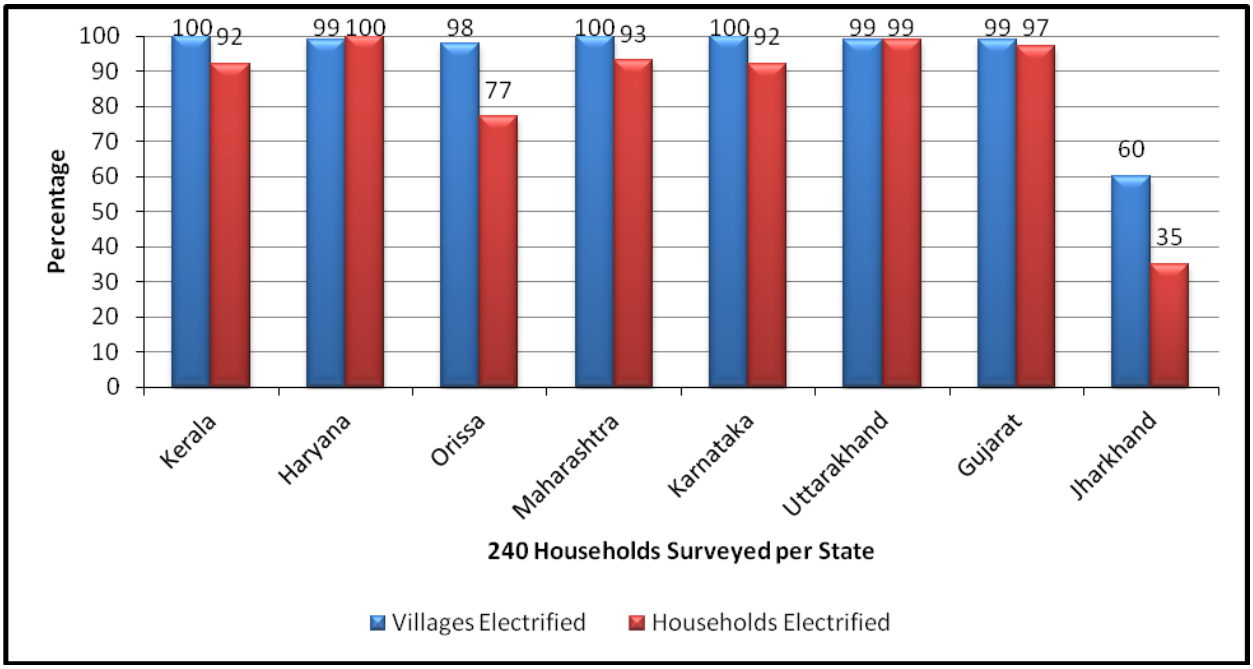
Number of electrified villages and households

As part of the survey, all the households were asked if their village and households were electrified or not. 94% respondents said that their village was electrified, where as the remaining 6% households responded negatively to the query.

Households from Maharashtra, Kerala, and Karnataka reported 100% electrification. Majority of households (98-99%) from Haryana, Orissa, Uttarakhand and Gujarat also said that their villages were electrified. Jharkhand had the least number of electrified villages (60%) among the eight states.

Household wise level of electrification was extremely encouraging, as 86% of the surveyed households had electricity connections across the eight states. Further analysis showed that Orissa faired below the average with household electrification at 77%, and Jharkhand had a staggeringly low 35%.

Figure 15: Number of villages and households electrified



It was also observed that the level of electrification had no relation with the size of the land holding (covered in section on **Land Ownership**) as the response was fairly consistent across all the four groups ranging from 94% to 98%. But a clear pattern of increase in percentage of electrified household vis-à-vis increase of landholding size was noted with an increase from 82% to 89% from households with no land ownership to those with more than 5 acres of land.

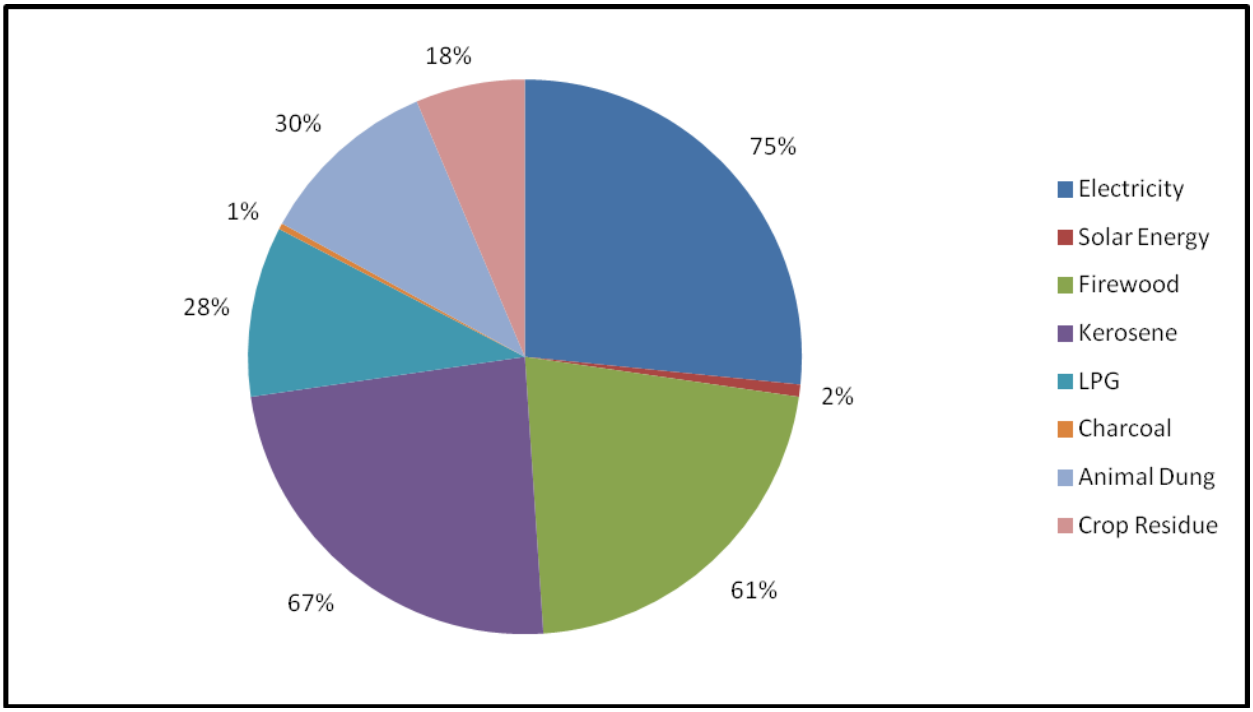
However, as the percentage of electrified households in case of respondents with no agricultural land was found to be more than 82%, therefore landholding size could not be attributed as a major contributor to having an electricity connection.

Energy sources in the households

Electricity (75%), kerosene (67%) and firewood (61%) were listed as major sources of energy. Animal dung, LPG, and crop residue were identified as other important sources of energy. In Jharkhand where the number of electrified households was relatively very less, firewood, kerosene and animal residue were found to be the main sources of energy in majority of the cases (range of 94-97%). The data and the graph shown in this section indicate that households used a combination of energy sources, rather than sticking to a particular source. Subsequently, we have obtained percentage values which collectively add up to way past 100%.

Further it was observed at the household level, that electricity consumption increased considerably with the increase in size of landholdings in possession. The consumption was found to increase from 57% in case of households with no agricultural land, to as high as 87% in households with more than 5 acres of landholding. Similarly, marginal increase in usage of other major sources such as firewood (from 54% to 69%) and kerosene (59% to 70%) was also observed for the same landholding pattern.

Figure 16: Energy sources in the households



Providers of electric connection

State Government/ Municipal Corporation were found to be the primary provider for electric connections, and they accounted for approximately 80% of electricity for the surveyed households. Other methods of electrical connection as shared by households included sourcing electricity from private firms, and pulling electricity line from a local area line.

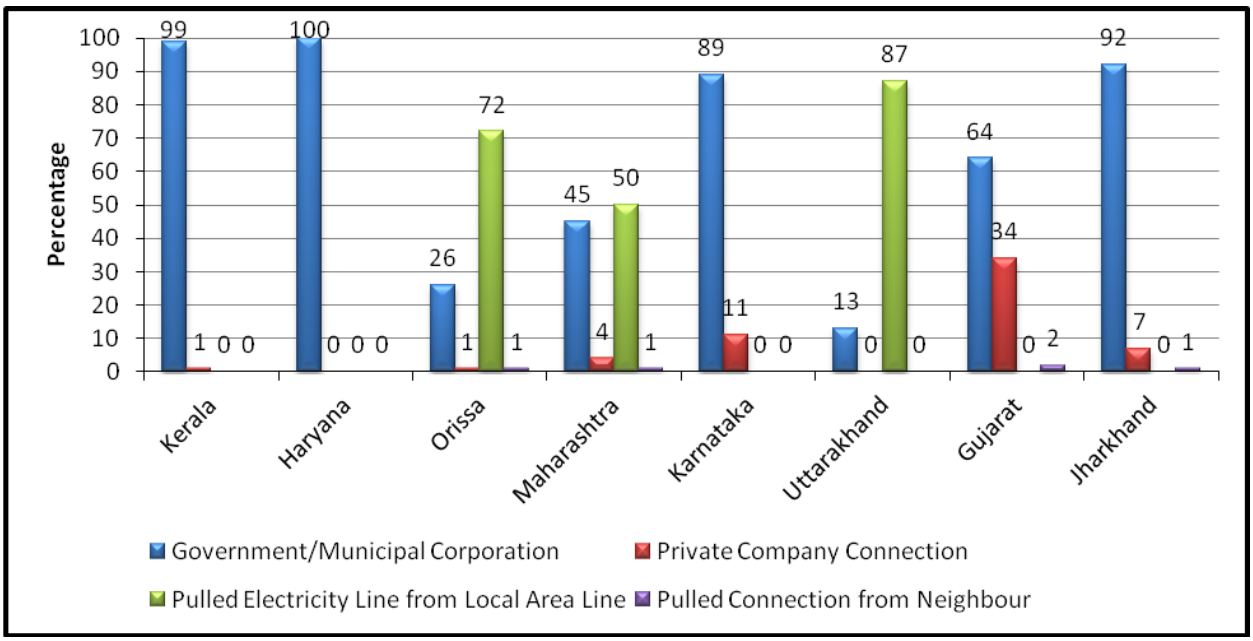
It came to notice that pulled electricity line from local area line contributed a significant amount of 29% of the total source of energy. An interesting observation was that this source of electricity was sparsely used by large land owners (22%), with land holding size greater than 5 acres of land, and it was primarily used by people with no self owned agricultural land (57%). Other observation was that as the amount of land holding increased, so did the number of private firm's connections with the corresponding decrease in State government/ Municipal corporations provided connections.

According to the survey responses, "high initial fees" was identified as a major deterrent for availing electric connections legally from public and private firms. Consequently, 29% of the household respondents illegally source electricity from local area line; this disturbing trend calls for attention from electricity providers, and should force them to make electricity more affordable.

It was found that electric connections had been provided at a far rapid pace in the last decade (2000-2009), with around 40 per cent of the installed connections being made available after the year 2000. This installation rate was moderately low for households with landholding more than 5 acres (around 38%), in comparison to the 48% of households with less than 1 acre of land.

From the results and analysis in this section, it can be concluded that the efforts towards electrification made in the last decade have benefited a substantial number of people, but still more concerted efforts need to be directed to achieve the broader objective of 100% rural electrification.

Figure 17: Source of electricity connection



Initial charges for the electricity connection

87% of the total households were found to have paid for the initial charges for electricity connections. Across the various landholding groups, the response on the above was rather uniform. Considering the size of landholding with the household as an indicator of the financial well being or the "ability to pay", it can be fairly assessed that "willingness to pay" for the initial charge outweighs the "ability to pay".

