



  
Quality in Everything We Do

# Models of Rural Electrification

## Report to Forum of Indian Regulators

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## EXECUTIVE SUMMARY

The Electricity Act, 2003 has accorded renewed priority to rural electrification and provision of electricity services in order to bring about a change in the overall grim picture of the state of rural electrification in the country. While several policy initiatives have been taken in the past, they have failed to successfully address the requirement on account of various impediments, including poor revenue realisation by the State utilities in the rural areas, high technical and commercial losses, low paying capacity of the rural populace etc.

Considering the prevailing conditions in the rural electricity services, it has thus become imperative to come up with alternative supply models for extending electricity services to the rural areas, based on the prevailing conditions in a particular area. The requirement at this juncture is to have a holistic approach to the entire program and suggest models that are sustainable in the long run. For this purpose it is important to incorporate the national and international best practices from successful models of rural electrification and dovetail them with the prevailing rural conditions and existing supply modes in a particular region.

The Forum of Indian Regulators (FOIR) has commissioned this study to evaluate such alternative models. This report has benefited from the guidance and advice of the sub-Committee set up by FOIR for the study. The key recommendations from the study are summarised below:

1. The specific approach to be adopted in a particular area must take into consideration a host of conditions in terms of characteristic load, indicative demand, capability of local governance systems, and feasibility of local participation, renewable energy potential, extent of grid penetration, distance from the main grid substations and current status of availability of grid power.

2. While there would be inevitable variations in the solutions implemented in various areas depending on local circumstances, this study envisages four broad categories of solutions for rural electrification needs:
- (i) **Grid Supply with Distribution Strengthening** – The key objective under this option would be to strengthen distribution and supply by extending grid connection and local community participation models in metering, billing and collection activities. The nature of demand addressed would be industrial, commercial and rural livelihood.
  - (ii) **Distributed Generation with Grid Back up** – The objective would be to augment grid power availability to the rural areas, using local resources, where available. In particular, in areas with low grid penetration and availability of grid power, standalone home systems or a standalone distributed generation facility (mini- hydro biomass, other technologies), could provide workable and economically viable solutions.
  - (iii) **Independent Micro Grids with Local Generation** - The objective would be to provide village or a cluster of villages (or hamlets) with electricity to create an independent self sufficient generation mini distribution network. Such standalone generation and distribution systems would be particularly viable in remote rural areas where providing grid access as well as management of grid based systems is technically infeasible, or is expensive. Local resource availability (biomass, micro-hydro, etc) is a pre-requisite for this service option.
  - (iv) **Individual home systems** - Providing household electrification solution to remote isolated villages where there is no aggregated demand through solar home systems (or any alternate energy source) would be the objective under this service option.

3. This study has categorised the states based on certain objective criteria. In particular, two key criteria identified include:
  - i. Current availability of grid power;
  - ii. Penetration of the existing electricity grid
4. In areas where there is fairly good grid penetration and availability of grid power, the key problem is of high cost of service, which in turn is caused by high commercial losses. The commercial losses can be reduced by re-focusing on the metering, billing and collection.
5. In states where there is availability of grid power but penetration of grid is low, the focus should be on grid extension only, whereas in areas with high grid penetration and low reliability of supply, there should be Distributed Generation facility with grid back –up to augment the grid supply. In such states small power through distributed generation could effectively complement grid based additions.
6. In other states, with poor network connectivity as well as inadequate sources of grid power the immediate focus has to be on off-grid systems, which could include standalone generation and distribution systems, as well as home systems. As the study identifies, application of a particular model is not in exclusion of others, and states could select more than one model based on what suits various parts of the geography of the particular state the best. However the predominant mode of service provision can be identified based on the categorisation provided.
7. Implementation of the models relies heavily on the institutional framework that is concurrently implemented, which in turn is dependent on local culture and strength (or practices) of local governance. In areas with strong local governance, there is a potential of formation of cooperatives or the

involvement of the village Panchayat in acting as a franchisee for metering, billing and collection. In fact, such local institutions can be the mainstay for local distributed generation by means identified in this report. In areas, where the strength of local governance is relatively lower, a facilitating agency (NGO/ Self Help Group/ Village Nodal Person) to organize the rural populace into a village society who could undertake the activities of a village level franchisee. In areas where the strength or potential of local governance systems is low, standalone generation by entrepreneurs or home systems could provide the default service option till the governance systems develop as a part of wider social development.

8. An aspect of great significance is the financial viability of the proposed arrangements in a particular area. This study demonstrates that under various efficiency and financing assumptions, the alternatives proposed can provide services at lower costs and higher efficiency levels. The key issue that arises is that of sustainability. A key finding of the study was that rural electricity services pose much greater challenges than urban services. Hence, for sustainability of rural services, the issues must be addressed in a deliberate and distinct fashion. After extensive consultation (including with the FOIR sub-committee), a common view that has emerged is that the entire institutional mechanism for rural areas should be separate from that for urban areas. This would necessitate separation of main operations from the rural operations, adopting specific policies and plans for rural operations and creation of a state nodal agency that would facilitate the implementation of the entire rural electrification program.
9. While it was initially envisaged that a Nodal Agency would be created for policy, planning, monitoring, and regulation, the expert consultation process revealed the need for including operations within the ambit of the Nodal Agency. The view was that (at least at this stage of development), unless

the Nodal Agency has implementation powers, the effectiveness of the Nodal Agency could be compromised. The separation of operations responsibilities from the others can be revisited at a later stage. Based on the above, the key roles of the Nodal Agency (hereon referred to as **RuralCo**) would include:

- Appraise and prioritize projects for funding based in accordance with master plans created;
- Development of project schemes for funding;
- Channelize the capital and operating subsidies;
- Facilitate the necessary institutional capacity building and training;
- Development of standard contractual structures;
- Bid out projects for PPP/PSP
- Regulatory support; and
- Operations of rural electricity systems transferred to it from the parent utility.

In effect the RuralCo would operate as the licensee in the rural areas, but with a greatly enhanced set of roles and responsibilities for successful implementation of the rural electrification program.

10. Going forward, we envisage private sector participation to be a necessity for successful rural electricity service provision. As rural electrification progresses, private entrepreneurship and public private partnerships (PPP) must be encouraged. The policy framework and its implementation through the RuralCo would have a critical bearing of success of private entrepreneurship and PPP approaches. This report envisages the following development stages facilitated by the RuralCo for rapid advancement of rural electrification.

- a. **Stage 1: Policy and Planning** - The main activities in this stage are to establish an *Overall Electrification Strategy* for the State and develop a *Service Master Plan*.
  - b. **Stage 2: Preparatory and Selection phase** - *Development of Standard Structures and Instruments* for each service option followed by the *Bid Process* for award of the projects to interested parties.
  - c. **Stage 3: Development Stage** - *Contracting and Financing* and *Project Implementation*.
  - d. **Stage 4: Project Operation** - *Review and monitoring of Projects* and future *Expansion and Up-gradation*.
11. Subsidies have always been an integral part of rural electricity service provision. The key challenge is to make the subsidies more transparent and efficient. This study concludes that subsidies should ideally be restricted to capital cost financing while operating costs should be paid for by users. Projects that desire subsidies should be qualified based on their ability to pay for operating costs and a part of their operating costs. However in the initial period, a few years of viability gap funding may be necessary for certain projects where long term viability is otherwise not in question.
12. The report identifies in detail the roles of the various agencies involved in the process, highlights of which are provided below:
- a. **State Government** - The State government would have part to play in facilitation of network transfer to the rural local bodies from the state utilities. Creation of State nodal agency as a counter-part body

for facilitation of RE projects is also an essential role that the State Government would have to undertake.

- b. **State Electricity Regulatory Commission** - The Commission will have a role in the following:
- Providing policy inputs on rural electrification policy as required by the Act;
  - Approving licenses and license exemptions;
  - Approving retail and bulk tariffs, where applicable;
  - Promoting co-generation and non-conventional energy;
  - Waiving the additional surcharge under Section 42(2) of the Electricity Act, 2003 on open access for transactions involving generators undertaking distributed generation in rural areas (where applicable)
- c. **Nodal Agency or RuralCo** - Main facilitator of the implementation program with the roles as identified earlier.
- d. **Developer/Service Provider**- Identify Opportunity, participate in bid process or in negotiations with Nodal Agency, develop Detailed Project Reports, enter into contracts for fuel, arrange financing and undertake financial close, construct ,operate and maintain projects.
- e. **Local Bodies (Zilla, Taluka and Village Level) /Self Help Groups/NGO** - Provide inputs for Master Plan creation and updation, provide fuel supplies from local plantations/fallow land (where applicable), enter into Fuel Supply Agreements ,manage local distribution services as franchisee.

## 1 Background

Rural Electrification (RE) has been in the focus of policy makers for the past several decades. However this policy priority has rarely translated into effective schemes on the ground. A combination of factors ranging from low tariffs, high cost to serve, poor efficiency levels and inappropriate organizational frameworks have led to continued neglect of rural India insofar as electricity services are concerned. Even within the overall levels of electrification in the country, the widespread regional disparities are a matter of genuine concern for policy makers and for the regulators.

The Electricity Act, 2003 (hereinafter referred as the “Act”) seeks to bring about a change in this picture. Through the law, rural electrification and provision of electricity services has been accorded renewed priority. Section 6 of the Act mandates that the Government shall endeavour to supply electricity to all areas including villages and hamlets. Section 5 directs the Government to formulate a national policy (in consultation with the state Governments and states Commissions) for rural electrification and for the management of local distribution through Panchayats and other local institutions. Further Section 4 says that for setting up power generating plants in local area on a stand alone basis no permission is required.

As a part of the efforts of Govt. of India to achieve the goal “Electricity for All”, rural electrification has been identified as a major thrust area. For this purpose an “Accelerated Rural Electrification Project” for electrification of One Lakh Villages and One Crore Households was launched in February 2004 as a national programme with an overall outlay of Rs. 6,000 Crores in which 40% was grant and 60% loan. The Central Government, in the last Finance Bill has enhanced the grant component to 90%. A plan for rural electrification – “The Rajiv Gandhi Grameen Vidyutikaran Yojana – has been launched to extend rural electricity

services to hitherto unelectrified areas, with requisite additional funds provided for in the Union Budget.

### **Objectives of this study**

The objective of this study, commissioned by FOIR, is to overcome this stalemate and suggest alternative approaches on rural electrification in India. The suggested models of rural electrification would be as per the provisions of the Act and based on the prevailing conditions in a particular area. Key learnings and best practices from International RE experiences would also be incorporated, so that the emerging solutions are of practical relevance with wide applicability. To summarise, the objectives of the study are as follows:

- Carry out a detailed study of the existing rural supply in the country
- Dovetailing the current rural electricity supply modes in the light of various policy pronouncements made by the Government
- Document Case Studies of Rural Electrification of five specific states – Karnataka, West Bengal, Uttar Pradesh, Jharkhand, Madhya Pradesh
- Undertake review of financing and subsidy related issues
- Analysis of institutional arrangement for sustaining the RE efforts
- Recommend various modes of rural electrification

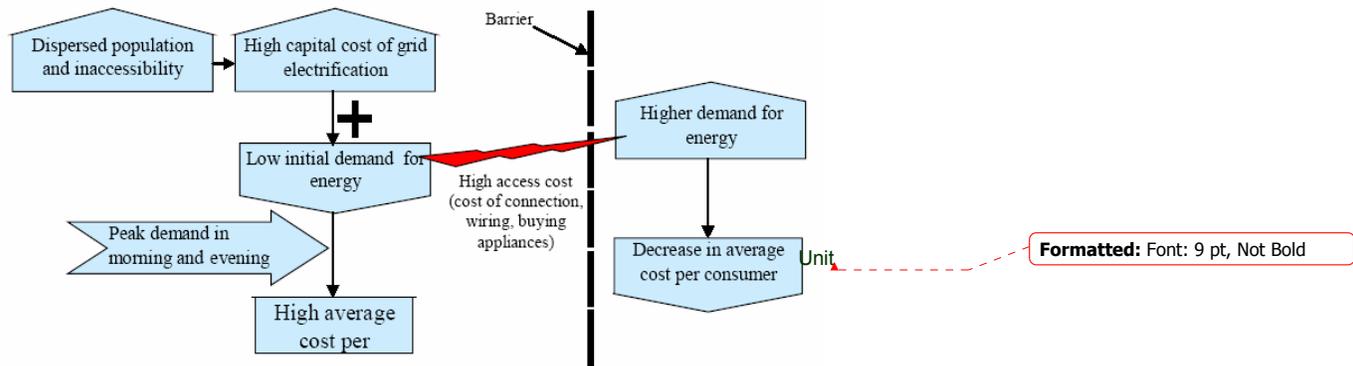
### ***Why the need for alternative approaches to rural electrification?***

In India, the State Electricity Boards (SEB) are at the heart of the Power System. The system, however, has been supplying power in an ever worsening manner and even if the absolute level of generation rises, it is not able to keep up with the social and economic demands of a large population and growing economy. There

is a crisis of production as the gap between demand and supply increases and a crisis of maintenance and functioning as power cuts generalize to become endemic. There is a financial crisis faced by the SEBs, burdened by huge arrears of payments.