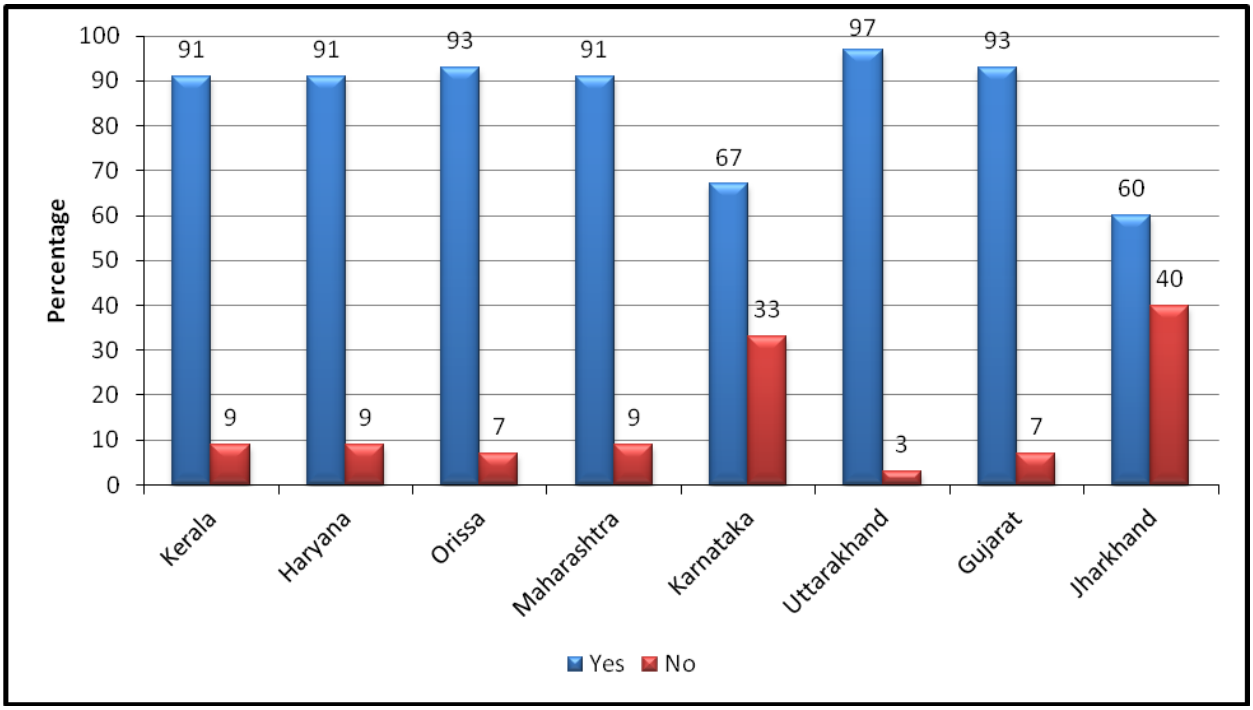
It was found out that about 61% of the households had paid up to Rs1500/- as the initial charges for availing electricity connection. About 15% had spent in the range of Rs.1500/- to Rs.3000/-, and a significant 21 per cent could not recall or didn't know the amount they had paid. This pattern is uniform across different landholding categories. Hence, it can be reasonably inferred that the increase in initial charges had an adverse effect on the need and desire to avail electric connections.

As mentioned above, in case of all the electrified villages, 60% of the respondents have paid up to Rs.1500/- as initial connection charges. Thus it can be deduced that a lower initial charge would encourage and promote more legal connections, and would hasten the spread of rural electrification.

Table 12: Average amount paid by people for an electricity connection

	All	No agricultural land	Less than 1 acre	1 to 5 acre	More than 5 acre
Less than 500	27	17	26	29	25
500-1500	34	48	36	29	31
1501-3000	16	10	17	16	16
3001-5000	2	2	3	3	1
5001-10,000	1	0	1	0	2
10000 and above	0	1	0	0	1
DK/CS	20	22	17	23	24
Sigma	100	100	100	100	100

Figure 18: Initial connection charges paid by households



Households were also enquired about monthly bill being paid by them. It was shared that for most of the households (56%), electricity bill paid last month was between Rs. 100 to 250/-. About 25% of the households paid amount in the range of Rs 250-500/-. It was interesting to note that there was no major difference in monthly bill amount of households with no agricultural land, and those having up to 5 acre or more land. The use of illegal source of energy through pulled electricity line could be one such reason for absence of difference in monthly bill being paid by these two categories.

Purposes for which electricity is used

Households were asked in detail about the purposes for which electricity was used by them. Given below is a summary of the responses:

- **Lighting:** Most households used electricity for the purpose of lighting. More than 50% of the households used electricity for the purpose of lighting, and it constituted more than 50% of their total electricity usage. Also, it was observed that relatively less percentage of households with more than 5 acres land used electricity primarily for lighting purposes, thereby indicating more productive use of electricity for other work and agriculture related activities for such people.
- **Cooking:** Electricity usage for cooking purposes was not very high, though it was significant as around 18% households consume up to 50% of their total electricity for purpose of cooking. No specific differences were observed within households having different categories of landholdings.
- **Use of electric appliances:** Around 60% people consumed 26-50% of their total electricity for running electric appliances. Thus, it can be inferred that this was the second major utility of electricity after lighting. Households with more landholding seemed to dominate over other segment people in use of electric appliances, clearly indicating higher penetration and need of such electrical goods for such a demographic.
- **Agriculture:** Survey results shows that use of electricity for purpose of agriculture is minimal in comparison to other uses of electricity. There were only 7% of people who used electricity for agriculture; and for them the percentage of electricity use for agriculture was up to 50 per cent of their total consumption. It was observed that households with large landholdings predominantly used electricity for agriculture and allied activities.
- **Business:** Use of electricity for business purposes was found to be the least out of all other uses of electricity. It was found that less than 1% of total respondents used electricity for business purposes.

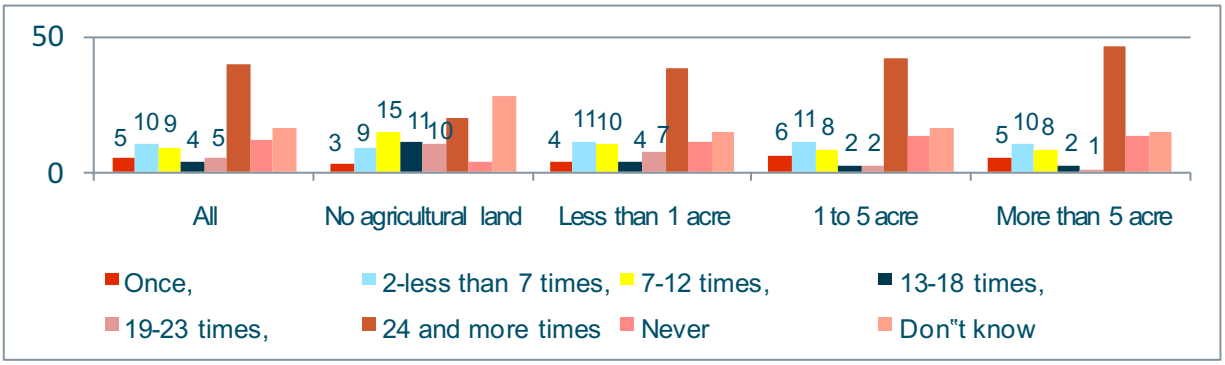
From the above points, it can be safely inferred that in rural households electricity is only consumed to support basic household chores and for ease and convenience of such work, rather than to support and afford extravagance and luxury.

Disruption in electricity supply experienced in last one month

To understand the regularity in electric supply, households were asked about number of power failures lasting for more than 30 minutes that they had faced in the last one month. About 50% households reported being faced with the problem of electric supply failure for more than 30 minutes for 24 or more times in a month (almost every day).The quality of supply in the states of Karnataka, Jharkhand and Haryana was reported to be fairly poor, as more than 85 per cent of respondents reported the above mentioned scenario. Constant fluctuations (indicated by dimming of light) were also mentioned by more than one third of the respondents.

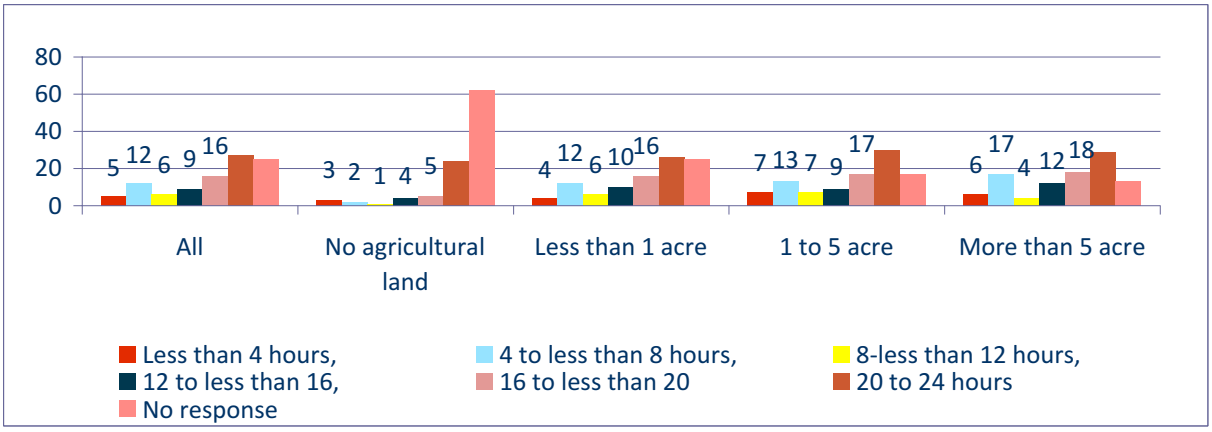
The amount of money that people pay for a connection and for their monthly usage should guarantee them a good and consistent quality of electricity supply. However, quality supply in most parts of India can at best be described as erratic. The quality of supply in the states of Karnataka, Jharkhand and Haryana is fairly poor as more than 85% of respondents indicated. Even though the state of Jharkhand has low rates of electrification and a poor supply network, these figures lay bare the claims of Haryana and Karnataka as being among the best electrified states in the country. The level of electrification has no significance if access is marred by poor quality of supply. Such bad quality of supply in this day and age with frequent outages is unacceptable and severely dents the government ambitions in achieving double digit growth. The next graph shows the average number of power cuts in a month in the states surveyed.

Figure 19: Average number of power cuts in a month in the states surveyed



It was found that only 36% of the households receive electric supply for 20 to 24 hours while up to 30% households get less than 12 hours of electricity supply. There are 23% households who get electricity supply for less than 8 hours. Only 44% of the electrified villages get supply for at least 16 hours. This is indicated in the graph below, and it also highlights the pathetic state of transmission and distribution in rural India.

Figure 20: Duration of electricity supply amongst all categories of landholdings



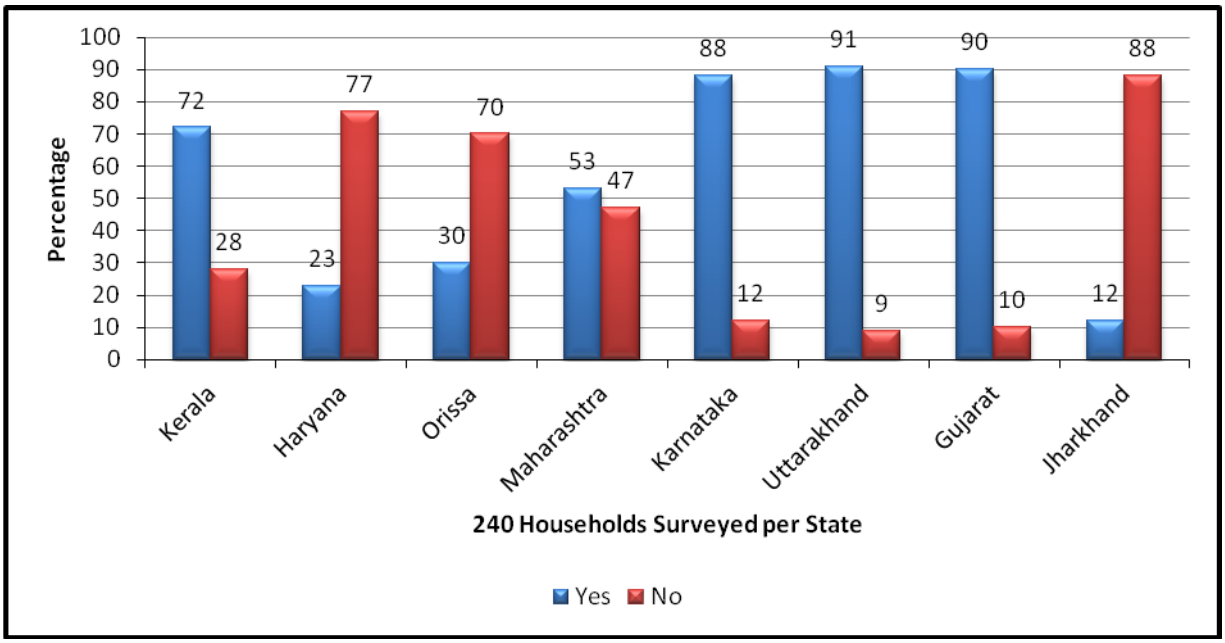
Backup equipment used in case of power failure

Kerosene wick lamps and candles were identified as the main sources for backup in case of power failures. Some of the other important sources used for providing backup are emergency lights, inverters and gas lamps, while use of solar and charger lights were found to be negligible. People with no agricultural land show maximum dependency on candles relative to other people. Emergency light finds maximum usage among households having more than 5 acres of land.