The supply of electricity to rural areas has been attempted almost exclusively through conventional grid supply by the State utility. There is a significant disincentive from the part of the State utilities to extend either better service to the rural consumer or provide extended hours of supply. This in turn results in low collection efficiency and high distribution losses. The tariffs in rural areas have also been very low compared to the urban areas. The average rural tariff in the country as on October 2005 is 109 paise compared to the urban domestic tariff level of the lowest slab which is 190 paise. The delivered cost of per unit for which dues are collected by the utility rises sharply with deterioration in supply and collection parameters. The low levels of rural demand consequent to poor supply conditions also amplifies the per-unit cost of supply as shown below in the diagram:

**Figure2: Barriers to Accessing Rural Electricity Services**



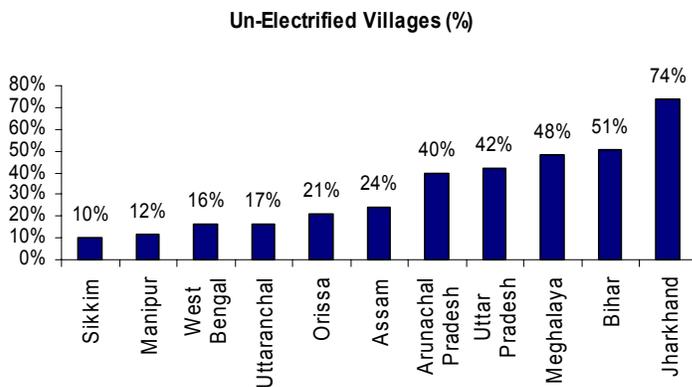
Source: *Subsidizing Rural Electrification in South Asia: An Introductory Guide prepared by Nexant for USAID SARI/ Energy Program*

In view of the poor quality of service, attempts in various states to rationalise user tariffs and reduce cross-subsidies have faced significant hurdles. Increasing level of tariffs along with the poor supply and service conditions have led to discord between the rural consumers and the utilities, which have been facing considerable problems in collecting the dues payable by these consumers. The poor collection efficiency of dues coupled with the high technical and distribution losses leads to a situation where the cost to recovery ratio becomes unacceptably high. This is almost a universal phenomenon in all states in the country.

### 1.1 Overall Status of Rural Electricity Services in India

In spite of several policy interventions across the years, actual performance on rural electricity services continues to be dismal. One out of six Indian villages still do not have access in electricity. The following sections provide the details of the current rural electrification status across States and an analysis of the causal factors behind the success/failure of rural electrification efforts in the States.

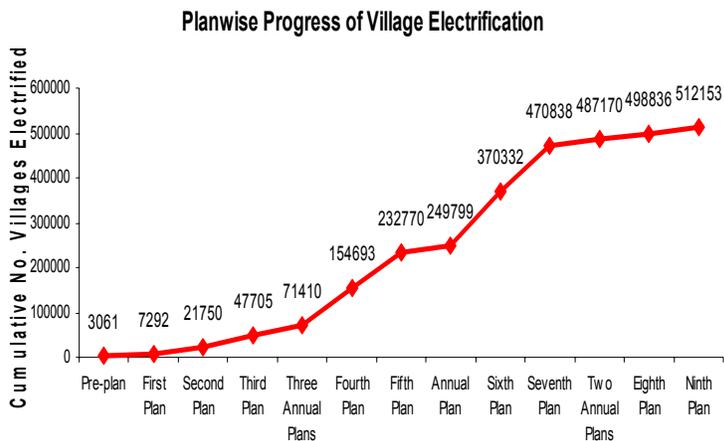
Fig: Indian States with more than 10% of un-electrified villages



Source: Ministry of Power Data on village electrification

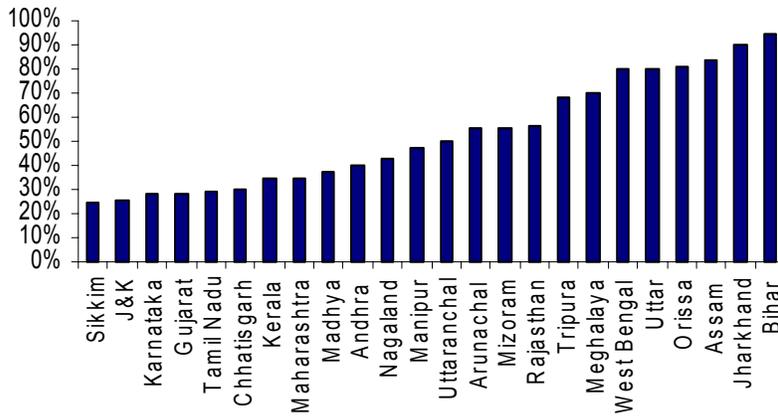
The above figure shows the levels of rural electrification as per the new definition of rural electrification. It shows that there is wide disparity in the levels of rural

electrification between states. Over the last two decades, the pace of rural electrification has slowed down as shown in the following figure:



In terms of household access to electrification, there hasn't been much progress so far. As per the 2001 Census, the national average of access to electricity by rural households stands at a mere 43.5%.

Un-Electrified Households (%)



India being primarily an agricultural economy, the Government of India (GoI) viewed Rural Electrification as a prime mover for rural development. It is also considered the basic pre-requisite for all industrial activity and contributes significantly to increasing agricultural productivity, jobs and income generation activities. GOI from has launched a number of schemes for electrification of rural areas in the country from time to time. These include:

- Minimum Needs Programme (MNP)
- Prime Minister Gramodaya Yojana (PMGY)
- Kutir Jyoti
- Accelerated Electrification of One lakh villages and One Crore households
- Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)

## 1.2 **Review of the Past Rural Electrification Programs**

This section reviews the various programmes that have been undertaken in the past for rural electrification in the country, with varies levels of success. Through an interview and analysis process the Project Team has analysed the relative successes and failures of the schemes.

### 1.2.1 **Minimum Needs Program (MNP)**

**Initiation** - The MNP was started in the Fifth Five Year Plan (1974-79) and rural electrification was one of the components of the program.

**Implementing Agency-** State Electricity Boards

**Scope of the program** - Funds were provided as Central assistance to the States in the form of grants and loans. The areas covered under MNP for the purposes of rural electrification were remote, far flung and difficult villages with low load potential. For identifying the beneficiaries and beneficiary areas, certain all India norms were taken as benchmarks at various points of time and the MNP assistance was directed to the population/area with low level of achievement below respective benchmark level.

**Reason for limited impact** - In the beginning, loans were made available at interest rates lower than the funds provided under the budgetary support for rural electrification by Government of India. However, over a period of time rate of interest charged under the MNP and the normal budgetary support became equal with the result that State Electricity Boards had to bear the burden of higher rate of interest for these uneconomical programmes.

No funds were released under the scheme from 2004-05 onwards in view of it being merged with the new scheme Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY).

### 1.2.2 Pradhan Mantri Gramodaya Yojana (PMGY)

**Initiation** - This scheme was launched in 2000-01 but rural electrification component was added only in the next year i.e. 2001-02.

**Implementing Agency** – State Electricity Boards / Electricity Departments/ Power Utilities

**Scope of the program** - Funds were released by State Governments to the implementing agencies and funds under the programme were provided to the States as additional Central assistance which followed the normal pattern of central assistance i.e. 90% grant & 10% loans for special category states, 30% grant & 70% loan for other states.

The states had discretion of utilizing the funds for different components as per their own priorities. At least one dalit/tribal basti was to be included in each un-electrified village being taken up for electrification. This condition was relaxed if there were no dalit/tribal basti left to be electrified in that village. In the states where 100% villages were already electrified, the implementation agencies could take up dalit/tribal bastis and if all the dalit/tribal bastis had also been electrified, they could take up electrification of hamlets or load intensification.

**Reason for limited impact** - Difficulties were faced under this scheme on account of no clear cut earmarking of percentage of funds for rural electrification. Many States directed the funds to other areas and Rural Electrification was neglected in the process.

### 1.2.3 Kutir Jyoti Scheme

**Initiation** - This program was launched in 1988-89.

**Implementing Agency** – State Electricity Boards

**Scope of the program** – The objective of the program was extending single point light connections to households of rural poor families below the poverty line including *Harijans* and *Adivasi* families. In the Kutir Jyoti Yojana, the outlay used to be allocated amongst the states based on two indicators i.e. size of rural population below the poverty line and level of village electrification obtained in the state in a manner that higher weightage is given to states with larger population of rural poor and with low electrification level. Under this programme, one time cost of internal wiring and service connection charges was provided by way of 100% grant to the states. The norm for grant per connection was changed from time to time as follows:

1988-90	Rs 180
1992-94	Rs400
1996-98	Rs 800 for un-metered connections and
	Rs 1000 for metered connections
March 2002	Rs 1500
	Rs 1800 for special category states*

[\*Special category states include Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Sikkim and North-Eastern States]

**Reason for limited impact** – According to an evaluation study set up by Ministry of Power, one of the reasons for low willingness on the part of beneficiaries to go for this programme was un-reliable and poor quality of supply in states like Uttar Pradesh and Bihar. It was found that because of these reasons beneficiary did not pay the bills as there was no use of the connection.

In May 2004, it was merged into programme for "*Accelerated Electrification of One Lakh villages and One Crore households*".

#### 1.2.4 Accelerated Rural Electrification Programme (AREP)

**Initiation** - The scheme was introduced in the year 2003-04

**Implementing Agency** – State Governments through State Electricity Boards / Power Utilities

**Scope of the program** – Interest subsidy of 4% was provided on loans availed by state governments/power utilities from financial institutions like Rural Electrification Corporation (REC), Power Finance Corporation (PFC), Rural Infrastructure Development Fund (RIDF), National Agricultural Bank and Rural Development (NABARD) etc. for carrying out rural electrification programme.

The assistance was limited to electrification of un-electrified villages, electrification of hamlets/dalit bastis/tribal villages and electrification of households in villages through both conventional and non-conventional sources of energy. Funds were provided on the basis of Net Present Value (NPV) of the interest subsidies applicable on disbursement.

#### 1.2.5 Accelerated Electrification of One lakh villages and One Crore households

**Initiation** - The scheme was introduced in the year 2004-05 by merging interest subsidy scheme AREP (Accelerated Rural Electrification Programme) and Kutir Jyoti Programme.

**Implementing Agency** – District Electricity Committees were to be constituted under section 166 (5) of the Electricity Act 2003 by the State government to facilitate proactive role for expeditious rural electrification in the district and monitor the functioning of projects. Scheme was implemented under overall supervision and control of REC as lead agency for the scheme.

**Scope of the program** – Under this scheme, there was a provision for providing 40% capital subsidy for rural electrification projects and the balance as loan assistance on soft terms from REC. Salient features of the scheme are as under:

- Grid based projects as well as stand-alone projects based on distributed generation were eligible for capital subsidies.
- Capital subsidy (up to 40% of capital cost) was to be linked to sustain delivery of electricity to the targeted beneficiaries over the project life of 15 years.
- Balance funds for the project were to be provided by REC as loan assistance.
- For availing capital subsidy, projects needed to demonstrate revenue stream that resulted in sustainable operations with the given level of capital subsidy.
- In the event the revenue streams were based on continuing subsidies from state governments, the same needed to be supported by satisfactory evidence of such continuing support.
- Projects had a universal obligation to provide electricity to all consumers on demand.
- Tariff was to be agreed between the beneficiaries and the Rural Electricity Supply Provider with the involvement of Panchayats, Cooperative, NGOs, and Franchisees etc.
- In electrified villages, 100% grant was to be provided for electrification of BPL households as per existing Kutir Jyoti guidelines.
- Scheme was to be aligned with the policies under section 4 and 5 of the Electricity Act 2003 to facilitate sustainable provision of electricity in rural areas.
- State Governments were required to make all projects receiving subsidy compliant with sections 13 and 14 of the Electricity Act, 2003 so as to enable rural electricity services providers (other than existing state

utilities/distribution licensees) to act outside the purview of the state electricity regulatory commissions for purposes of tariff determination (Section 61, 62 and 86 of the Electricity Act, 2003).

### 1.2.6 Reviewing of the Schemes – Key Findings

The proper implementation of the Rural Electrification schemes in the past had some shortcomings in the methods of implementation. Schemes like the Minimum Needs Program (MNP) and Prime Minister's Gramodaya Yojana (PMGY) provided for assistance under the state sector as additional central assistance, with the states allowed to choose the pace and direction of rural electrification. The funds had to be released to the states and in turn to the implementing agencies and in many cases the funds would not reach in time. The following were the primary reasons for the limited impact of the earlier Rural Electrification schemes:

- The village electrification was left to the State Electricity Boards, which were in bad financial health and not in a position to provide sufficient funds.
- The task of maintenance of rural electricity infrastructure was with the State Utilities which did not have the necessary manpower in the rural areas; as a result substantial infrastructure became useless. Neglect of revenue sustainability of the additional electrification infrastructure for the rural areas made the SEBs reluctant to take up rural electrification as it led to more losses. The programmes were not implemented on a top priority basis.