Level of Satisfaction with current electricity supply

About 65% households were satisfied with current electricity supply in their region, while the remaining substantial 35% households expressed serious dissatisfaction with quality and quantum of electricity. Analysis of the state wise response on the level of satisfaction highlights that the level of dissatisfaction was very high for households in the state of Jharkhand (88%), Haryana (78%), and Orissa (70%). Dissatisfaction was more pronounced among people with large landholdings; about 40% of the households with landholding more than 5 acres were not satisfied with the current electricity supply that they were receiving.

Figure 21: Level of satisfaction with the present supply of electricity



Reasons for dissatisfaction

The following were stated as the primary reasons for dissatisfaction with the existing supply of electricity-

- **Intermittent supply**:-Rural areas received an average 6-9 hours of power supply and that too irregularly. Erratic cuts and lack of scheduled timing meant that people could not use electricity when they really needed it. Equipment break-downs, technical faults, and the delayed repairs have further contributed to the erratic supply schedule. Bulk of the supply was during the night, with some supply in the evening, with virtually no or limited supply either during peak morning or evening hours.

- **Quantum of supply**:- is not enough to operate even a single tubelight as the voltage was consistently low. Despite having subsidized CFLs and tubelights, people were found to be using incandescent bulbs as they were the only appliances that would work on the low voltage.

  Limited access to latest information through means such as television and radio.

Chapter III. Households not having electricity connection

This chapter discusses findings relating to households that do not have electricity connection. The following related aspects are discussed in detail - Reasons for no access to electricity connection, alternate sources of energy used and costs incurred on such alternate energy sources.

As shown in section on number of electrified villages and households in the Chapter II, of the total households surveyed across eight states, 14% did not have access to electricity with majority of such households in Jharkhand (35%), followed by Orissa where about one fourth of total households surveyed did not have electricity connection.The southern states of Kerala and Karnataka reported only 8% such households which were not having electricity access, and 7% in Maharashtra said the same. The situation was comparatively better in the states of Gujarat and Uttarakhand where only 3% and 1% households lacked access to electricity respectively. In Haryana, all the households (entire 100% sample) were found to have electricity connections.

Reasons for household having no electricity

Households with no access to electricity were enquired about the reasons for being in such a situation. The primary reasons cited for no electricity access were their inability to pay initial connection fees, unaffordability of monthly bills, and unavailability of electricity in that area.

For states of Orissa and Uttarakhand, the major deterrent was found to be the high initial fees that is charged, and it was mentioned by more than two thirds of the households which were not having electric connections. For other states too, high initial connection fee was one of the key barriers as mentioned by an average of 47% households. Affordability of the monthly usage and the inability to pay monthly bills was cited as the next major deterrent as mentioned by 21 % of the households.

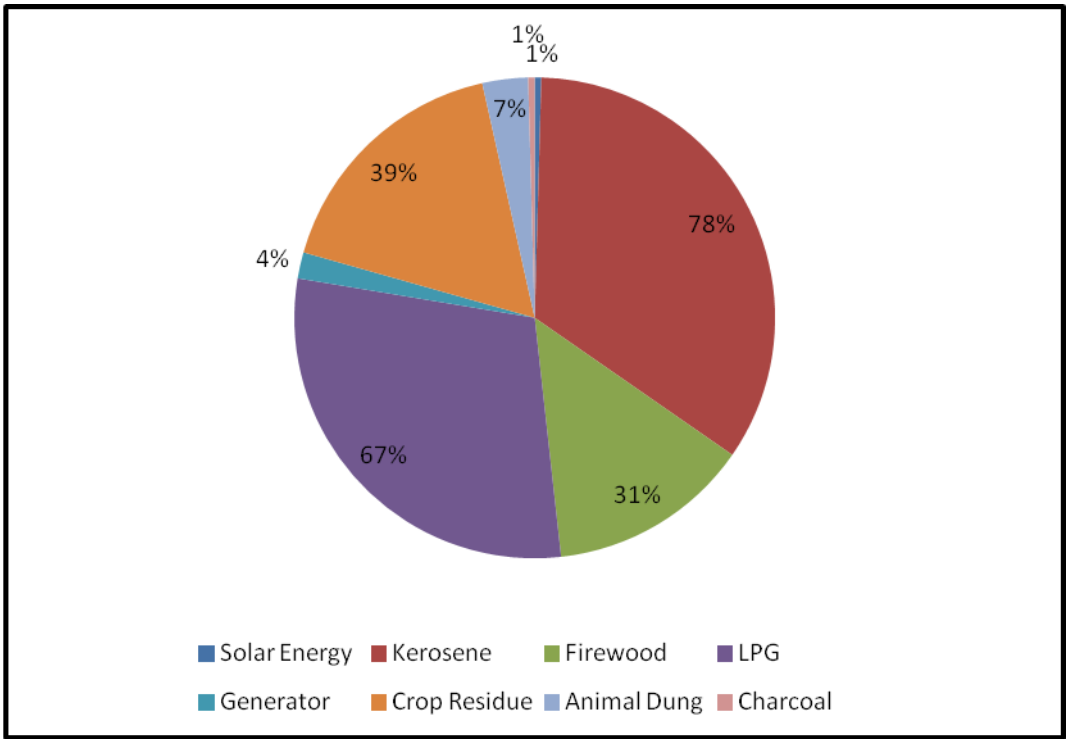
While the reasons for not having electricity connections were different for different classes of people, those with no agricultural landholdings of their own attributed inability to pay connection fee (52%) as the main reason for not having electricity. For people with relatively more landholdings, reasons like unavailability of electricity in that area and the inability to pay connection fee were found to be the main reasons for not possessing electric connections.

The variance of responses across various states and different categories of rural households indicated that changes in the policy decisions on making initial connection charges nominal and increasing investment for establishment of electricity related infrastructure (generation,supply, transmission and distribution) to maximize electricity availability will enhance the spread and span of rural electrification.

Major source of energy for households with no electricity connection

Kerosene, LPG, and firewood were found to be most important alternate sources of energy for households with no electricity connection with crop residue, animal dung and generators following in usage. It was observed that the consumption of kerosene for electricity increased with the increasing size of the landholding. Similar pattern was observed in usage of generators and animal dung; while medium and small land owners found maximum use of crop residues. The graph depicted in this section indicates that these households used a combination of energy sources, rather than sticking to a particular source. Subsequently, we have obtained percentage values which collectively add up to way past 100%.

Figure 22: Major sources of energy for households without electricity connection

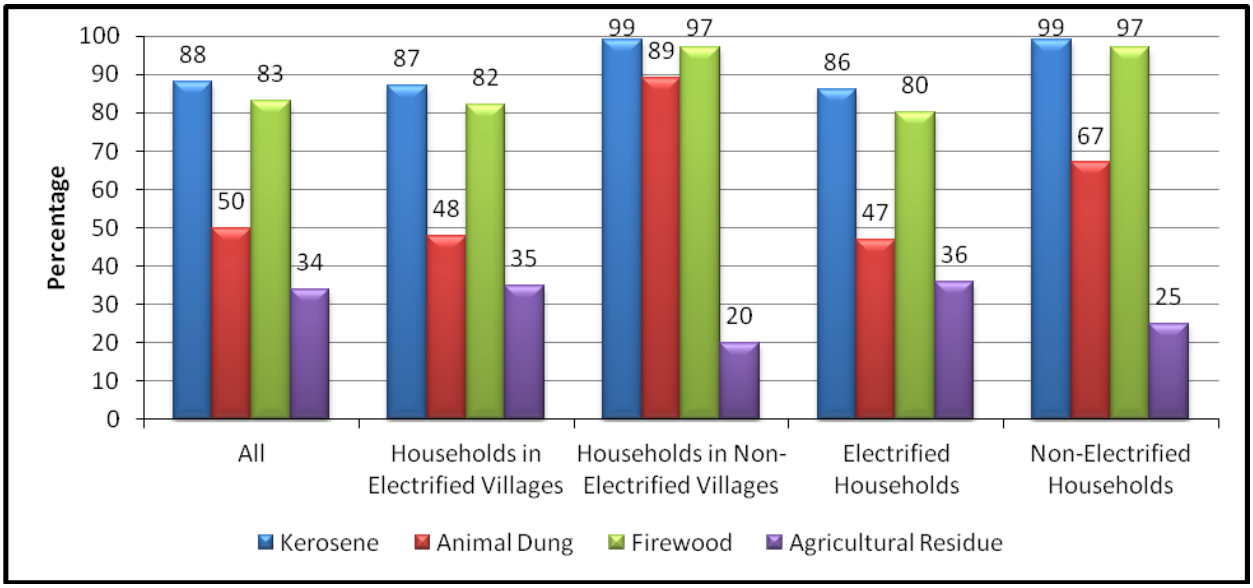


On comparing the findings across the eight states, it was observed that all the families (100% households) in the states of Kerala, Maharashtra, Karnataka, Gujarat and Jharkhand used LPG as their primary source of energy, whereas in the states of Orissa and Uttarakhand, kerosene and firewood were found to be predominant source of energy. Along with LPG and kerosene, crop residue was used as a major source of energy by 98% and 60% households in Jharkhand and Gujarat respectively. It was also found that diesel powered generators use was extremely rare in most of the states, barring Kerala (33%) and Maharashtra (6%).

Various energy sources used in last one month

Towards understanding the extent of use of different energy sources by the households, information was sought regarding use of these sources in last one month. As can be seen in the graph that follows, kerosene and firewood were used in majority of the households. Animal dung is also used by a significant number of households, primarily in households with no electricity. Agriculture/ crop residue is the least used energy source.

Figure 23: Various energy sources used by both electrified and non-electrified households in one month



Energy Sources used in last one month

a) Kerosene- Use and issues

Most households (88%) have used kerosene in last one month. It was observed that the consumption of kerosene for lighting purposes due to lack of electricity, increased with the increasing size of the landholding. The reason for the increase might be due to the steep price and availability of kerosene. Average consumption of kerosene was up to 100 rupees. Most of the people procured kerosene from ration shops only, while a few people (around 18%) used private shops for procurement of kerosene. It is worth highlighting that people with no agricultural land (24%) had to depend more on private shops than the public distribution system. It may be noted that since the dependency on kerosene and frequency of requirement is more by the non-electrified households than the electrified households, thus it is perceived to be extremely difficult to procure, and is considered scarce for such households.

b) Firewood- Use, procurement and incurred costs

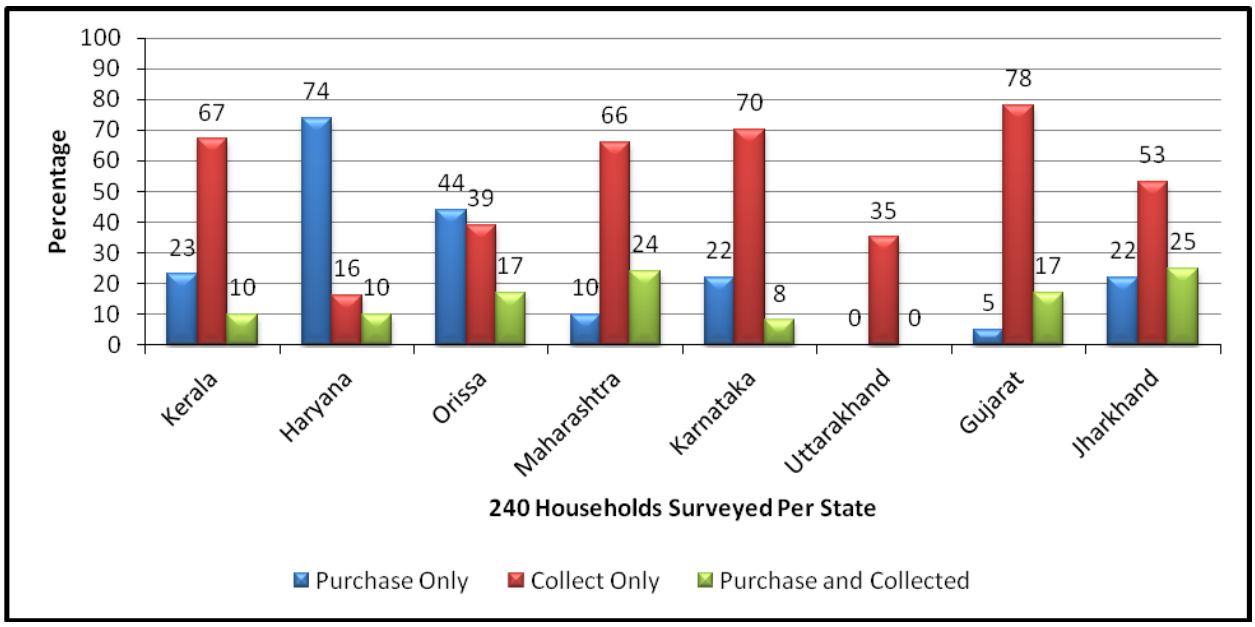
Majority (83%) of the respondents said that they had used firewood during the last one month. It is a pertinent point to note here that firewood is the second most preferred source of energy after kerosene (88%).

If we compare between states, 100% from Kerala, 79% from Haryana, 93% from Orissa, 92% from Maharashtra, 100% from Karnataka, 96% from Gujarat and 97% households from Jharkhand said they had used firewood during the last one month. However, there is a huge difference in the responses from Uttarakhand, where only 7% said that they had used firewood during the last one month.

From among the non-electrified villages, most of the respondents (97%) said they had used firewood during last one month as compared to the electrified villages (82%). Similar trend was found to be prevalent among non-electrified households (97%) and electrified households (80%).

On further comparison between states, it was found that the major source of firewood is purchased in the states of Haryana (74%) and Orissa (44%), whereas for the rest of the states the major source is obtained through collection i.e. Kerala (67%), Maharashtra (67%), Karnataka (70%), Gujarat (78%), Uttarakhand (35%) and Jharkhand (54%).

Figure 24: Firewood procurement sources



Average spending on firewood in one month was observed around Rs 484/-. However it was found that as size of landholdings increased, so did the average spending on firewood.

Though average spending on firewood for most of the respondents was between Rs.100 to Rs.500, if we compare among the states, it was noted that in the State of Haryana 46% respondents spend between Rs.500-1000 and 26% spend more than Rs.1000 per month.

It was also observed that most of the respondents (58%) in the non-electrified villages spend between Rs.250-500 as compared to electrified villages, where the percentage is only 32%. Similarly most of the respondents (42%) in the un-electrified households spend between Rs.250-500 as compared to the electrified households where the percentage is only 32%.

c) Animal Dung- About half of the households used animal dung; there was a significant difference in usage of animal dung between un-electrified households and electrified households. It was observed that most of the respondents in Haryana (80%), Maharashtra (63%) Gujarat (61%) and Jharkhand (95%) reported using animal dung as source of energy during last one month as compared to the other states where the use was minimal i.e. Kerala (14%), Orissa (17%), Karnataka (22%) and Uttarakhand (46%).

Unfortunately in a male dominated Indian society, it was mostly women who went for animal dung collection irrespective of their landholding patterns. Also, it was found that as landholding size of the household increased, this percentage of women who went to collect animal dung decreased from as high as 90% for people with no agricultural landholdings to 69% for people having more than 5 acres of land.

Expense incurred per month on energy sources used in the households

a) Firewood- Almost 53% of people had spent more than Rs 250/- for purchase of fire wood, whereas 30% had spent less than Rs 250/- per month. The indirect costs of collecting fuel and their implication on women and households is separate and is not included here. Un-electrified households are spending more as compared to those with access to electricity.

b) LPG- Majority (86%) spend more than Rs 100, with 57 per cent spending less than Rs 250/- It was observed that households with no electricity connection spend substantially less than those having access to electricity.

c) Charcoal- Expenditure on Charcoal is very low and almost half of the people spend only less than 10 rupees monthly.

d) Generator- Expenditure on fuel consumption for generators was around Rs.20/- only as there generators find minimal use in rural households. For people with no agricultural land this amount is negligible. Average spending on repair and maintenance of generators was again negligible for people with no agricultural land, while it was around 200 rupees for people who own land less than 1 acre of land.

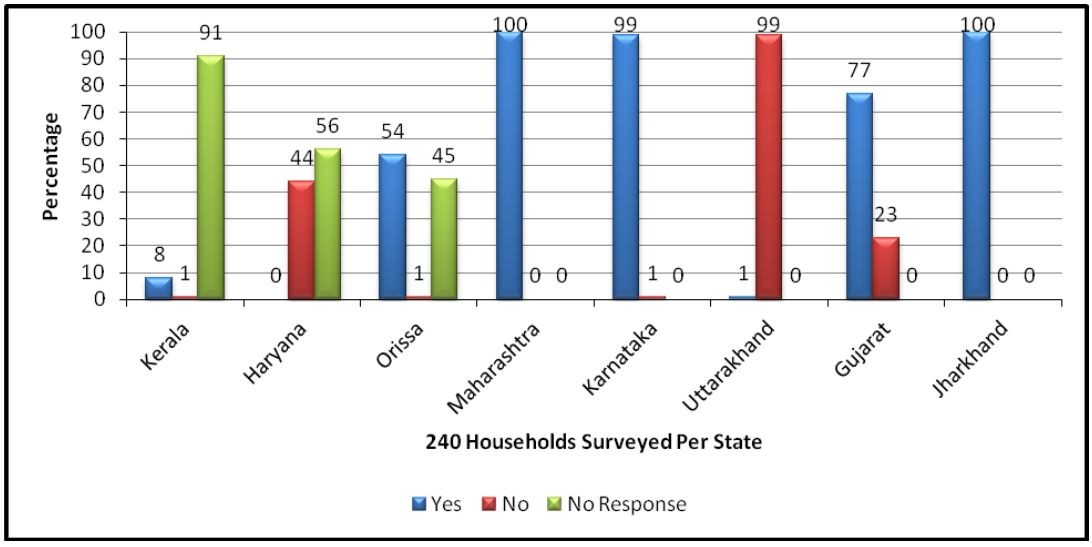
e) Dung-cakes - The expense on dung-cakes was minimal for most of the people. Around 89% of people had less than 50 rupees expenditure per month. Only people with more than 5 acres of land were less in terms of the percentage of total people who had spent less than 50 rupees per month.

35% of the total respondents were totally dissatisfied with the current electricity supply and felt that the amounts that they were paying for electricity was not worth it. A number of households who do not have electricity connection also got their connection disconnected due to the poor service. However, it is not that people were not willing to pay for electricity services, since their average energy expenses still constitute about 11% of their total monthly household expenses. Their main concern was primarily the inadequacy of services and the high cost of services in relation to quality of the services. Almost all the respondents did express their views that good quality electricity services would bring in holistic development and this was expressed in various ways, as is detailed below. The story in short being that people understand that electricity and energy are important and they are willing to pay, as long as they feel that they get their money's worth.

Perception that electricity connection will help better your lifestyle

Most of the respondents (55%) believed that an electricity connection will help them lead a better lifestyle. Around 24% households were unsure about access to electricity and how it would help them lead a better lifestyle. While comparing the states, it was seen that in Orissa (55%), Maharashtra (100%), Karnataka (99%), Gujarat (77%) and Jharkhand (100%), this perception was stronger as compared to other three states. It is important to mention here that in the previous analysis of households having electricity connection, it was seen that most of the households in the other states already have electricity connections i.e. Kerala (92%), Haryana (100%) and Uttarakhand (99%).

Figure 25: Perception that an electricity connection will help improve the lifestyle



For this query, we observed that there was a distinct difference in response among electrified and un-electrified households and villages. 97% of the un-electrified households believed that access to electricity will help them better their lifestyle as compared to just 48% of electrified households. Similar difference in response was observed amongst un-electrified (94%) and electrified villages (53%).

Perception of how electricity connection will impact life of women in the household

Households when asked about how electricity could impact women in the household, listed the following benefits -

- Being able to work during the night (17%)
- Access to information including health related programs on the television (30%)

It was interesting to observe that apart from having readily available light sources, the most preferred use was discovered to be watching television; a medium which brought both entertainment and information to one's doorstep.

Households realized the benefits that electricity will bring to women in doing domestic chores, and how it will ensure their good health as they recognized the ill effects of kerosene (an alternate source used for lighting and/or cooking).

Table 13: Perception of how electricity will benefit women in the households

Statements	Response	Total	Electrified Village	Non-Electrified Village	Electrified Household	Non-Electrified Household
To use Kerosene or Oil for lighting is harmful for health	Agree	69	68	90	67	83
	Disagree	23	23	8	25	11
Electricity helps with domestic tasks and care of the children	Agree	85	85	96	85	86
	Disagree	5	5	3	5	5
Health of women will improve if electricity is made available to the household	Agree	80	80	72	83	62
	Disagree	5	5	16	4	12

Perception of how electricity connection will impact life of children in the household

As far as the perception of the respondents on electricity connections and their impact on life of children was concerned, almost all the responses related it to education. 40% said it was important for children's education, 42% said children can study well, 13% said children can study during the night, and a few of them also mentioned that there would not be any problems to the eyes of their children while they read and write in well lit conditions, which were ensured by electricity . Their responses are also reiterated in the table below:

Table 14: Perception of how electricity will impact the lives of children in the household

Statements	Response	Total	Electrified Village	Non-Electrified Village	Electrified Household	Non-Electrified Household
Electricity is very important for children"s education	Agree	94	93	99	93	99
	Disagree	0	0	0	0	0
With electrical light children can study at night	Agree	93	93	99	92	99
	Disagree	1	1	0	1	0
Reading in electrical light is better than with light of candles or lamp	Agree	81	80	95	78	97
	Disagree	13	13	4	15	2

Perception of how electricity connection will impact work/income in the household

When asked about how electricity connection would impact their work, majority mentioned the ease and comfort that electricity would provide them in completing their daily household chores. Some of the responses were that it would help them in their household works (27%), help them in filling water at their houses (12%), and would also enable them to cook food at night (18%). It was clear from all the responses that an electricity connection was found to be making a positive impact upon the lives of all the members of the household.

The table below also highlights benefits of electricity in gaining better access to information, safety of women, and in removing the financial burden associated with the non-electric energy sources that they were currently using.

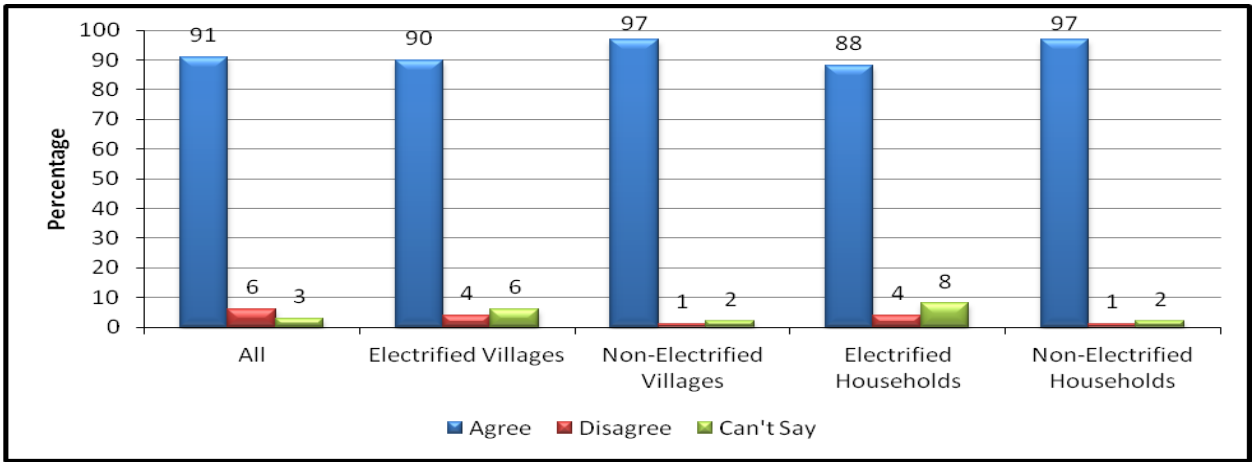
Table 15: Perceived impact of electricity on the household

Statements	Response	Total	Electrified Village	Non-Electrified Village	Electrified Household	Non-Electrified Household
Our House is happy with the lighting system we have in our home	Agree	54	57	7	60	17
	Disagree	36	33	88	32	59
Monthly spending for non-electric energy sources is/was a burden for my family	Agree	60	61	49	62	50
	Disagree	31	31	33	29	39
Even without electricity women in my household feel safe to go out in the evenings	Agree	37	38	23	40	22
	Disagree	54	53	75	51	70

Perception of how electricity connection will impact life in the village

Continuing with the responses on perception of benefits, households were also enquired about how access to electricity could impact their village. While most responses highlighted collective benefit for women, children, and households, access to information in form of news on television and radio, information useful for agriculture activities, health issues and entertainment were also expressed by a majority of the respondents. Households with or without electricity reiterated through their responses that electricity was no longer a value added service for them but an essential commodity.