Thus, there was a need of a more comprehensive scheme that would address all the issues viz. development of rural electrification infrastructure in rural areas, increase the viability of rural electricity infrastructure by covering all BPL families,

set up a uniform village infrastructure at block level to cater to non domestic demand of power etc.

### 1.2.7 Current Rural Electrification Program

#### ***Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)***

Government of India under the National Electricity Policy has taken a decision to electrify all villages and provide accessibility to all households in rural areas over a period of four years. To ensure that electricity reaches all villages and rural households, the provision has been made to create Rural Electricity Distribution Backbone (REQB) at the block level besides covering BPL households in rural areas. Since this programme envisaged covering un-electrified villages and households, all villages, including bordering villages were expected to be covered.

In order to achieve the above objective, Government of India conceived and launched "Rajiv Gandhi Grameen Vidyutikaran Yojana" with the requirement of Rs 160 billion of which Rs 50 billion has been provided for Tenth Plan to cover 50,000 villages. The scheme will be implemented through the Rural Electrification Corporation (REC). This scheme merges the Minimum Needs Programme for rural electrification, and scheme of "Accelerated Electrification of One lakh villages and one Crore households".

Details of the scheme are provided in the Annexure I to this report. The electrification targets outlined in the scheme (which is also reflected in the National Electricity Policy, 2005 and the Rural Electrification Policy, 2006)

**Table: Village Electrification Targets**

Tenth Plan	I Year (2005-06)	10,000
	II Year (2006-07)	40,000
Eleventh Plan	III Year (2007-08)	40,000
	IV Year (2008-09)	10,000
	<b>Total</b>	<b>1,00,000</b>

### Cost Estimates of the Scheme

The table below provides the cost estimates of the RGGVY program

Table: Cost Estimation – RGGVY

(Rs Crore)

1	Electrification of 125000 un-electrified villages including REDB and VEI and last mile service connectivity to 10% in the village @ Rs 6.50 lakh/village	8,125
2	RHE of population under BPL i.e., 30% of the 7.7 Cr Un-electrified Households/ i.e. 2.34 Cr households @ Rs 1500/ HH as per Kutir Jyoti dispensation	3,510
3	Augmentation of backbone network in already electrified villages having un-electrified inhabitations @ Rs 1 Lakh / village for 4.62 lakh villages	4,620
	<b>Total Expenditure</b>	<b>16,255</b>
	<b>Outlay for the Scheme</b>	<b>16,000</b>
	<b>Subsidy component @ 90% for items 1&amp;3 and 100% for item 2</b>	<b>14,750</b>
	<b>Component of subsidy to be set aside for enabling activities including technology development @ 1% of outlay</b>	<b>160</b>

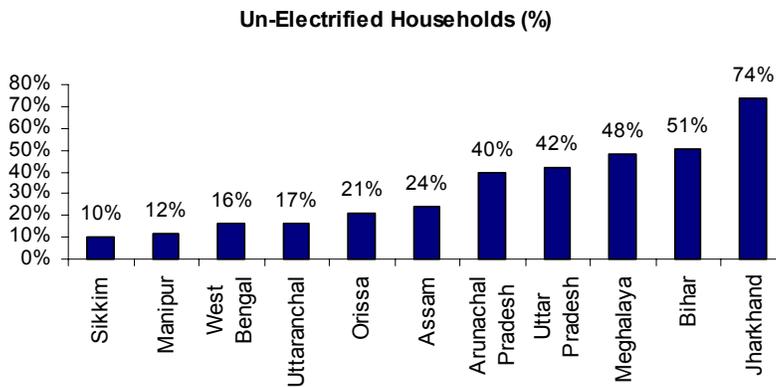
Clearly the targets as well as the funds allocation for rural electrification under the scheme are substantial. However it is important that the funds are well invested and bring recurring benefits to the rural populace over a period of time. This report, in line with the terms of reference, analyses the various issues, as well as the national and international experience that could be useful for the rural electrification endeavours.

### 1.3 Analysis of the Present Status of Rural Electrification in the States

#### Level of electrification

The efforts of the utilities along with development funds from the Central and State governments in this regard have resulted in an impressive rural electrification of 85% at an all-India level. Out of the 27 States, there are only 8 States remaining with more than 10% their villages yet to be electrified, as shown below:

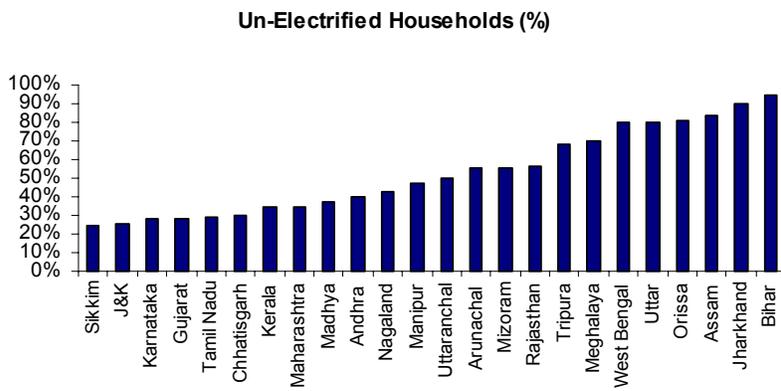
**Indian States with more than 10% of un-electrified villages**



Source: Ministry of Power Data on village electrification

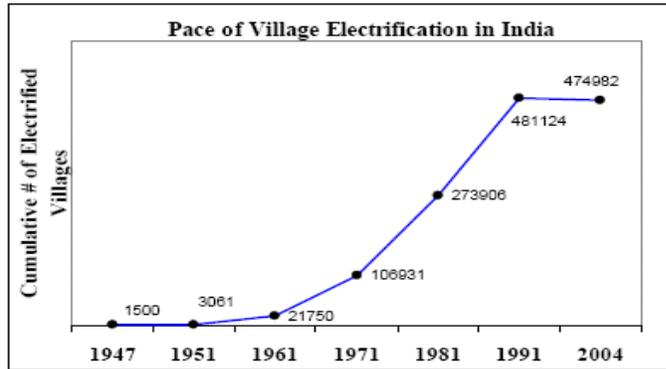
However, the above data does not reveal the true picture of the reach of electricity to the larger rural populace. The actual picture is far grim in most Indian States in terms of number of rural households having access to electricity. The national average of access to electricity by rural households stands at a mere 43.5%. Out of the 27 Indian States, more than 24 States have more than 25% of their rural households yet to have an access to electricity with the broad distribution across States shown in the graph below:

**Indian States with more than 25% of rural households without access to electricity**



Source: Ministry of Power Data on village electrification

It is quite evident from the above analysis that although there has been a gradual increase in village electrification levels over the past decades, the average of household electrification has been abysmally low. With the new definition of village electrification, having a stricter criterion of at least 10% households being electrified, the actual village electrification figures have suffered a setback. The figure below provides the pace of village electrification in India since independence:

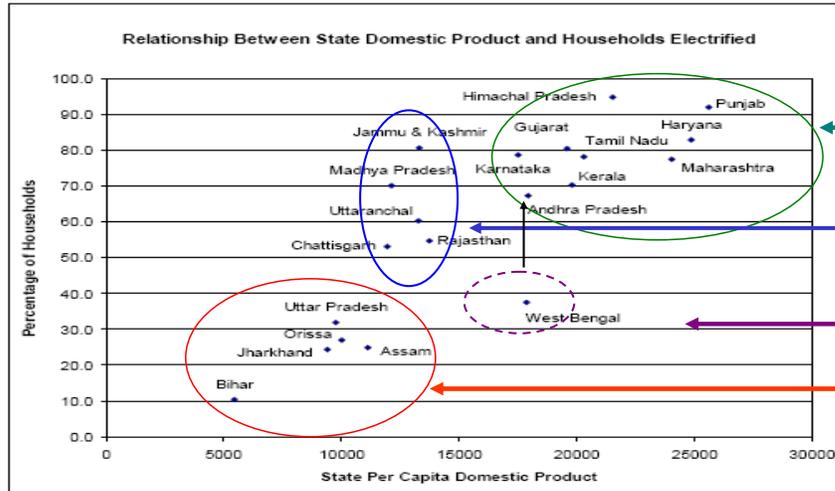


Source: Ministry of Power, RGGVY pamphlet, 2005

**Correlation of socio-economic factors with electrification levels**

Various socio-economic factors and governance issues explain the disparity in the village and household electrification levels. Typically States with higher GDP showed a greater penetration level of the grid. The per capita GDP and electrification rates of all major states (population greater than 1 million) are shown in the following figure:

**Figure: State Domestic Product and Percentage of Electrified Households**



Source: Census of India, 2001

The above graphic shows that Bihar, Jharkhand, Orissa, UP and Assam (shown in the red circle) having a low per capita GDP also have a low levels of household electrification. The same correlation exists between the Per Capita State Domestic Product and Percentage of Household Electrification in other States except in West Bengal where the per capita SGDP is high but the penetration level is low. Although correlation exists between the per capita GDP and household electrification, the causal factor cannot be identified in this case. The low per capita GDP can also be inter-alia, due to low level of household electrification.

**The issue of supply reliability**

It is however, not correct to conclude from the above data that the States having high household electrification levels have been able to address the rural demand in a more successful manner than the other States with low penetration levels. If we look at the peak deficits in the states of Haryana, Maharashtra and Tamil Nadu, where the household electrification levels are comparatively higher, it can be observed that these States suffer from high peak deficits. Although rural

demand does not contribute significantly to the peak deficit, but it has been widely observed that in the event of peak deficit, the supply conditions typically worsens in rural and semi- urban areas. Therefore, it can be concluded that there is no supply reliability in the rural areas even in States with high penetration levels.

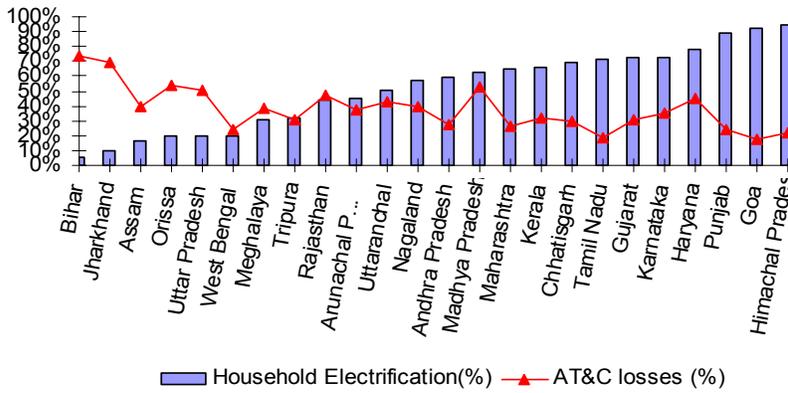
The following table gives the State wise peak deficits in FY 2005-06:

State/System/Region	Deficit MW	Percentage (%)
Delhi	122	-3%
Haryana	402	-9%
Himachal Pradesh	39	-5%
Jammu & Kashmir	375	-23%
Punjab	1573	-20%
Rajasthan	738	-13%
Uttar Pradesh	1587	-19%
Uttaranchal	134	-14%
Chattisgarh	276	-13%
Gujarat	2173	-22%
Madhya Pradesh	1422	-22%
Maharashtra	3709	-23%
Andhra Pradesh	457	-5%
Karnataka	391	-7%
Kerala	45	-2%
Tamil Nadu	1078	-12%
Bihar	198	-15%
Jharkhand	46	-7%
Orissa	41	-2%
West Bengal	144	-3%
Sikkim	2	-4%
Andaman - Nicobar	8	-20%
Arunachal Pradesh	2	-3%
Assam	54	-7%
Manipur	4	-4%
Meghalaya	75	-27%
Mizoram	4	-5%
Nagaland	3	3%
Tripura	16	-9%

Moreover, the current supplies at the rural areas are at odd hours of the day. Thus it fails to help in the productive utilization of power in most of the cases.

#### Rural electrification vs. efficiency levels

It has been observed that the level of rural electrification has a negative correlation with the T&D losses as shown in the following figure.