Figure 26: Perception that electricity is an essential commodity and not a value added service



Chapter V. Summary and Conclusion

This extensive rural household survey titled “Ability and Willingness to Pay for Energy Services in Rural India” was carried out in 8 states, and it covered 240 villages comprising 1920 households. The responses and survey data obtained from the household questionnaire (Annexure 2) were collated, tabulated, and all the facts and findings were graphically illustrated and presented in utmost detail in the previous four chapters.

In this concluding section, we have tried to summarize the findings and results of the previous chapters. Subsequently, through this analytical summary we will once again reiterate the moot point of this study, that rural households in India desire for quality electricity based services and not free and cheap electricity.

All the important results and conclusions are being summarized topic wise in the following section:-

1. State wise electricity penetration - It was found that approximately 86% of the total households had an electricity connection, and that too with minor variations based on landholding ownership patterns. But it was noted that as the size of landholding increased, so did the chance of a household having electricity connection. Among different states, 100% electrification was observed in the study villages of Maharashtra, Kerala and Karnataka. Almost all surveyed villages in Haryana, Orissa, Gujarat and Uttarakhand were found to be electrified, whereas in the state of Jharkhand as many as 40% of the study villages were un-electrified. On household basis, Jharkhand and Orissa were found to be far below the overall average with 35% and 77% electrification respectively. This analysis indicates that a concentrated effort needs to be undertaken to provide electricity to rural households of Orissa, and especially Jharkhand.

2. **Electricity based services being used and the ones desired for** - Currently electricity was being used mainly for lighting purposes. Some of the other uses were in cooking, agriculture and business. It was observed that though lighting was the primary use of electricity for majority of the households, but people with more land ownership diverted certain amount of electricity towards purposes like cooking and agriculture.

Survey results showed that only 7% of the people used electricity for agriculture purposes i.e. irrigation. This trend was mainly observed in Gujarat, Haryana and Maharashtra where majority of the landholdings were irrigated, and electricity was one of the major sources of energy for irrigation. There wasn’t much variation in the preference for using electricity for irrigation of among small landholders and large holders, although large landholders were found to depend more on diesel and other forms of energy due to their higher purchasing power. Less than 1% of used electricity for business purposes.

The survey results also showed that if the quantum and quality of electricity supply were to improve, more number of people would have used electricity for agriculture purposes too. With electricity supply being not only inadequate, but also unpredictable in terms of hours of supply, only 7% of the people surveyed were using electricity for agriculture and allied purposes.

Electricity services desired for - Majority of people were of the view that electricity would help them gain access to knowledge through the mediums of television and radio, and that this knowledge would also assist them in their agriculture and business activities. The respondents also felt that electricity would have a positive impact on the life of women as it would improve their health and working conditions. Majority of people also mentioned that electricity would help their children in studies; they would be able to spend more time on their studies as lighting would enable them to study also during nights.

Most of the respondents perceived that electricity connection would help them lead better lifestyles. Around 55% said that electricity connection would bring positive impacts in the lives of women of the village, as it would enable them to finish their work easily thereby providing them an opportunity to lead a better and comfortable life. They opined that an electricity connection would help women to work during night (17%), would enable them to watch awareness programs on health related issues on television (30%), and would allow them to finish their work in a timely manner (20%). It is interesting to note that apart from electricity bringing more light, to the people, the most preferred use of electricity by people living in rural areas would be to watch television, which people believe brings them both entertainment as well as information. People consider that electricity will help improve conditions of women in household by helping them in taking care of children by being informed mothers as well as help them in performing other domestic tasks. It can be concluded that a clear perception is being established here that electrification shall lead to improvement of quality of life and it would also decrease burden on women in terms of collection of firewood, animal wastes as an alternate source of clean energy. This last part came out more in the responses of people from Jharkhand.

3. Alternate sources of energy and accompanying issues-In states like Jharkhand where the level of household electrification was very low, firewood, kerosene and animal residue were found to be the primary alternative source of energy in majority of cases (94-97%). While in the other states being studied, the main sources for backup in case of power failure were Kerosene wicks lamp and candles. Some of the other important sources used for power backup being used were emergency light, inverter and gas lamp, while use of solar light and charger light was found to be negligible. People with no agricultural land show maximum dependency on candles. While emergency light was mostly found being used by people holding more than 5 acres of land.

If we compare between the states, it was observed that 100% families in the States of Kerala, Maharashtra, Karnataka, and Gujarat use LPG as major source of energy, whereas in Orissa and Uttarakhand the major sources of energy are kerosene and firewood respectively. As far as usage of crop residue is concerned, 98% families in Jharkhand, 60% families in Gujarat use it as major source of energy along with LPG and kerosene. It was noticed that Generator usage is minimal and was found in only two of the study States i.e. Kerala (33%) and Maharashtra (6%). Also, if we compare between states it may be seen that except Uttarakhand (35%), in all other states the kerosene usage ranges between 88% - 100%.

Most of the respondents in the States of Maharashtra (62%), Jharkhand (48%) and Uttarakhand (48%) mentioned that kerosene is costly. A striking 86% respondents in Kerala said that most of the time they found it out of stock. As far as Haryana is concerned, almost 50% respondents said they either buy it from other places or from the black market, whereas 20% said it is costly and another 20% said it is not available timely and that they have to buy it from general stores.

From this study, we can conclude that people are facing lot of trouble in finding alternative sources of power when electricity is not available. But, despite the unavailability and high costs of these alternative sources, the question which arises is why people in rural areas across states are still not opting in for electrification?

4. Current level of dissatisfaction with electricity services - Across the study states it was found that majority people were dissatisfied with the service of electricity connections. Major reasons for dissatisfaction were irregular power supply, frequent power cuts and in the case of agriculture - improper

timings. The responses were common across all respondents in all the states irrespective of their landholding size.

It was observed that only 44% of the electrified villages got at least 16 hours of electric supply while there were 23% villages which got less than 8 hours of daily electricity supply. The quality of supply in the states of Karnataka, Jharkhand and Haryana was fairly poor, as more than 85% of respondents indicated that they faced power cuts of more than 30 minutes duration for at least 24 times in a month. 30% of the households people faced voltage fluctuation problem which very often lead to dimming of light. 41 % of the people not owning any agricultural land faced this problem frequently.

Analysis of the state wise response to the level of satisfaction towards electricity supply showed that the level of dissatisfaction was very high in the range of 67% to 88% in the states of Jharkhand, Haryana, and Orissa. Dissatisfaction was more prominent among people with large landholdings. Major reasons observed for dissatisfaction were found to be irregular power supply without any timing notifications, smaller amount of supply time and the adverse affect on children's study time. Despite being faced with such supply related problems, it was found that majority of the respondents were willing to go for a new electricity connection due to the impending benefits and the prospective improvements that electricity would bring in their lives and livelihood. Of course, there were some deterrents in adoption of a new electricity connection. Chief amongst them is the high initial amount which is to be paid during the installation of the connection.

5. Barriers towards electricity connections: In Orissa and Uttarakhand, for 60 to 67% of the respondents, the major deterrent in possessing an electricity connection is the high initial fees charged. For other sates this is also a major factor but of relatively lesser magnitude at an average of 47%. Affordability of monthly usage is the next major deterrent with 21% response. The willingness to pay the initial fee is more in the States of Maharashtra (98%), Karnataka (56%), Gujarat (76%) and Jharkhand (63%) as compared to the States of Kerala (8%), Haryana (0%), Orissa (19%) and Uttarakhand (2%).

6. **Awareness and willingness to pay for electricity services**: While comparing the states, it was seen that in the States of Orissa (55%), Maharashtra (100%), Karnataka (99%), Gujarat (77%) and Jharkhand (100%) there is a greater willingness to have an electricity connection and pay for those services. If we compare between the electrified villages and non-electrified villages, it is clearly seen that there is a greater willingness among respondents of non-electrified villages (94%) to have electricity connection and pay for electricity services in anticipation of a better lifestyle than electrified villages (53%). Similar pattern may be seen among the households *having* and *not having* electricity connections. There is much higher willingness to pay for electricity services amongst household not having electricity connection (97%) to go for a connection than households already having connections (48%).

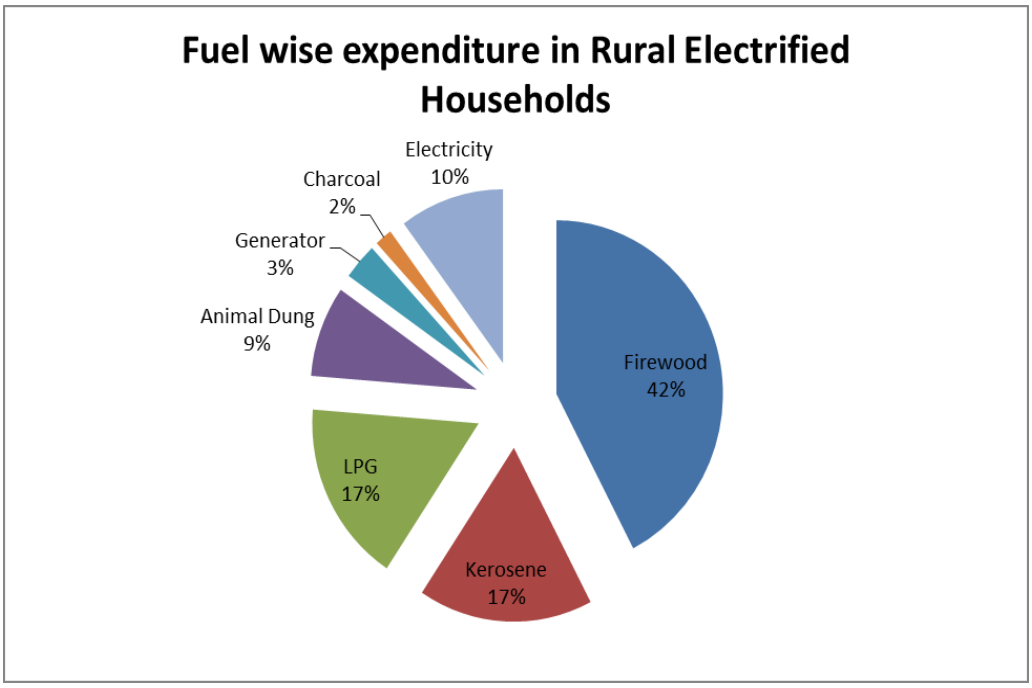
Almost half of the people surveyed have expressed their willingness to pay for the initial amount for installing an electricity connection. Only 21% of people have responded negatively. It may be observed from this study that with the increase in the number of landholdings there is an increase in the willingness of people to pay for the initial fee for electricity connection.

Majority of people want to keep their monthly bill under 100 rupees irrespective of their land holdings. While it can be also observed that this percentage is slightly low for people who own more than 5 acres of land and they are willing to pay upto 500 rupees as their monthly energy bills. At the same time from the survey it emerged that 72% of the respondents are willing to pay a monthly bill of more than Rs. 250/- . Across the states, most of the respondents are ready to pay even to the tune of Rs. 500/- per month except in Jharkhand, Orissa and Haryana.

Apart from this the most striking point to emerge from the survey has been the high initial cost to be paid for getting an electricity connection. Even here people are willing to pay up to Rs. 1500/- and when it comes to paying the monthly electricity bill majority of the people are willing to pay even to the tune of Rs. 500/- provided there is better quality of service delivery. Thus, from this survey, we can analyse and conclude that it is time we put to rest a commonly held hypothesis that "people living in India's rural areas want free power". This is not true; 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.

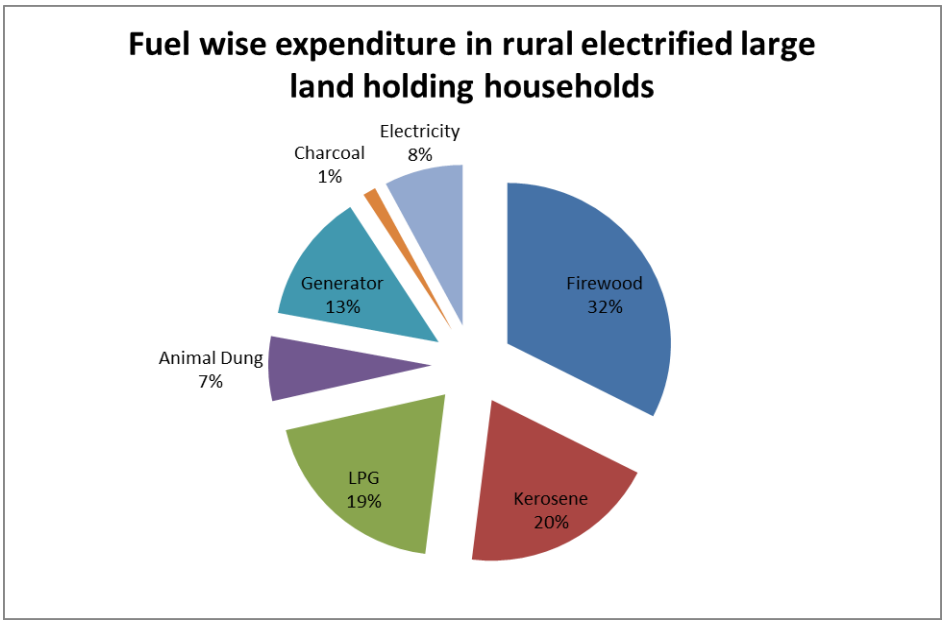
The figure below indicates the approximate expenditure incurred on various fuel sources by a rural electrified household with a small land holding (in the surveyed villages). It can be seen from the figure that despite the fact that these villages are electrified and many of them have access to LPG connection, there is a huge expenditure on firewood, kerosene, diesel generator and cow dung. While the expenses incurred on firewood and dung cakes would in large cases be "notional expenses", there are instances where people have had to buy both firewood and dung cakes. A total of 42% of the expenses incurred for energy sources goes towards firewood, with kerosene accounting for 17% of the total expenses and electricity accounting for 10% of the total expenses.