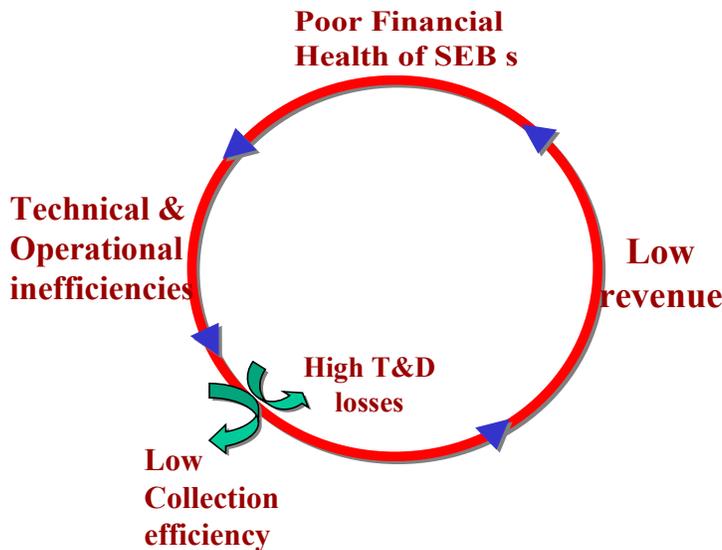


Source: Performance Report of SEB s, PFC

**Utility financial losses and rural electrification – a high positive correlation**

While analyzing the data on the financial condition of SEB s it was observed that most of the SEB s suffered from heavy financial losses. The loss making State utilities had little incentive to provide access to electricity to rural households as it led to increased T&D losses and low collection efficiency, which in turn further added to the already poor utility finances, giving rise to a vicious cycle.

Fig: Vicious Cycle of Rural Supply by SEB s



**1.4 Illustration: Cost of grid supply to rural areas in states with high commercial losses vis-à-vis lower commercial losses**

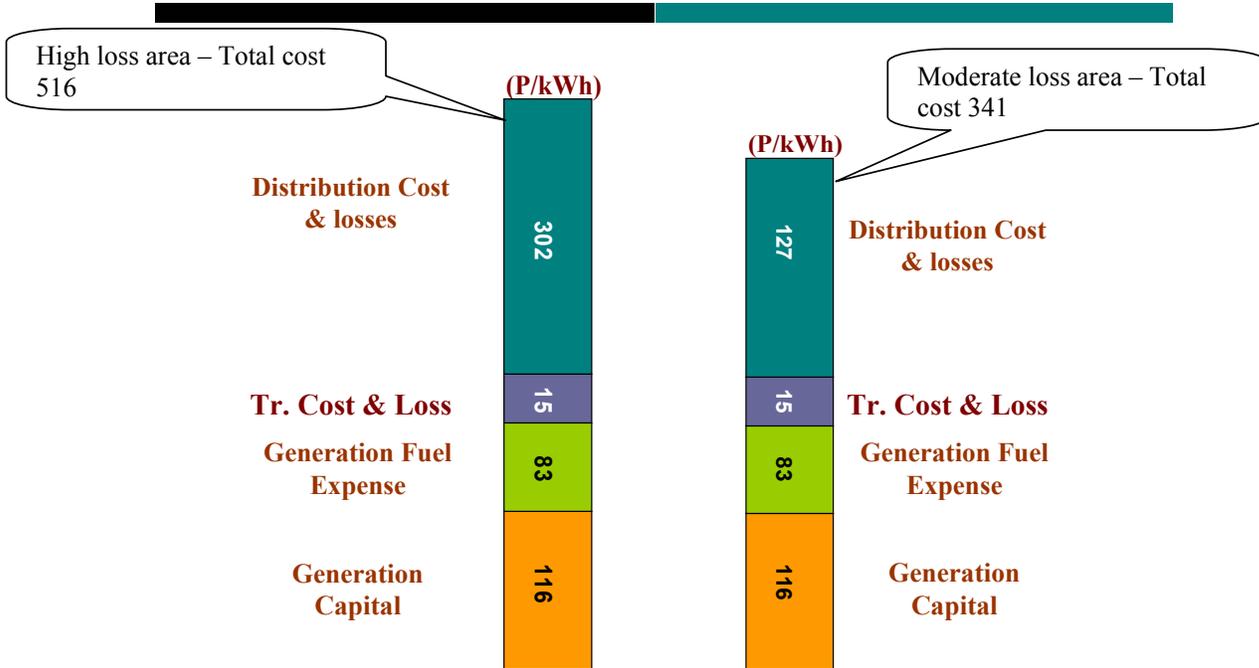
**Common assumptions:**

- Average distribution cost – 46 Paisa/ kWh
- Transmission cost – 15 Paisa/ kWh
- Per unit fixed cost of generation – 116 Paisa/ kWh
- Per unit variable cost of generation – 83 Paisa/ kWh

Assumptions taken for cost computation in the high T&D loss area:

	High loss area	Moderate loss area
Transmission loss	5%	5%
Distribution loss	33%	15%
Collection losses	22%	7%
Total AT&C loss	50%	25%

The cost build – up for per unit delivery of electricity is given below in the following figure



Clearly, the efficiency levels in distribution have a very high impact on the overall costs of service. Hence it is logical to expect lower service levels when the efficiency levels are low (on account of poor network efficiency, theft and collection losses).

## 2 Development of Service Models

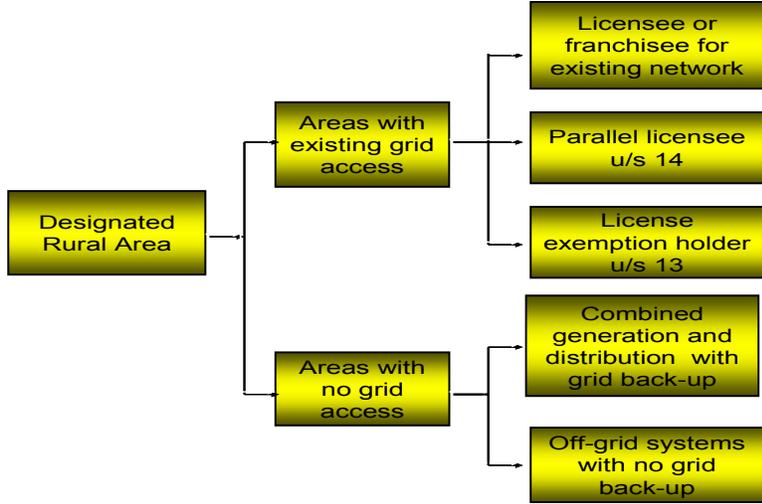
While developing the rural service models it is imperative to define the goals of the entire exercise. The following are the key issues that need to be addressed:

- ✓ Provide increased penetration in rural areas
- ✓ Improve quality of supply
- ✓ Lower cost of service
  - Delivery cost
  - Cost due to losses
  - Cost of default
- ✓ Build sustainable local markets that will persist beyond the developmental assistance phase

### 2.1 Potential electrification models

The possible options for under the key provisions of the Act are shown in the graphic below:

Fig: Options for Rural Electrification under Electricity Act 2003



While developing the service models for this study, rural areas were classified in various categories based on the following parameters:

- (i) Characteristic Load
- (ii) Indicative Demand
- (iii) Extent of local participation
- (iv) Renewable energy potential
- (v) Extent of grid penetration
- (vi) Current status of availability of grid power

The classification of rural areas by the nature of rural demand is shown in the following table:

**Table: Classification of Rural Areas according to load**

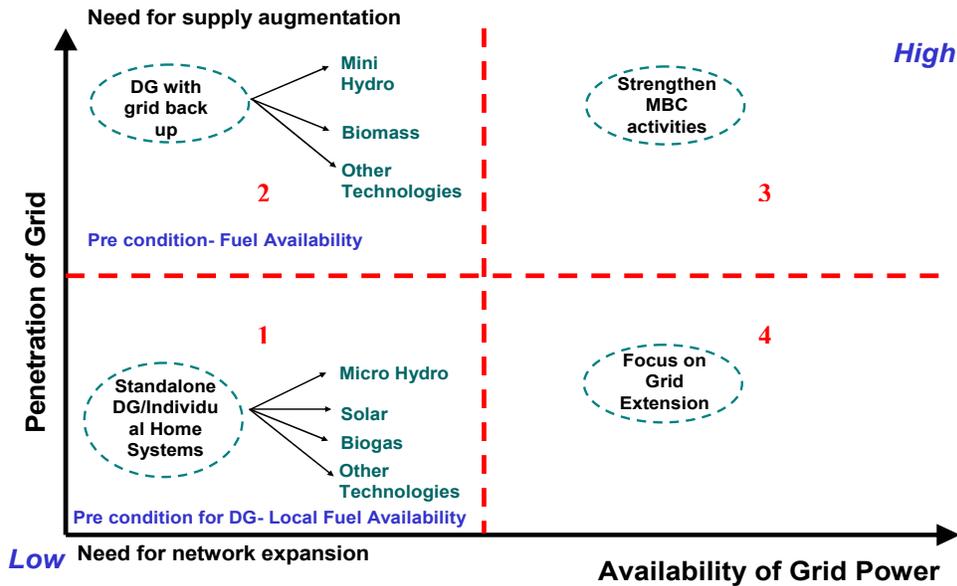
Load Characteristics	Need	Indicative Demand	Typical States*
High Load Areas	<ul style="list-style-type: none"> <li>❖ Livelihood                             <ul style="list-style-type: none"> <li>✓ Agriculture</li> <li>✓ Commercial</li> <li>✓ Industry</li> </ul> </li> <li>❖ Domestic                             <ul style="list-style-type: none"> <li>✓ Basic Supply</li> <li>✓ Recreational</li> </ul> </li> </ul>	50 KW + irrigation +rural industry	Karnataka Andhra Pradesh Maharashtra
Intermediate Load Areas	<ul style="list-style-type: none"> <li>❖ Livelihood                             <ul style="list-style-type: none"> <li>✓ Agriculture</li> </ul> </li> <li>❖ Domestic                             <ul style="list-style-type: none"> <li>✓ Basic Supply</li> <li>✓ Recreational</li> </ul> </li> </ul>	15 KW + irrigation	West Bengal Uttar Pradesh
Low Load Areas	<ul style="list-style-type: none"> <li>❖ Domestic                             <ul style="list-style-type: none"> <li>✓ Basic Supply</li> </ul> </li> </ul>	8 – 12 KW per village	Jharkhand Bihar North Eastern States

\* The typical states represented the above table refer to the predominant profiles of the rural areas in the state.

Based on the nature of demand, nature of supply and the key objective to be achieved, various service delivery models can be established. They are categorized in the following four categories:

- (i) **Grid Supply with Distribution Strengthening** – The key objective is to strengthen distribution and supply by extending grid connection and local community participation models in metering, billing and collection activities. The nature of demand addressed would be industrial, commercial and rural livelihood.
- (ii) **Distributed Generation with Grid Back up** – The objective is to augment grid power availability to the rural areas, using locally available resources. The nature of demand addressed would be industrial, commercial and rural livelihood.
- (iii) **Independent Micro Grids with Local Generation** - The objective is to provide village or a cluster of villages with electricity to create an independent self sufficient generation mini distribution network. The nature of demand addressed would basic and rural livelihood.
- (iv) **Individual home systems** - The objective is to provide household electrification solution to remote isolated villages where there is no aggregated demand. The nature of demand addressed would basic lifeline.

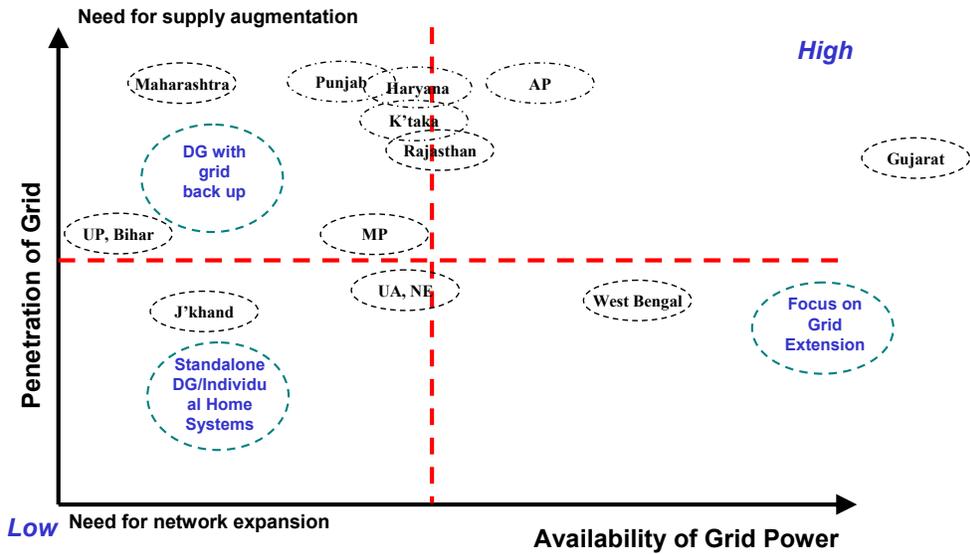
The classification of areas according to requirement and the local characteristics is shown in the matrix below:



M, B, C – Metering, Billing and Collection

In the above figure, in the areas where grid penetration is low and the availability of grid power is also low as in quadrant 1, standalone home systems or a standalone distributed generation facility (mini- hydro biomass, other technologies), would be the ideal solution. In areas where there is fairly good grid penetration and availability of grid power as in quadrant 3, commercial losses can be reduced by only focusing on the metering, billing and collection. In areas where there is availability of grid power but penetration of grid is low, as shown in quadrant 4, the focus should be on grid extension only, whereas in areas with high grid penetration and low reliability of supply as in quadrant 2, there should be Distributed Generation facility with grid back –up to augment the grid supply.