Figure 27: Fuel-wise expenditure in Rural Electrified Household



However, in case of households surveyed with large land holdings, the expenses incurred on diesel for water pumping increases, while the amount spent on electricity and firewood and dung cakes tends to reduce. This can be attributed to the fact that some of the firewood required probably comes from their own land holding. It also indicates that due to poor quality of electricity supply, diesel generators are required for irrigation purposes. Depending on the size of land holding, households buy about 10-20 litres of diesel every month for irrigation purposes during crop seasons.

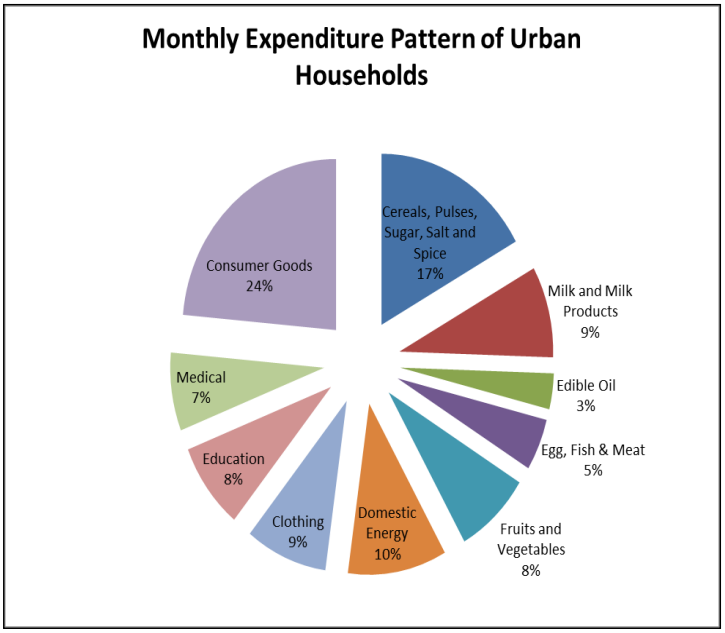
Figure 28: Fuel-wise expenditure in Rural Electrified large land-holding household

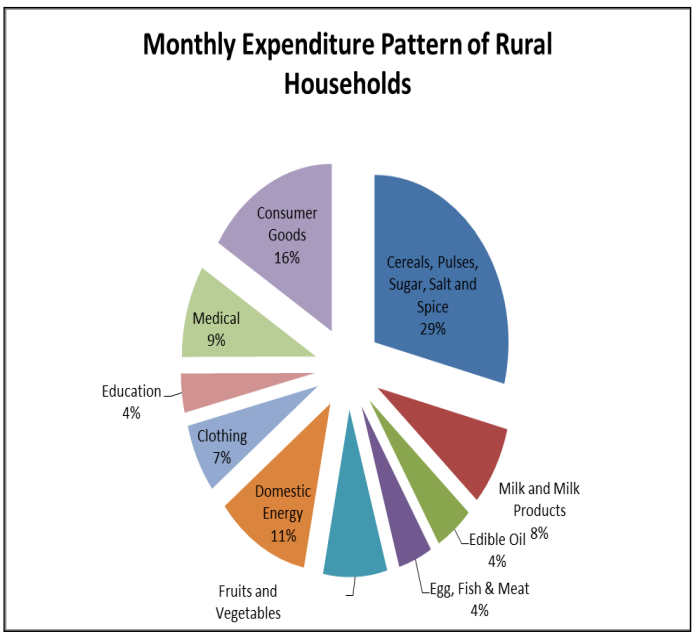


The following graphs give an overview of monthly expenditure patterns of urban and rural households. These are based on the NSSO data of 2007 extrapolated with the survey findings for rural households.

It can be seen from the graphs that despite the fact that electricity and energy for rural poor is highly subsidized, the amount spent for energy in a rural households accounts to 11% of their total monthly expenditure, while in the urban households on an average only 10% is spent toward energy.

Figure 29: Monthly Expenditure Pattern of Urban (figure on left) and Rural (figure on right) household





To further substantiate this, if we look at the purpose of energy usage in rural and urban households, we find that the primary usage of energy in rural households is for lighting, water pumping/extraction, heating (which includes cooking and water heating in winters). Negligible amount of energy is spent for charging mobile phones and on other miscellaneous appliances such as radio, television etc.

However on the other hand, the urban household consumption for electricity would include, lighting, space heating/cooling, cooking, kitchen appliances, bathroom appliances (Water heating, washing machines etc), entertainment appliances, in addition to water pumping and extraction.

From the above observations it becomes evident that people perceive electricity connection as a means of development and better quality of life, as it is enables them to gain knowledge, acts as an aid in improve the living conditions of women, and helps provide opportunities for their children to have a better education. Also people who do not have an electricity connection are facing problems to acquire alternate sources of energy like kerosene etc. and are finding them costlier and hazardous too.

Despite this, there still are some deterrents for them in opting for an electricity connection as the quality of supply is not good and the duration of supply is highly irregular across the states. Despite the fact that electricity and rural energy needs are subsidized on paper, it is evident that the rural consumer spends a higher percentage of his income on energy as compared to an urban consumer, though his usage of energy is for a much lesser application than that of a urban consumer. Thus, majority of the respondents in some states are particularly unhappy with the electricity services being provided

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Annexure 1:- List of Villages surveyed

No	State	District	Tehsil	Gram Panchayat	No of HHs
1.	Gujarat	Panchmahal	Shehera	Shehera	2516
2.	Gujarat	Panchmahal	Kalol	Adadra	1350
3.	Gujarat	Panchmahal	Godhra	Orwada	1003
4.	Gujarat	Panchmahal	Shehera	Boriya	847
5.	Gujarat	Panchmahal	Halol	Champaner	730
6.	Gujarat	Panchmahal	Shehera	Bodidra khurd	657
7.	Gujarat	Panchmahal	Shehera	Morva	573
8.	Gujarat	Panchmahal	Lunawada	Kaslal	508
9.	Gujarat	Panchmahal	Shehera	Tarsanag	462
10.	Gujarat	Panchmahal	Kalol	Madhvas	405
11.	Gujarat	Panchmahal	Ghoghamba	Gundi	369
12.	Gujarat	Panchmahal	Morwa (Hadaf)	Chopada Bujarg	338
13.	Gujarat	Panchmahal	Halol	Dhariya	306
14.	Gujarat	Panchmahal	Lunawada	Ukedi	264
15.	Gujarat	Panchmahal	Halol	Panelav	223
16.	Gujarat	Junagadh	Sutrapada	Sutrapada	3832
17.	Gujarat	Junagadh	Una	Gir Gadhada	1439
18.	Gujarat	Junagadh	Bhesan	Ranpur	1046
19.	Gujarat	Junagadh	Junagadh	Dungarpur	894
20.	Gujarat	Junagadh	Sutrapada	Lati	731
21.	Gujarat	Junagadh	Una	Mota Desar	615
22.	Gujarat	Junagadh	Una	Umej	548
23.	Gujarat	Junagadh	Mangrol	Dhelana	498
24.	Gujarat	Junagadh	Manavadar	Vekri	448
25.	Gujarat	Junagadh	Mendarda	Gundala	398
26.	Gujarat	Junagadh	Talala	Pipalva	352
27.	Gujarat	Junagadh	Manavadar	Chikhlodra	311
28.	Gujarat	Junagadh	Malia	Jalondar	279
29.	Gujarat	Junagadh	Malia	Chuldi	245
30.	Gujarat	Junagadh	Vanthali	Dungri	210
31.	Haryana	Kurukshetra	Shahbad	Ismailabad (317)	2184
32.	Haryana	Kurukshetra	Thanesar	Josar (428)	965
33.	Haryana	Kurukshetra	Thanesar	Barwa (5)	867
34.	Haryana	Kurukshetra	Pehowa	Murtzapur (48)	771
35.	Haryana	Kurukshetra	Pehowa	Kalsa (1)	600
36.	Haryana	Kurukshetra	Shahbad	Shanti Nagar Alias Kurri (286)	544
37.	Haryana	Kurukshetra	Shahbad	Patti Jhamra Shahbad (Part)(253)	461
38.	Haryana	Kurukshetra	Pehowa	Ramgarh Alias Rohar (60)	385
39.	Haryana	Kurukshetra	Shahbad	Jandheri (Part)(240)	349

No	State	District	Tehsil	Gram Panchayat	No of HHs
40.	Haryana	Kurukshetra	Shahbad	Ajrawar (314)	314
41.	Haryana	Kurukshetra	Thanesar	Baraut (81)	283
42.	Haryana	Kurukshetra	Shahbad	Samalki (219)	263
43.	Haryana	Kurukshetra	Pehowa	Jakhwala (20)	244
44.	Haryana	Kurukshetra	Pehowa	Mandi (415)	226
45.	Haryana	Kurukshetra	Shahbad	Dhakala (269)	200
46.	Haryana	Rewari	Rewari	Maheshari(293)	1651
47.	Haryana	Rewari	Rewari	Ghatal Mahaniawas(291)	1083
48.	Haryana	Rewari	Rewari	Manethi(28)	845
49.	Haryana	Rewari	Rewari	Bharawas(145)	714
50.	Haryana	Rewari	Bawal	Khandewra (50)	607
51.	Haryana	Rewari	Bawal	Raj Garh (47)	549
52.	Haryana	Rewari	Rewari	Khaleta(17)	482
53.	Haryana	Rewari	Rewari	Bhatsana(301)	432
54.	Haryana	Rewari	Rewari	Tint(41)	392
55.	Haryana	Rewari	Rewari	Bhudpur(116)	350
56.	Haryana	Rewari	Rewari	Malpura (295)	334
57.	Haryana	Rewari	Rewari	Ladhuwas Ahir(129)	290
58.	Haryana	Rewari	Rewari	Chandanwas(251)	269
59.	Haryana	Rewari	Rewari	Kishangarh(110)	249
60.	Haryana	Rewari	Rewari	Khushpura(4)	215
61.	Jharkhand	Gumla	Palkot	Palkot	1397
62.	Jharkhand	Gumla	Thethaitangar	Thethaitangar	863
63.	Jharkhand	Gumla	Gumla	Phasia	737
64.	Jharkhand	Gumla	Thethaitangar	Meromdega	605
65.	Jharkhand	Gumla	Jaldega	Orga	481
66.	Jharkhand	Gumla	simdega	Sogra	432
67.	Jharkhand	Gumla	simdega	Jokbahar	390
68.	Jharkhand	Gumla	Kolebira	Dom Toli	363
69.	Jharkhand	Gumla	Kamdara	Renrwa	333
70.	Jharkhand	Gumla	simdega	Taisra	308
71.	Jharkhand	Gumla	Jaldega	Silanga	274
72.	Jharkhand	Gumla	Thethaitangar	Binjhiyabandh	255
73.	Jharkhand	Gumla	Kurdeg	Khalijor	237
74.	Jharkhand	Gumla	Gumla	Barisa	219
75.	Jharkhand	Gumla	Kurdeg	Chhotkibiura	202
76.	Jharkhand	Deogarh	Deoghar	Rohini	966
77.	Jharkhand	Deogarh	Karon	Chitra	451
78.	Jharkhand	Deogarh	Deoghar	Chanddih	409
79.	Jharkhand	Deogarh	Sarwan	Bhandaro	378