Keeping in mind the typical characteristic of rural areas, the various Indian states have been mapped on the four options for rural electrification as shown below (indicative only):



The above classification of the states is indicative, taking into account the generic rural supply conditions in these states. However, the various alternatives, including the choice of technology and the institutional arrangement need to be mapped according to varying different local conditions. For a particular supply model to be successful, a set of pre-conditions needs to be fulfilled. The following matrix gives a summary of pre-conditions for each supply model.

Pre- conditions \ RE Options	Franchisee	Sole licensee/licen se exempt	DG with network takeover & grid back-up	DG with grid back-up	Standalone generation
Peri-urban area; Grid connectivity; High losses; Low collection; Local community involvement	✓	✓	✗	✗	✗
Rural area ; Grid access ; Unreliable & low quality supply ; Local community involvement	✓	✓	✓	✗	✗
Rural area; No grid access; Reasonable proximity to the grid; Local community involvement	✗	✗	✗	✓	✓
Remote rural area; Local community involvement required	✗	✗	✗	✗	✓

The above matrix fundamentally describes the ideal option for rural electrification for a particular type of area. This would help in classification of each rural cluster in a particular state and assign the best suited model as per the provision of the Act.

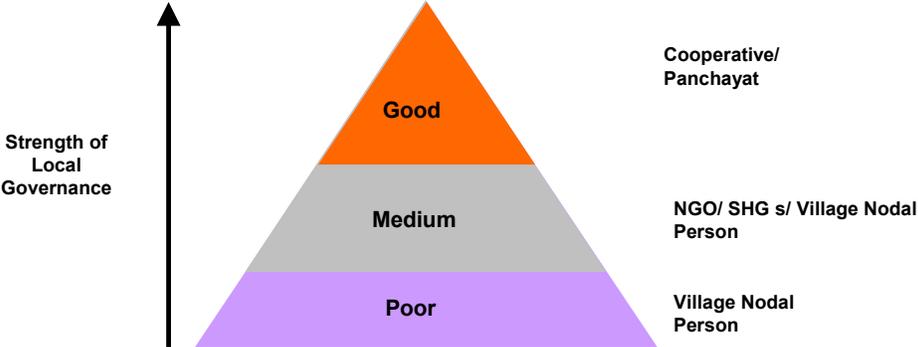
## 2.2 Institutional Framework

The choice of institutional framework in an area would be determined by its strength of local governance. In areas where local governance is strong, there is a potential of formation of cooperatives or the involvement of the village Panchayat in acting as a franchisee for metering, billing and collection. With the passage of time, these village cooperatives can also undertake O&M activities with training received from an NGO/ State Nodal Agency for Rural Electrification and eventually become a licensee or license exempt.

In those areas, where the strength of local governance is medium, there is need for a facilitating agency (NGO/ Self Help Group/ Village Nodal Person) to

organize the rural populace into a village society who can undertake the activities of a village level franchisee.

Areas where the strength of local governance is low, there is little potential for group activity. In these areas, a village nodal person (village businessman /political leader / *Sarpanch* of the Panchayat) who could be made responsible for collections.



### Key Success Factors for Each Service Delivery Option

The table below gives the key success factors for each of the service delivery options:

Service Delivery Option	Technology	Local Community Participation	Tariff	Sustainability	Regulatory & Policy
<b>Grid Supply with Distribution Strengthening</b>	Not Applicable	<b>Level</b> – High	Ability to pay	Loss reduction, Proper incentives, targeted subsidy	Formation of district committees, training and capacity building, good local governance
<b>DG Grid Backup</b>	Competitive Cost	<b>Level</b> – Medium to High (depending on model variant) Fuel Sourcing	Cost Recovery	Utility Cooperation, Payment certainty, targeted subsidy	Appropriate feed in tariff, license exemption where needed
<b>Independent Micro Grids with Local Generation</b>	Competitive Cost, Low maintenance	<b>Level</b> – High Operation, Administration, Fuel Sourcing	Connection based tariff for cost recovery	Productive use, linkage with other rural development scheme	Encourage technology demonstration, adoption, cost lowering
<b>Individual home systems</b>	Portable, low maintenance	<b>Level</b> – Low	Not Applicable	Take care of after sales service and spares	Targeted schemes, competitive procurement to drive down costs

Within the several options available, selection of the best suited options would be driven by prevailing conditions and the institutional capacity. For our analysis, distribution loss levels, the collection efficiency and potential of electricity

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generation from renewable source of energy of the individual rural areas have been used as the benchmark for selection of a particular option.

### Key Recommendations

The successful implementation of each of the rural supply models depends on the following factors:

1. **Master Plan** – The implementation of each model should be supported by a thorough Master Plan of village infrastructure development. The complete rural electrification strategy should be reflected in the Master Plan.
2. **Suitable technology** - The choice of technology will drive the economic viability of the projects. Technology should be based on the local conditions including size of the local demand, biomass availability, local participation etc.
3. **Local community participation** - Community participation is one of the most vital success factors for the long term sustainability of the models. Local bodies such as the *Village Panchayats* should be involved in bringing together the local populace.
4. **Role of State Nodal Agency** - There should be a **State Nodal Agency** responsible for overall implementation of the rural electrification programs. Their primary function would be to help in the development of the Master Plan, monitor the construction and operations of the village electrification projects, implementation of village infrastructure backbone through a competitive basis (PPP etc), receive regular feedback and recommendation from stakeholder groups like the *Zila Parishad* and *Panchayat Samities*.
5. **Inclusion of 11 KV feeders in the REDB** – This is essential for the long-term sustainability of the entire rural electrification projects.

### 3 Financial Viability of the Service Models

While assessing the financial viability of the service models it is important to assume that the marginal cost of extending the supply will be above the average cost of supply for the utility. However the marginal cost of extending supply needs to be considered in conjunction with a) the loss reduction potential and b) the overall economic benefits that accrue to the society.

Utilities need to investigate avenues for reducing cost of rural expansion through a) demand side management and b) technical solutions like distributed generation and isolated grid. Expansion of rural access to electricity should preferably be through smaller and focused entities.

For the financial viability assessment, a load profile of a typical village has been taken as follows:

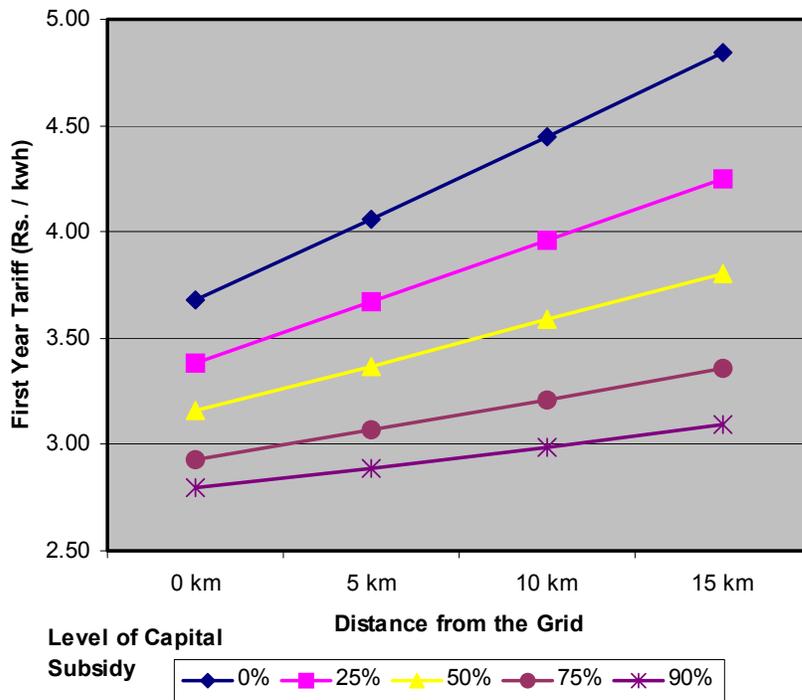
- Number of households – 200 having an average load of 0.4 KW giving a total load of 80 KW
- Number of pump sets – 50 an average load of 5 HP per pump set giving a total load of 185 KW
- Others (Public Lighting, Commercial, Industrial)– 75 KW
- Distribution assumptions:
  - Cost of Distribution Network – Rs. 2.6 crore / MW
  - Distribution Loss – 10%
  - Collection Efficiency – 90%
- Scenarios evaluated are with respect to :
  - Grid Connected Vs Isolated Modes

- PLF
- Sale of Surplus Power
- Distance from Grid
- Level of Capital Subsidy
- Technology Options

**A) Option 1: Grid Supply with Distribution Network Expansion**

The option has been evaluated on the basis of the distance of the village from the grid and at various capital subsidy levels. The per unit tariff in the first year of operations with the various combinations of capital subsidy for distribution strengthening and distance from the grid is shown below:

(First Year Tariff) Capital Subsidy	Distance from Grid			
	0 km	5 km	10 km	15 km
0%	3.68	4.06	4.45	4.84
25%	3.38	3.67	3.96	4.25
50%	3.16	3.37	3.59	3.80
75%	2.93	3.07	3.21	3.36
90%	2.80	2.89	2.99	3.09

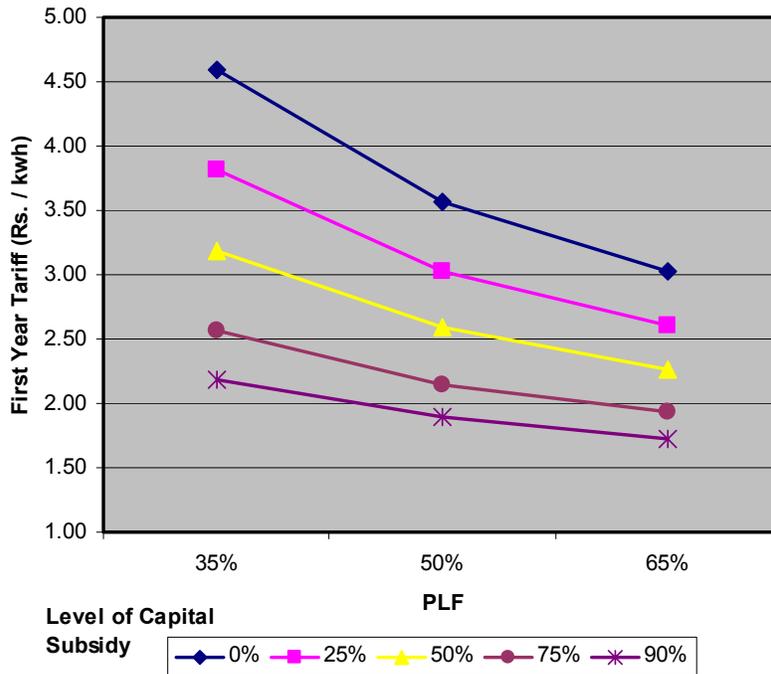


The cost to serve in the first year has been derived by adding the bulk supply tariff of Rs 2.35 / kWh and load assumption of 350 KW. Apart from these, the other key cost drivers are distance from the grid and level of capital subsidy as shown in the above table.

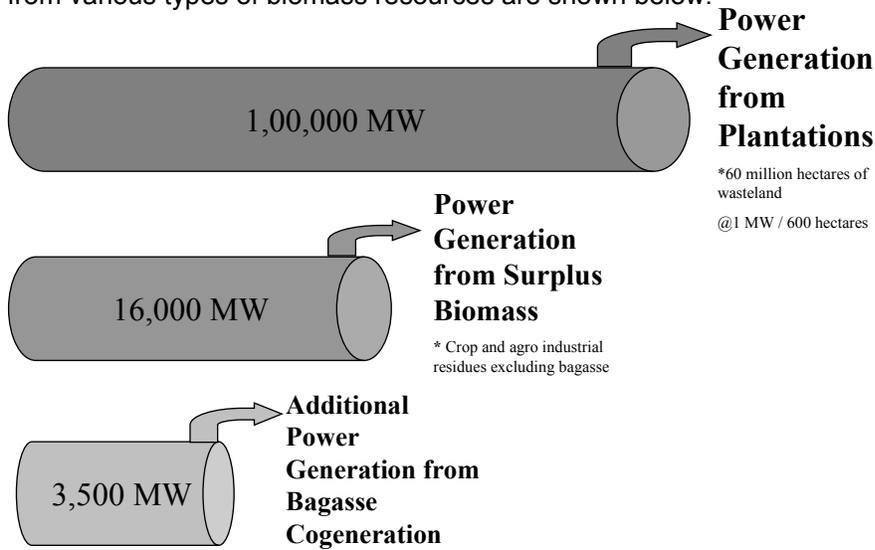
**B) Option 2: Biomass Gasifier Distributed Generation with Distribution Network Expansion**

In this option, a biomass gasifier has been assumed as the technology option for Distributed Generation (DG). A rural distribution network setup has been assumed along with the setting up of DG facility in the village. The option has been evaluated on the basis of the distance of the village from the grid and at various capital subsidy levels for both the DG facility and distribution network expansion. The per unit generation tariff in the first year of operations with the various combinations of capital subsidy both for generation and distribution and distance from the grid is shown below:

(First Year Tariff)	PLF		
	35%	50%	65%
Capital Subsidy			
0%	4.59	3.56	3.02
25%	3.81	3.02	2.60
50%	3.19	2.59	2.26
75%	2.56	2.15	1.93
90%	2.19	1.89	1.73



The key cost drivers in this option would be the cost of biomass, plant load factor and the level of capital subsidy. This option is suitable for area with high biomass potential. According to MNES, the potential power generation from biomass in India is around 1, 19,500 MW. The break-up of the potential power generation from various types of biomass resources are shown below:



Fairly significant amount of biomass resources are available in the Southern states of Tamil Nadu, Andhra Pradesh and Karnataka, the Eastern states of Jharkhand and Bihar, parts of Orissa and Madhya Pradesh and Punjab in North India.