No	State	District	Tehsil	Gram Panchayat	No of HHs
80.	Jharkhand	Deogarh	Karon	Pandaniya	349
81.	Jharkhand	Deogarh	Devipur	Bhojpur	323
82.	Jharkhand	Deogarh	Palojori	Patharghatia	306
83.	Jharkhand	Deogarh	Palojori	Chhaglajor	287
84.	Jharkhand	Deogarh	Devipur	Narainpur	270
85.	Jharkhand	Deogarh	Karon	Badiya	261
86.	Jharkhand	Deogarh	Karon	Sabaijor	243
87.	Jharkhand	Deogarh	Karon	Jamuasol	233
88.	Jharkhand	Deogarh	Palojori	Paharudih	220
89.	Jharkhand	Deogarh	Karon	Nawadih	211
90.	Jharkhand	Deogarh	Sarwan	Dundiya	202
91.	Karnataka	Dharwad	Kundgol	Saunshi	2285
92.	Karnataka	Dharwad	Dharwad	Garag	1679
93.	Karnataka	Dharwad	Dharwad	Uppinbetageri	1268
94.	Karnataka	Dharwad	Dharwad	Tadakod	1105
95.	Karnataka	Dharwad	Dharwad	Mugad	893
96.	Karnataka	Dharwad	Hubli	Kirasur	745
97.	Karnataka	Dharwad	Hubli	Bhandiwad	681
98.	Karnataka	Dharwad	Kundgol	Kubihal	624
99.	Karnataka	Dharwad	Navalgund	Belavatagi	515
100.	Karnataka	Dharwad	Kundgol	Hiregunjal	456
101.	Karnataka	Dharwad	Kundgol	Sankalipur	408
102.	Karnataka	Dharwad	Navalgund	Shanawad	352
103.	Karnataka	Dharwad	Dharwad	Guledakoppa	305
104.	Karnataka	Dharwad	Dharwad	Dori	258
105.	Karnataka	Dharwad	Kundgol	Hosakatti	224
106.	Karnataka	Uttara Kannada	Honavar	Manki	3241
107.	Karnataka	Uttara Kannada	Bhatkal	Kaikini	1778
108.	Karnataka	Uttara Kannada	Bhatkal	Bengre	1454
109.	Karnataka	Uttara Kannada	Honavar	Karki	1274
110.	Karnataka	Uttara Kannada	Ankola	Belambar	933
111.	Karnataka	Uttara Kannada	Yellapur	Madnur	771
112.	Karnataka	Uttara Kannada	Haliyal	Mangalawad	671
113.	Karnataka	Uttara Kannada	Mundgod	Chigalli	584
114.	Karnataka	Uttara Kannada	Honavar	Mahime	505
115.	Karnataka	Uttara Kannada	Honavar	Navilgone	429
116.	Karnataka	Uttara Kannada	Kumta	Bargi	359
117.	Karnataka	Uttara Kannada	Ankola	Halvalli	307
118.	Karnataka	Uttara Kannada	Yellapur	Kalache	268
119.	Karnataka	Uttara Kannada	Siddapur	Kyadgi	236

No	State	District	Tehsil	Gram Panchayat	No of HHs
120.	Karnataka	Uttara Kannada	Sirsi	Naroor	209
121.	Kerala	Kannur	Taliparamba	Alakode	7456
122.	Kerala	Kannur	Taliparamba	Payyavoor	5285
123.	Kerala	Kannur	Taliparamba	New Naduvil	4351
124.	Kerala	Kannur	Thalassery	Kottiyoor	3905
125.	Kerala	Kannur	Kannur	Kunhimangalam	3653
126.	Kerala	Kannur	Kannur	Ezhome	3566
127.	Kerala	Kannur	Thalassery	Mokeri	3448
128.	Kerala	Kannur	Thalassery	Manathana	3092
129.	Kerala	Kannur	Thalassery	Keezhur	2963
130.	Kerala	Kannur	Taliparamba	Peringome	2827
131.	Kerala	Kannur	Taliparamba	Pulingome	2650
132.	Kerala	Kannur	Thalassery	Manantheri	2524
133.	Kerala	Kannur	Taliparamba	Kankole	2136
134.	Kerala	Kannur	Taliparamba	Alapadamba	1876
135.	Kerala	Kannur	Thalassery	Tholambra	1208
136.	Kerala	Idukki	Devikulam	Kannan Devan Hills	16249
137.	Kerala	Idukki	Udumbanchola	Kattappana	9000
138.	Kerala	Idukki	Udumbanchola	Ayyappancoil	8049
139.	Kerala	Idukki	Udumbanchola	Konnathady	7222
140.	Kerala	Idukki	Thodupuzha	Vannapuram	6439
141.	Kerala	Idukki	Udumbanchola	Vathikudy	5576
142.	Kerala	Idukki	Udumbanchola	Parathodu	5316
143.	Kerala	Idukki	Peerumade	Upputhara	5004
144.	Kerala	Idukki	Peerumade	Vagamon	4415
145.	Kerala	Idukki	Devikulam	Vellathuval	3431
146.	Kerala	Idukki	Thodupuzha	Idukki (Part)	3069
147.	Kerala	Idukki	Udumbanchola	Udumbanchola	2822
148.	Kerala	Idukki	Thodupuzha	Karikkode (Part)	2671
149.	Kerala	Idukki	Devikulam	Mankulam	2422
150.	Kerala	Idukki	Devikulam	Keezhanthoor	843
151.	Maharashtra	Nashik	Niphad	Pimpalgaon Baswant	4780
152.	Maharashtra	Nashik	Deola	Lohoner	1571
153.	Maharashtra	Nashik	Malegaon	Patane	1190
154.	Maharashtra	Nashik	Baglan	Antapur	889
155.	Maharashtra	Nashik	Sinnar	Vadgaon Pingala	735
156.	Maharashtra	Nashik	Chandvad	Dhodambe	626
157.	Maharashtra	Nashik	Baglan	Sompur	543
158.	Maharashtra	Nashik	Yevla	Nimgaon Madh	472
159.	Maharashtra	Nashik	Niphad	Nimgaon Wakada	421

No	State	District	Tehsil	Gram Panchayat	No of HHs
160.	Maharashtra	Nashik	Nashik	Mahirawani	373
161.	Maharashtra	Nashik	Dindori	Haste Dumala	338
162.	Maharashtra	Nashik	Niphad	Vijay Nagar	305
163.	Maharashtra	Nashik	Surgana	Narul	272
164.	Maharashtra	Nashik	Igatpuri	Bortembhe	239
165.	Maharashtra	Nashik	Sinnar	Aundhewadi	206
166.	Maharashtra	Sangli	Jat	Jat	5607
167.	Maharashtra	Sangli	Miraj	Arag	2668
168.	Maharashtra	Sangli	Palus	Bhilwadi	1946
169.	Maharashtra	Sangli	Shirala	Mangle	1593
170.	Maharashtra	Sangli	Walwa	Gotkhindi	1307
171.	Maharashtra	Sangli	Palus	Malewadi	1114
172.	Maharashtra	Sangli	Tasgaon	Savarde	949
173.	Maharashtra	Sangli	Khanapur	Mahuli	826
174.	Maharashtra	Sangli	Khanapur	Pare	691
175.	Maharashtra	Sangli	Khanapur	Devikhindi	601
176.	Maharashtra	Sangli	Walwa	Surul	515
177.	Maharashtra	Sangli	Palus	Gondilwadi	439
178.	Maharashtra	Sangli	Walwa	Kakachiwadi	363
179.	Maharashtra	Sangli	Kavathe-Mahankal	Thabadewadi	297
180.	Maharashtra	Sangli	Jat	Shedyal	231
181.	Orissa	Anugul	NALCO	Balaramprasad(Part)	1332
182.	Orissa	Anugul	Samal Barrage	Seepur	852
183.	Orissa	Anugul	Colliery	Danara	722
184.	Orissa	Anugul	Anugul	Balasinga	639
185.	Orissa	Anugul	Anugul	Chheliapada	575
186.	Orissa	Anugul	Colliery	Jaganathpur(part)	495
187.	Orissa	Anugul	Kishorenagar	Dhaurapali	431
188.	Orissa	Anugul	Palalahada	Batisuan	397
189.	Orissa	Anugul	Kishorenagar	Himitira	378
190.	Orissa	Anugul	Bantala	Hamamira	351
191.	Orissa	Anugul	NALCO	Ankula(Part)	319
192.	Orissa	Anugul	Bikrampur	Teheranpur	284
193.	Orissa	Anugul	Handapa	Solanda	254
194.	Orissa	Anugul	Bantala	Jamunda	232
195.	Orissa	Anugul	Anugul	Bedasara	201
196.	Orissa	Khorda	Balipatna	Bhakarsahi	1279
197.	Orissa	Khorda	Tangi(P)	Gopalprasad	763
198.	Orissa	Khorda	Balipatna	Makundadaspur	632
199.	Orissa	Khorda	Jatani	Rathipur	578

No	State	District	Tehsil	Gram Panchayat	No of HHs
200.	Orissa	Khorda	Jatani	Ogalapada	510
201.	Orissa	Khorda	Balianta	Uparasahi	472
202.	Orissa	Khorda	Khordha(P)	Muktapur	436
203.	Orissa	Khorda	Jankia(P)	Orabarasingh	404
204.	Orissa	Khorda	Chandaka(P)	Bhatakuri	351
205.	Orissa	Khorda	Tangi(P)	Taladihi	323
206.	Orissa	Khorda	Chandaka(P)	Kujimahal	291
207.	Orissa	Khorda	Khordha(P)	Jhinkijhari	265
208.	Orissa	Khorda	Jankia(P)	Ambhabil	244
209.	Orissa	Khorda	Khordha(P)	Thakurpada	223
210.	Orissa	Khorda	Jankia(P)	Aranga	205
211.	Uttarakhand	Pauri	Kotdwara	Kalagarh Colony	2085
212.	Uttarakhand	Pauri	Kotdwara	Padampur Sukhran	1368
213.	Uttarakhand	Pauri	Kotdwara	Jonk	921
214.	Uttarakhand	Pauri	Srinagar **	Srikot Gagnali	858
215.	Uttarakhand	Pauri	Kotdwara	F-1	838
216.	Uttarakhand	Pauri	Kotdwara	Sitabpur	819
217.	Uttarakhand	Pauri	Lansdowne	Satpuli Sain	713
218.	Uttarakhand	Pauri	Kotdwara	Balasaur	530
219.	Uttarakhand	Pauri	Thali Sain	Kainyur	487
220.	Uttarakhand	Pauri	Lansdowne	Kimgarhi Gawani	445
221.	Uttarakhand	Pauri	Kotdwara	Neenbuchaur	335
222.	Uttarakhand	Pauri	Kotdwara	Ghamandpur	287
223.	Uttarakhand	Pauri	Kotdwara	Ratanpur	249
224.	Uttarakhand	Pauri	Kotdwara	Lalpur	234
225.	Uttarakhand	Pauri	Kotdwara	Mawakot	203
226.	Uttarakhand	Almora	Almora	Khatyari	944
227.	Uttarakhand	Almora	Ranikhet	Talli Riuni	466
228.	Uttarakhand	Almora	Ranikhet	Irha Avam Chak Malla Bayera,Ta	436
229.	Uttarakhand	Almora	Bhikia Sain	Masi	381
230.	Uttarakhand	Almora	Almora	Dugal Khola	339
231.	Uttarakhand	Almora	Almora	Golna Karariya	325
232.	Uttarakhand	Almora	Almora	Sunoli Mafi	265
233.	Uttarakhand	Almora	Almora	Dasoli Badiyar	257
234.	Uttarakhand	Almora	Almora	Pachchisi	245
235.	Uttarakhand	Almora	Ranikhet	Khira	239
236.	Uttarakhand	Almora	Ranikhet	Ashgoli Avam Chakpatal Ravb	229
237.	Uttarakhand	Almora	Almora	Ara Salpar	219
238.	Uttarakhand	Almora	Almora	Balai	214
239.	Uttarakhand	Almora	Bhikia Sain	Matakhani	206

No	State	District	Tehsil	Gram Panchayat	No of HHs
240.	Uttarakhand	Almora	Almora	Chami	200

Annexure 2- Household questionnaire

STUDY ON ABILITY AND WILLINGNESS TO PAY FOR ENERGY SERVICES IN RURAL AREAS						
	State					
	District					
	Name of the Village					
	Interview Date					
	Start Time			End Time		
	Duration of interview					
	Name of the interviewer					
	Name of the Supervisor					
	Quality Check by	AC	SC	BC	Signature	
	Supervisor					
	Field Executive					
	Field Monitor					

Namaste. I am _____ from Synovate SEDC, which is a specialized research and consultancy centre in Synovate a global research company. We carry out studies on various social issues. Currently we are carrying out a study to assess the willingness and ability to pay for energy services in rural areas. This information would be useful for organizations that intend to reach various rural areas to provide and improvise the energy services. We would be grateful if you can give us some time and participate in this survey. This would take about 30 minutes. Before I start if you have any questions related to study you could ask. Further, at any point during the survey if you do not want to answer any questions or chose to not be part of the survey you can opt out.