**Fig: Map showing states with Biomass potential in India**



Source: 8<sup>th</sup> Report – Standing Committee on Energy, 14<sup>th</sup> Lok Sabha

### **C) Option 3: Biomass based Steam Turbine for Distributed Generation with Distribution Network Expansion**

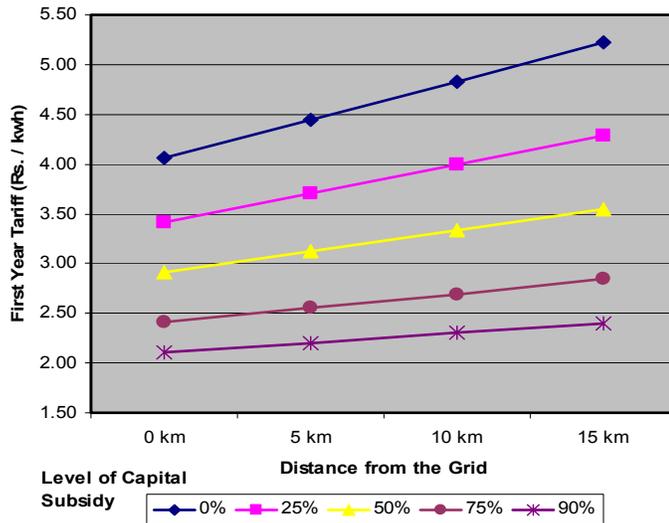
In this option, a biomass based steam turbine has been chosen as the technology option for DG. The biomass considered in this case is bagasse. A rural distribution network setup has been assumed along with the setting up of DG facility in the village. The option has been evaluated on the basis of the distance of the village from the grid and at various capital subsidy levels for both the DG facility and distribution network expansion. The per unit generation tariff in the first

year of operations with the various combinations of capital subsidy for generation and distance from the grid is shown below:

(First Year Tariff) Capital Subsidy	PLF			
	35%	50%	65%	80%
0%	4.99	3.91	3.33	2.97
25%	4.14	3.32	2.88	2.60
50%	3.50	2.87	2.54	2.32
75%	2.86	2.43	2.19	2.05
90%	2.48	2.16	1.99	1.88

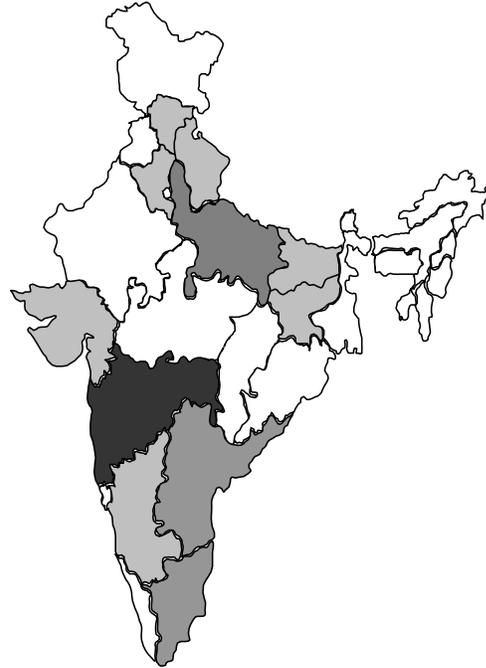
The per unit cost of generation and distribution in the first year of operations with various levels of capital subsidies and at various distances of the village from the grid is given below:

(First Year Tariff) Capital Subsidy	Distance from Grid			
	0 km	5 km	10 km	15 km
0%	4.06	4.44	4.83	5.22
25%	3.41	3.70	3.99	4.28
50%	2.91	3.12	3.34	3.55
75%	2.41	2.55	2.69	2.84
90%	2.11	2.20	2.30	2.40



The key cost drivers in this option would be the cost of bagasse, plant load factor and the level of capital subsidy. This option is suitable for area with high biomass potential. The state wise bagasse potential is given below:

State	Potential (MW)
Maharashtra	1,000
Uttar Pradesh	900
Tamil Nadu	350
Karnataka	300
Andhra Pradesh	200
Bihar	200
Gujarat	200
Punjab	150
Uttaranchal	100
Haryana & Others	100
<b>Total</b>	<b>3,500</b>



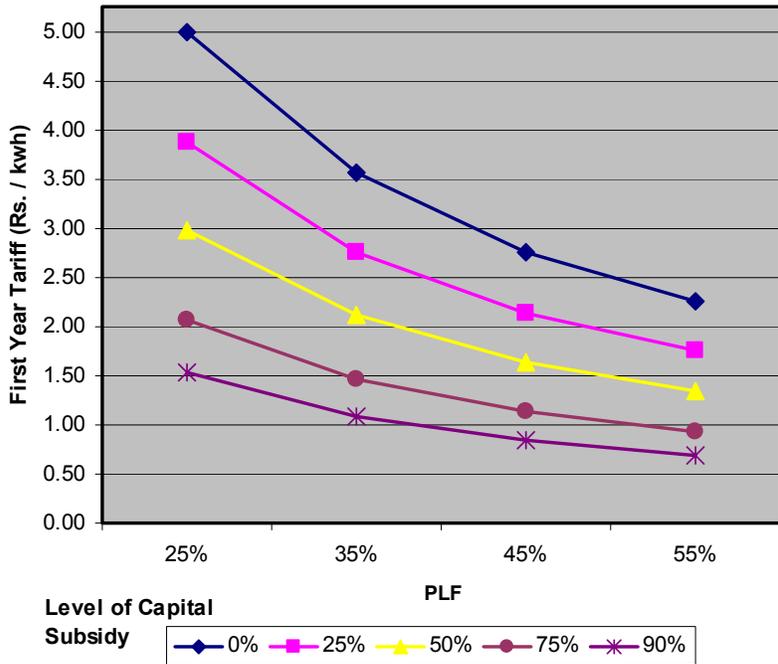
Source: 8<sup>th</sup> Report – Standing Committee on Energy, 14<sup>th</sup> Lok Sabha, 2005-06

#### D) Option 4: Micro Hydel plant for Distributed Generation with Distribution Network Expansion

In this option, a micro hydro power plant has been chosen as the technology option for DG. A rural distribution network setup has been assumed along with the setting up of DG facility in the village. The option has been evaluated on the basis of the distance of the village from the grid and at various capital subsidy levels for both the DG facility and distribution network expansion. The per unit generation tariff in the first year of operations with the various combinations of

capital subsidy both for generation and distribution and distance from the grid is shown below:

(First Year Tariff)	PLF			
	25%	35%	45%	55%
0%	5.00	3.56	2.76	2.26
25%	3.87	2.75	2.14	1.75
50%	2.97	2.11	1.64	1.34
75%	2.07	1.47	1.14	0.93
90%	1.53	1.09	0.85	0.69



The key cost drivers in this option would be PLF and level of capital subsidy. This is a viable option for the regions abundant in hydro potential. Successful examples of DG micro hydro plants in operation can be found in Uttaranchal, where micro hydro plants have been set up by Uttaranchal Renewable Energy Development Agency (UREDA) in remote rural areas in the state. The state wise small hydro potential is shown below:

**Table: Small Hydro Potential – Excluding North East**

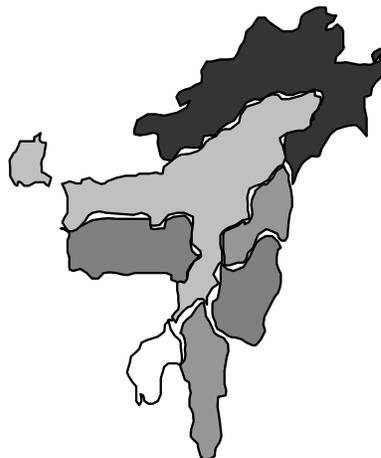
State	No of Identified Sites	Identified Capacity (MW)
Uttar Pradesh	310	327
Gujarat	283	113
Andhra Pradesh	271	115
Maharashtra	183	124
Karnataka	181	166
Kerala	167	199
HP	166	216
Bihar	158	199
Orissa	152	89
West Bengal	141	154
Tamil Nadu	131	142
J&K	106	146
Madhya Pradesh	99	75
Punjab	78	65



Source: MNES

**Table: Small Hydro Potential – North Eastern States**

States	No of Identified Sites	Identified Capacity (MW)
Arunachal Pradesh	433	382
Manipur	91	60
Meghalaya	83	41
Mizoram	73	42
Nagaland	67	27
Sikkim	52	56
Assam	38	50
Tripura	8	10



Source: MNES

**Conclusions**

Based on review of the costs and operating profiles, the cost of DG based technologies at best equals the cost of grid based supplies (under similar efficiency conditions)

The DG technologies that appear cost competitive under present conditions are Biomass based steam and Mini-Hydro. Other technologies are relatively expensive at present, but may still be necessary depending on the requirements of electrification in a region. It could be concluded that DG technologies are complements of Grid Supply, but not financially viable substitutes under current cost conditions if the location is not very remote and grid supply is relatively efficient. Practical realities may however still make DG based supplies

economically viable. Key trade off is between grid based supply vs. DG are in terms of:

- ✓ Time for implementation
- ✓ Efficiency expectations
- ✓ Ease of implementation and management
- ✓ Quality of service expectations

It also requires mention that the above data is indicative and actual costs would vary on topography, demography, load profile, fuel availability and other relevant factors. However, as revealed by the analysis, under a reasonable set of assumptions, the costs of alternative delivery models are usually higher than the typical utility supply costs given a certain level of efficiency. Hence there is a case for capital subsidies and also for viability gap financing, since while being economically viable, the alternate options would not be commercially feasible without subsidies. However the net societal costs would be lower and government could derive substantial savings through of these alternative models.

### Specific Recommendations for Hilly Regions

*In remote hilly locations with scattered villages and small communities where electrification levels are currently low and where the demand is lower than the viability threshold for rural electrification, it is important to popularize the use of electricity and create demand before large-scale rural electrification is undertaken. Individual home systems such as solar home lighting systems could be the technology adopted in the beginning to create demand for electricity. On a per-unit basis this may however still be expensive. Hence subsidy mechanisms (including those currently operational) would be essential.*

*Once there is an adequate perceived need for electricity service and enhanced reliability levels are required, alternatives like micro hydel systems may be installed. This would ensure the sustainability of projects. Other alternatives could include distributed generation and mini-grids based on bio-fuels (or alternate energy sources like Coal Bed Methane or Natural Gas) where resources are locally available.*

*Over time, as demand picks up and viability permits such areas could be considered for integration with the electricity grid. The key is to graduate the development to a master plan for such areas that reflects the need for electricity, the stage of development and the economic and financial viability of the services.*

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## 4 Development and Implementation Arrangements

### 4.1 *Separation of the rural operations from urban utility services*

Rural electrification is a technology intensive process as the rest of the electricity business. Therefore it is difficult for large projects to be implemented without technical and financial assistance. Rural projects face greater quality and reliability issues than urban utility services. The fragmented nature of rural demand entail increasing costs, requiring greater intervention than mainstream technologies that is more mature in general. Performance for the models needs periodic review and a simple but effective mechanism is required for regular monitoring. The paying capacity of the rural consumer is much lower as compared to the urban consumer; therefore a well administered subsidy mechanism becomes a fundamental necessity for the successful implementation of the service models. Moreover, the limited availability of resources calls for better allocation and prioritized utilization.

There would be several issues to contend with for establishing the alternate models and implementing actual projects based on such models. Therefore there is merit in focusing on the specific problems in the rural areas and creating an institutional structure that promotes electrification in these areas, improvement in service quality and reliability and also sustainability of the services provided. This would almost inevitably necessitate creating a separate organization to serve the rural areas primarily because it would be difficult to bring about any improvement without making significant alterations in the monolithic structure that exists in the present distribution sectors in most of the states.