If the respondent consents, thank the respondent for their time and begin or if does not consent, say thank you and end.
I certify that the nature and purpose, the potential benefits and possible risks associated with participating in this research have been explained to the volunteer.

Q No	Question	Responses	Codes	Instructions	Column No
1.	Name of the respondent				
2.	Address				
3.	Religion				
4.	Caste				
5.	Tribe				
6.	Category of HH	APL	1		
		BPL	2		
		Others- Specify	3		
7.	Characteristics of household members starting with self	Kindly refer the codes for various options from the table below			

Relationship with Head of HH	Code	Age	Code	Sex	Code	Educational Qualification	Code	Occupation	Code	Monthly Income	Code
Self	1	<18 yrs	1	Male	1	Never attended school	1	Agriculture on own land	1	> 3000	1
Husband	2	19-24 yrs	2	Female	2	Primary	2	Agriculture on others land	2	3001-5000	2
Wife	3	25-30 yrs	3			Upper Primary	3	Labourer	3	5001 – 10000	3
Daughter	4	31-35 yrs	4			Secondary	4	Own business	4	10001 – 15000	4
Son	5	36-40 yrs	5			Higher Secondary	5	Industry worker	5	15001 – 20000	5
Brother	6	> 40 years	6			Diploma	6	Self employed	6	20001 - 25000	6
Sister	7					Degree and Above	7	Government job	7	>25001	7
Father	8										
Mother	9										
FIL	10										
MIL	11										
Others specify											

QNo	Question	Responses	Codes	Instructions	Column No
8.	Type of House	Individual Cemented (Pucca)	1		
		Kuccha	2		
		Any Other, Specify			
9.	Do you own this house?	Owned	1		
		Rented	2		

QNo	Question	Responses	Codes	Instructions	Column No
10.	Do you own any land in this village?	Yes	1		
		No	2		
11.	If yes, how much land do you own	No agricultural land	1		
		Less than 1 acre	2		
		1 to 5 acre	3		
		More than 5 acre	4		
12.	Is the land that you own	Only irrigated	1		
		Only non irrigated	2		
		Partly irrigated and partly non irrigated	3		
13.	Can you state for what purpose the land is primarily used?	Agriculture	1		
		Business	2		
		Not used for anything	3		
		Any other, Specify			
14.	If land is used for agriculture, is it irrigated?	Yes	1		
		No	2		
15.	If yes, what is the source of irrigation?	Well	1		
		Tube well	2		
		Tank	3		
		Any other, Specify			
16.	What source of energy is used for irrigation?	Electricity	1		
		Diesel	2		
		Another, Specify			
17.	Are you or any of your family members in debt?	Yes	1		
		No	2		
18.	If yes, what are the reasons for the debt				
19.	Can you tell us how much is the debt?				
20.	What is the source of water in your house	Government Pipeline within the house	1		
		Government pipeline outside the house	2		
		Tanker	3		
		Well	4		
		Hand pump	5		
		Any other, specify			
	Current Energy Consumption				
21.	Is your village electrified?	Yes	1		
		No	2		
22.	What are the sources of	Electricity	1		

QNo	Question	Responses		Codes	Instructions	Column No
	energy used in your house?	Solar energy		2		
		Firewood		3		
		Kerosene		4		
		LPG		5		
		Electric Generator		6		
		Charcoal		7		
		Animal Dung		8		
		Crop Residue		9		
		Any other, Specify				
23.	Does your house have an electricity connection?	Yes		1		
		No		2		
	For Households having Electric connection					
24.	If yes, when was the electric connection made available to your house?					
25.	What is the source of electric connection to your household?	Government / Municipal comnnection		1		
		Private firm connection (specify name)		2		
		Pulled electricity line from local area line		3		
		Pulled connection from neighbour		4		
		Any other, Specify				
26.	Did you pay any initial connection charges for the electricity?	Yes		1		
		No		2		
27.	If yes, can you specify the amount?					
28.	Whom did you pay the amount to?	To the distributing company		1		
		To the neighbor / relative		2		
		Any other, Specify				
29.	What is your average monthly bill for electricity?					
30.	Whom do you pay the monthly bills to?	To the distributing company		1		
		To the neighbor / relative		2		
		Any other, Specify				
31.	Can you tell us what your last bill amount was? (Request to see the last bill receipt paid)					
32.	Can you list the purposes for which electricity is used in your house and on an average what is the percentage of electricity usage for the same.	**Purpose**	**Percentage**			
		Lighting		1		
		Cooking		2		
		Electrical appliances		3		
		Agriculture		4		
		Business		5		
		Any other, Specify				

QNo	Question	Responses				Codes	Instructions	Column No
33.	Does your household use any incandescent light bulbs?	Yes				1		
		No				2		
34.	If yes, kindly state the numbers and number of hours they are used.	Type of light	Number of bulbs	Hrs of usage				
		25 Watts						
		50 Watts						
		75 Watts						
		100 Watts						
35.	How many hours per day does your home typically have electricity service?							
36.	How many days per month does your household typically have electricity service?		Summer	Winter	Monsoon			
		Normal				1		
		Irregular				2		
37.	Over the past one month, how many times has the household's electricity services failed for more than 30 minutes?	Number of times				1		
		Never				2		
		Don"t know				3		
38.	Over the past one month could you estimate the amount of hours (in total) electricity supply has not been available to your home due to electricity cuts or blackouts?							
39.	Over the past one month how often did the household experience dimming of light?	Often				1		
		Rarely				2		
		Never				3		
40.	In case of power failure, what backup equipment does the household use, if any?	Candles				1		
		Kerosene wick lamp				2		
		Gas lamp				3		
		Generator				4		
		Any Other, specify						
41.	Are you satisfied with the current electricity supply to your household?	Yes				1		
		No				2		
42.	If no, can you state the reason for the same							
	For Households having no Electric connection							
43.	Kindly state the reason	Electricity is not available in my area				1		

QNo	Question	Responses	Codes	Instructions	Column No
	for no electricity connection to your household.	We cannot pay the connection fee	2		
		We cannot afford to pay the monthly bills	3		
		We cannot afford to buy electrical equipment	4		
		We are satisfied with the present energy source	5		
		We do not see any need for electricity	6		
		Any Other, specify			
44.	In absence of electricity, which is the major source of energy used in your household?	Solar energy	2		
		Firewood	3		
		Kerosene	4		
		LPG	5		
		Generator	6		
		Charcoal	7		
		Animal Dung	8		
		Crop residue	9		
		Any other, Specify			
45.	What is your current expenditure per month on energy sources used in your household	Solar energy			
		Firewood			
		Kerosene			
		LPG			
		Generator			
		Charcoal			
		Animal Dung			
		Crop residue			
		Any other, Specify			
	Use of Kerosene				
46.	In the past one month did your household use Kerosene?	Yes	1		
		No	2		
47.	How many liters of Kerosene do you use per month and at what price?				
48.	From where do procure your monthly quota of Kerosene?	The ration Shop	1		
		Private shops	2		
		Any other, Specify			
49.	Is Kerosene easily made available to you?	Yes	1		
		No	2		
50.	If no, what are the problems faced by you in procuring kerosene from the market?				

QNo	Question	Responses			Codes	Instructions	Column No
51.	For what purposes does your household use kerosene for? What percentage of kerosene is used each month for these purposes?	Purposes		Percentage			
		To start firewood					
		To light lamps					
		Cooking					
		Appliances					
		Home Business					
		Any Other, Specify					
	Use of Generator						
52.	Does your household have a generator?	Yes			1		
		No			2		
53.	Ownership of the generator	Owned (Specify total cost)			1		
		Leased (Specify monthly payment)			2		
		Rented (Specify monthly rent)			3		
54.	What is the type of fuel the generator uses and state the monthly expenditure incurred on the same.	Fuel	No. of liters/month	Average expenditure /month			
		Diesel			1		
		Gasoline			2		
55.	On an average, how much do you spend per month on repairs and maintenance of the generator set?						
56.	Kindly state the number of incandescent light bulbs energized by the generator and number of hours they are used.	Type of light	Number of bulbs	Hrs of usage			
		25 Watts					
		50 Watts					
		75 Watts					
		100 Watts					
57.	Can you list the purposes for which the generator is used in your house and on an average what is the percentage of your household monthly spending on generator set is for the purposes mentioned.	**Purpose**		**Percentage**			
		Lighting					
		Cooking					
		Electrical appliances					
		Agriculture					
		Business					
		Any other, Specify					
	Use of Firewood						
58.	In the past one month did your household use firewood at home?	Yes			1		
		No			2		
59.	How does your household obtain firewood?	Purchase only			1		
		Collect only			2		
		Purchased and collected			3		
		Any other, Specify					
60.	If purchased, can you specify how much is						

QNo	Question	Responses	Codes	Instructions	Column No
	spent on the same over a period of one month?				
61.	If collected, can you specify how many times did your household collect firewood last month?				
62.	What is the approximate distance travelled to collect the firewood?				
63.	Generally, who from the household goes to collect the firewood?	Men	1		
		Women	2		
		Both	3		
		Children	4		
	Use of Agriculture Residue				
64.	In the past month did your household use agriculture residue at home?	Yes	1		
		No	2		
65.	Can you specify how many times your household collected agriculture residue last month?				
66.	What is the approximate distance traveled to collect the agriculture residue?				
	Use of Animal Dung				
67.	In the past month did your household use animal dung at home?	Yes	1		
		No	2		
68.	Can you specify how many times your household collected animal dung last month?				
69.	Who usually collects animal dung at your household?	Men	1		
		Women	2		
		Both	3		
		Childern	4		
	Use of Pumps				
70.	Does your household have any pumps?				
71.	If yes, how many?				
72.	For what activities does your household utilize the pumps?	Irrigation			
		Filling up water tanks			
		Any Other, Specify			
73.	Can you specify what the average monthly expense				

QNo	Question	Responses	Codes	Instructions	Column No
	on the pumps is?				
	Willingness to have an electricity connection				
74.	Do you think having an electricity connection will help better your lifestyle?	Yes	1		
		No	2		
75.	If yes, How?				
76.	Would you like to have access to electricity connection in your house?	Yes	1		
		No	2		
77.	If no, Why?	1			
		2			
		3			
78.	If yes, How do you think electricity will impact the lives of women in your household				
79.	How will it impact children				
80.	How will it impact your work/ income				
81.	How will it impact your village				
	Willingness to pay				
82.	Are you aware that to get an electric connection you need to pay initial connection charges?	Yes	1		
		No	2		
83.	Are you willing to pay the initial amount for getting the electric connection?	Yes	1		
		No	2		

QNo	Question	Responses	Codes	Instructions	Column No
84.	How much can you pay for getting the electric connection?				
85.	Are you aware you have to pay monthly bills once you get the electric connection?	Yes	1		
		No	2		
86.	How much can you pay for the monthly bills?				

A few statements on usefulness of electricity have been listed down. Kindly tell us if you agree or disagree with the statements.

S.no	Statements	Agree	Disagree	Can't say	Column No
1.	Electricity is very important for children"s education.	1	2	3	
2.	With electrical light children can study at night	1	2	3	
3.	Even without electricity it is easy to read at night in the home.	1	2	3	
4.	Reading with electrical light is better than with the light of candles or lamp.	1	2	3	
5.	Our household is happy with the lighting system that we have in our home.	1	2	3	
6.	To use kerosene or oil is harmful for the health.	1	2	3	
7.	A solar PV home system is a good source of electricity.	1	2	3	
8.	Electricity helps with domestic tasks and care of the children.	1	2	3	
9.	The monthly electric bill is or would be a financial burden for my family.	1	2	3	
10.	Monthly spending for non-electric energy sources is/was a financial burden for my family.	1	2	3	
11.	Even without electricity women in my household feel safe to go out in the evenings.	1	2	3	
12.	The electricity makes it easy to have information and the news.	1	2	3	
13.	Watching TV provides/ will provide my household with great	1	2	3	

S.no	Statements	Agree	Disagree	Can't say	Column No
	entertainment.				
14.	News and information from radio and television provide good information relevant for conducting business.	1	2	3	
15.	News and information from radio and television provide useful information about agricultural activities.	1	2	3	
16.	News and information from radio and television provide good knowledge on family health issues.	1	2	3	
17.	The health of women will improve if electricity is made available to the household	1	2	3	
18.	Electricity is an essential commodity for me rather than a value added service	1	2	3	

Address for Communication:

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