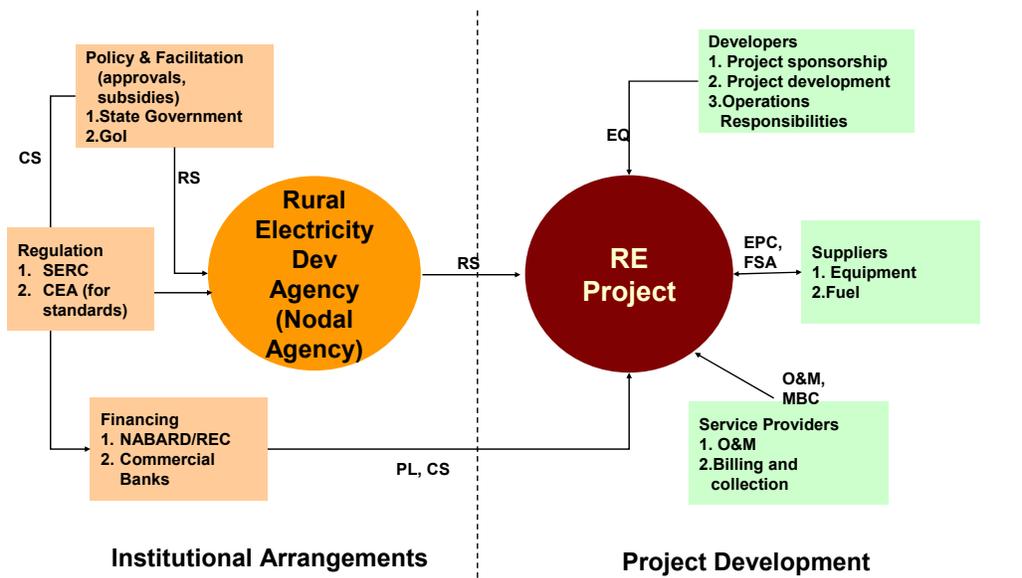
## 4.2 State Nodal agency for rural electricity services

State Nodal Agency which would be an autonomous body separated from the SEB should be created. While creating a separate rural focused organization, it will be equally important to ensure that the structure does not result in inflexibility in the future. There is thus a necessity to create the rural-centric organization, but without losing the flexibilities that the current structure affords. This would necessitate separation of main operations from the rural operations, adopting specific policies and plans for rural operations. The rural nodal agency would broadly perform the following tasks:

- Appraise and prioritize projects for funding based on its commercial viability during an year;
- Utilize the funds received from schemes such as the RGGVY scheme in the village and household electrification
- Regular monitoring of the progress of the RGGVY schemes in the state;
- Carry out transparent project bidding procedures that would be:
  - a) Simple and standard to reduce costs
  - b) Based on requirements of each project
- Standardise technology with focus on:
  - a) Economies of scale – Obtain economies of scale as well as reach
  - b) Size economies – Migrating into larger unit sizes
  - c) Scope economies – Multiple use of energy generated. Livelihood development
- Reduce cost and project time cycle reduction by
  - a) Reduction in input costs through economies of scale, size and scope
  - b) Using simplified procedures

- c) Providing concessional funds, grants and subsidies (for economically viable projects)
- Channelize the capital and operating subsidies to the identified projects through a dedicated fund as per the framework finalized by the State Government;
- Facilitate the necessary institutional capacity building, training and support to
  - a) the local communities to undertake decentralized generation and distribution operations;
  - b) Developers and financiers
  - c) Service providers
- Development of standard contractual structures between various entities under various options;
- Formulation of a standard organization structure for the local rural body to undertake operations;
- Preparation of tariff-related proposals and incentive proposals for the approval of the Commission; and
- Development of proposals for financing of schemes under various funding schemes of the Ministry of Power (GoI) / Ministry of Finance (GoI) / funding agencies.

The rural nodal agency would be guided by the above guidelines. The facilitating role of the rural nodal agency with the state regulator, government, financing institutions as well as the developer, suppliers and service providers for setting up the rural electrification projects are shown below:



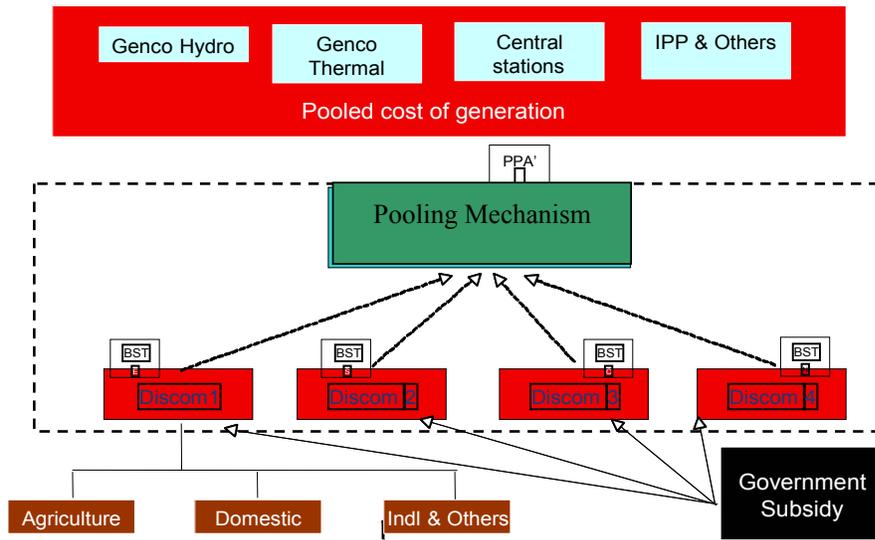
CS: Capital Subsidies, RS: Revenue Subsidies, PL: Project Lending, EPC: Engineering Procurement & Construction Services, MBC: Metering Billing & Collection Services, FSA: Fuel Supply Agreement

A key issue that needs consideration is on the administrative location of the nodal agency in the electricity industry structure. The first option was to create a separate nodal agency that operates independent of the utility service providers and undertakes a facilitation role. The second is to house it within the rural electricity organization created for provision of the rural electricity services. After extensive consultation it was felt that it would perhaps be preferable at this stage to house the agency within the overall rural electricity organization, but with sufficient autonomy to execute its roles as a Nodal Agency. This would lessen the co-ordination issues and other administrative problems that would otherwise be expected if an altogether separate agency were to be created. This can be reviewed at a later stage if the situation so warrants.

### 4.3 State Level Implementation

Under the currently arrangements, rural supply is the responsibility of the state Discoms who procure power from the Bulk Supply Agency (essentially a trading intermediary) or through direct contracts with generators. In most cases there is a common pool of generators, and a bulk supply tariff is paid for by the Discoms. These Discoms are provided with revenue subsidy by the state governments for supplying electricity to the rural consumers at a subsidized rate.

**Fig: Current Supply Arrangement (typical arrangements)<sup>1</sup>**



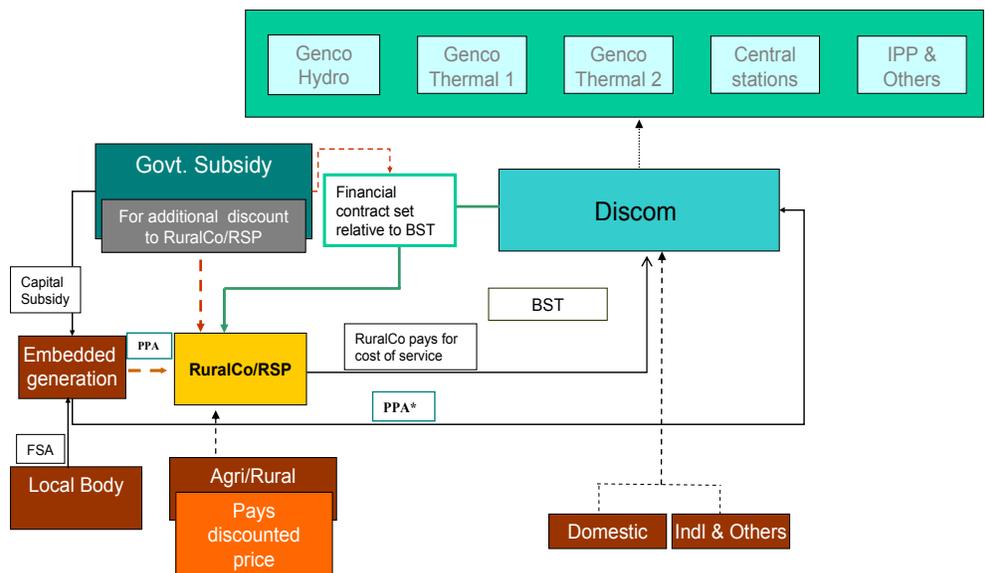
The key changes proposed in the new rural supply arrangement are as follows:

- a) Separate Rural Service Provider (RSP or RuralCo) for serving rural/remote areas
- b) Subsidy provided directly to RSP or through local body

<sup>1</sup> With the Electricity Act, 2003 various new mechanisms have emerged. However, most of these mechanisms feature some form of pooling arrangements. The diagram shown here is schematic and should not be considered representative of a universal industry structure.

- c) Financial contract set relative to Bulk Supply Tariff for cross subsidy
- d) Embedded generation (non-conventional/diesel) is option where DG is viable
- e) Commercial transaction with main Utility for
  - (i) Bulk Purchase ,and
  - (ii) Generation output where the exact nature of transaction would depend on the model adopted

Fig: Modified Supply Arrangement

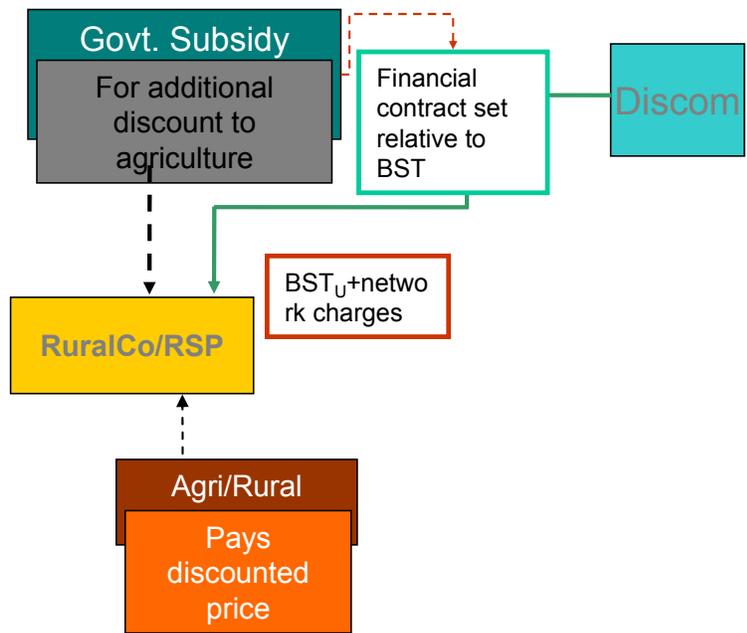


\* For full generation or only for surplus depending on the model adopted

**Key features of the Rural Service Provider (RuralCo)**

The RuralCo would serve the rural consumers who would be supplied electricity from 33/11kV feeders with flows metered separately from the rest of the network. It can use the local bodies to bill and collect from rural consumers on behalf of RuralCo (operations contracts). This would also address staff related issues. It pays the Discoms full cost of service (BST and network charges). Its sources of income would be:

- a) Tariff revenue
- b) Government subsidy
- c) Financial payments from Discom in contract set relative to BST representing over-recovery from individual consumers



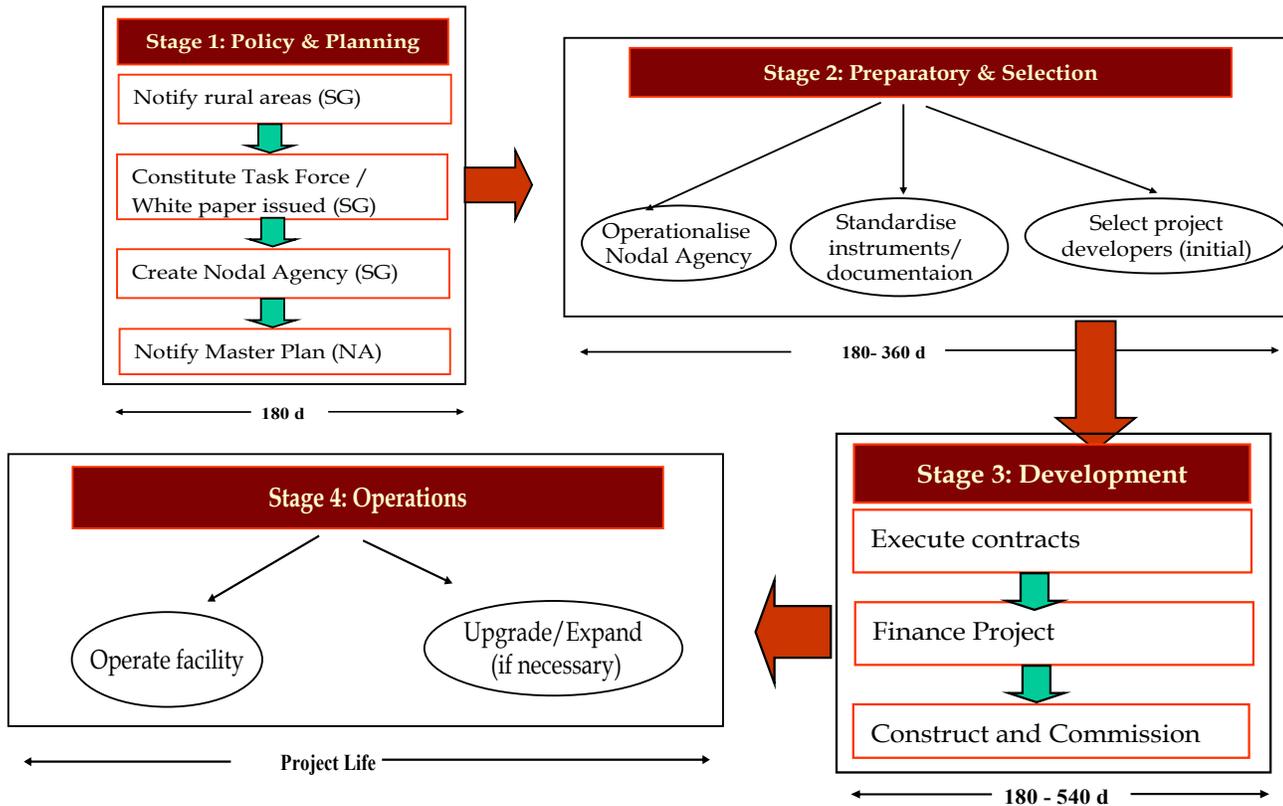
The key benefits of the proposed arrangements would be as follows:

- Greater focus and accountability in rural areas as compared to an integrated utility;
- Transparency in payment and monitoring of capital and revenue subsidies;
- Ability to implement with greater speed the alternate service models featuring franchisees, distributed generation etc;
- Price transparency and ability to focus the subsidies better;
- Transparent contracts through which the suppliers (including the Discoms) are remunerated adequately.

The Nodal Agency function would inevitably have a very important role in ensuring that these arrangements are implemented effectively in the respective states. The following section draws out the high level implementation process envisaged.

## 5 The Implementation Process

In this section the implementation process has been described in a time bound phased manner beginning at the planning stage till the commissioning of the projects. The generic roll out process of implementation of the rural electrification schemes is shown in the graphic below. The individual stages have been discussed at length subsequently.



## Stage 1: Policy and Planning

The main activities in this stage are to establish an **Overall Electrification Strategy for the State** and develop a **Service Master Plan**. The electrification strategy should aim to:

- (i) Establish overall electrification plans and targets including service levels to be achieved for next 15 years
- (ii) Identify service options relevant for the State
- (iii) Identify facilitation measures to be undertaken by the State
- (iv) Identify funds requirements
- (v) Identify aspects and modes of local participation
- (vi) Issue white paper/ RE strategy document

The core responsibility of formulation of the overall electrification strategy would be of the State Government. The Central government and the SERC would intervene through policy prescriptions.

Following the establishment of the rural electrification strategy in the State, the Service Master Plan should be drawn up through the following steps:

- (i) Estimation of fund availability, both capital and revenue for electricity services
- (ii) Identification of service delivery costs in unserved / under-served areas
- (iii) Establishment of the criteria for service delivery option selection which should largely be based on financial criteria, but could include certain non-financial criteria as well.
- (iv) Creation of service master plan based on established criteria after due consultative process.

The Nodal agency would have the core responsibility of the development of the Service Master Plan which would be reviewed by the State Government and the SERC.

## Stage 2: Preparatory and Selection phase

In this stage **Development of Standard Structures and Instruments** for each service option would take place followed by the **Bid Process** for award of the projects to interested parties. The standard templates would consist of the following:

- (i) Standard templates for each service option
  - ✓ Licensing/exemption
  - ✓ Procurement contracts
- (ii) Sales/consumer contracts
- (iii) Tariff or Pricing framework/ arrangements for service options
- (iv) Service standards – Defined for each project category
- (v) Subsidy delivery arrangements (capital and revenue)
- (vi) Technology facilitation arrangements to reduce costs (e.g. through rate schedules) and ease of implementation
- (vii) Defining the processes and criteria for solicited and unsolicited bids

The core responsibility of drafting the standard templates for award of the projects would be of the Nodal Agency reviewed by the SERC.

The bid process would comprise of the following stages and guidelines:

### **For solicited bids-**

- (i) Notify priority areas as per master-plan by year

- (ii) Identify the service model(s) to be implemented in each area
- (iii) Invite tenders (for solicited bids)
- (iv) Select bidders based on criteria.

***For unsolicited bids***

- (i) May include areas outside notified master plans for the year
- (ii) Select bidders based on identified requirements being met and economic criteria being addressed

The Nodal Agency would carry out the bid process. In the event where the district level committee is competent to carry out the process, the responsibility may be delegated to them.

The bid based approach suggested herein inherently envisages private participation as the primary means of extending rural services. This differs from Bangladesh which is largely driven by the parastatal REB, but relates closely the South American models. We believe that the framework suggested would be more suited for the Indian circumstances.

**Stage 3: Development Stage**

The development stage would involve ***Contracting and Financing*** and ***Project Implementation***. The contracting and financing would involve:

- (i) Selection of bidder to execute contracts
- (ii) Obtaining finances from banks and institutions where local institutions would play a primary role in financing.
- (iii) Arranging for refinancing arrangements through NABARD/REC facilitated by the Nodal agency

- (iv) Approval of project documentation by Nodal Agency. This process would be mainly necessary for initial projects till standardisation is achieved
- (v) Financial closure

The core responsibility for contracting and arrangement of finances would be of the developer who would be awarded the project in the stage 2. The project finance can be provided by financing agencies like REC or NABARD and the entire process is to be facilitated by the Nodal Agency.

In the project implementation phase, both the developer and the Nodal Agency have a crucial role to play. While the developer would construct the project through an EPC contractor or by a successful builder, the Nodal Agency would monitor the progress on a regular basis and award the Completion Certificate after successful completion of construction of the project. The Nodal Agency can also nominate an officer to oversee the project from start to completion.

#### Stage 4: Project Operation

This stage would involve overall **Management of the Project** and future **Expansion and Upgradation**. The key activities in project management would involve:

- (i) **Operations management** – Through standard service providers (certified by nodal agency or self)
- (ii) **Fuel sourcing** – Tie-ups where applicable through local bodies
- (iii) **Determination of tariffs**
  - Based on framework defined under stage 3 for assisted projects
  - By developer for non-assisted projects
- (iv) **Service monitoring** – By nodal agency or nominee (for assisted projects)

The core responsibility of project management would be of the developer and monitoring and required facilitation would be done by the Nodal Agency.

The expansion and upgradation project should be entirely based on financial criteria and could either be *Norm Based* which is more applicable for expansion in the same service area or *Bid Based* which is more relevant for expansion into neighbouring areas. The entire expansion process is to be standardized by the Nodal Agency.

The role of the Nodal Agency for various service delivery options is summarized below:

<i>Service Delivery Option</i>	<i>Developer selection</i>	<i>Financing of project</i>	<i>Tariff (delegated regulatory)</i>	<i>Training</i>	<i>Subsidy administration</i>	<i>Performance monitoring</i>	<i>Technology development and cost reduction<sup>1</sup></i>
<b>Grid Supply with Distribution Strengthening</b>	Yes	Low involvement facilitation	Input tariff determination	For distribution networks only	Input subsidy determination & administration (mainly BST)	Yes	Not significant
<b>Grid Connected DG</b>	Yes	Important facilitation role	Yes (particularly if subsidies are involved)	Yes. For generation and distribution	If subsidies are involved	If subsidies are involved	Yes
<b>Independent Micro Grids with Local Generation</b>	Only if subsidies are involved	Potential facilitation role	If subsidies are involved (should be normative and fixed upfront)	Yes	If subsidies are involved	If subsidies are involved	Yes
<b>Individual home systems</b>	Not applicable	Not applicable	Not applicable	Limited (could be done by/ through Renewable Energy Agency)		Not Applicable	Facilitation role

Certain roles like technology development better served by a common central agency. State nodal agencies would have a support role.

## 6 Financing, Subsidies and Tariff

Subsidies have been an integral part of all successful rural electrification programmes across the world ranging from developed countries like the USA to developing countries in Latin America and Asia. In India, particularly considering the prevalent differences between costs and tariffs, alternate schemes for rural electrification are unlikely to succeed unless the resultant tariffs are perceived to be reasonable. It is reasonable to assume that the utility tariffs would be considered as benchmark by the consumers. Alternate sources, while economically viable, may not pass the tariff/financial test. Thus there would be a need for some subsidies to make the tariffs attractive for the consumer for the quality of service delivered.

From an economic standpoint, subsidies should ideally be restricted to capital cost financing while operating costs should be paid for by users. Projects that desire subsidies should be qualified based on their ability to pay for operating costs and a part of their operating costs. However in the initial period, a few years of viability gap funding may be necessary for certain projects where long term viability is otherwise not in question. This approach has been successfully implemented in Bangladesh, where viability gap funding is provided for a maximum of first five years of operations, if required. Thereafter the projects have to meet at least their actual operating costs. Subsidy administration therefore becomes an important aspect for the success and sustainability of the projects. Nodal agency has to develop transparent processes for subsidy administration.

While Bangladesh follows pre-specified financial criteria for selecting “qualifying projects” several Latin American countries have introduced an element of competition in allocating the subsidy funds. Current policies of the GoI provide for capital subsidies up to 90% of project costs. It is understood that the subsidies would be available not only for network extension as per the Rajiv Gandhi

Grameen Vidyutikaran Yojana, but also for DG facilities. Clarity is however required on whether such subsidies would be available for establishment of parallel networks and DG based mini-grid facilities that avail limited Grid back-up.

The recent union budget has made an explicit provision on viability gap financing for several infrastructure sectors, but not power. The scope of viability gap financing needs to be extended to the power sector as well.

### ***Key Challenges***

Large number of projects involved will pose challenges. Subsidy to private entrepreneurs is still open to question. A combination of capital and production linked subsidies would be necessary. This requires a separate study in detail. Regular and rigorous performance monitoring is essential to protect consumer, taxpayer and financier interests.

### Revenue Model for Rural Electrification

A key issue that needs to be addressed directly is that of the Revenue Model for rural electrification. This is of particular importance since in the past a large number of projects have been financed through capital grants and loans, only to be rendered unviable (and often inoperative) after commissioning.

A cardinal principle that has to be adopted is that financial viability and reliability of services should drive the choice of model(s) in a particular area. The specific recommendations relating to the revenue model are provided below.

- a) **Financing of project development – capital subsidies:** Projects for rural electricity services more often than not require subsidy or concessional financing since their viability from a purely commercial standpoint is limited. There are several instruments of soft financing currently available, including the RGGVY scheme. Grants for such projects are available under various GoI funding schemes through MNES, REC, DST, PFC etc. as well as through other national & international agencies. We envisage the continuation of funding through such schemes.

We believe that the current mechanism of upfront financing of projects (during their construction) will need to be progressively transformed to *production/delivery based subsidy credits* over time. However this may take considerable time and greater maturity of the sector may be necessary before the transition can take place,

- b) **Operating Expenses:** All operating expenses for operating & maintaining the facilities (including the cost of fuel) should ideally be borne by the consumers. However such operating costs could vary considerably between technologies. In case more expensive liquid fuels are used, the tariff revenues may be inadequate to cover such operating costs in the short run. In such cases a trajectory of tariffs need to be identified and agreed upon as a part of the service model so as to minimize/eliminate such operating subsidies over time.

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- c) Retail Tariff: Tariffs should be based on the paying capacity of the consumers. Typically the benchmark would be available from the utilities in the area. In particular, case any particular project avails capital and operating subsidies, then it is likely that the tariffs of the licensee in the relevant area would need to be adopted by the RE project as well.
- d) Bulk Tariffs: Bulk tariffs are relevant only if supply is through the grid. In event of a franchisee being involved, the franchisee is to be provided with an input tariff (bulk supply tariff). Typically this input tariff would feature an element of subsidy in order to make it sufficiently remunerative for the franchisee to undertake the operations in the rural area.
- e) Generation tariff: The generation tariff would be relevant only in event of a distributed generation facility interfaces with the utility network, and is paid by the utility for the generation output. While such distributed generation is often interfaced with the 11 kV rural networks, and is instrumental in the extension or enhancement of rural electricity services in the area, from a contractual standpoint it would sell to the local licensee at the tariffs approved by the regulator for such generation.

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It is possible for such distributed generation networks to be implemented in conjunction with the franchisee model. Such arrangements are already in vogue in certain areas in the country. A key advantage of such arrangement is that the difficulties arising of the large-scale distortions in retail tariffs vis-à-vis the costs can be obviated.

## 7 Roles of Various Entities

### 7.1 State Government

Proactive support from the State Government is essential for success of the program. Apart from statutory functions like notification of rural areas and recommendations to the Commission on specific cases of license exemption (u/s13), the State Government would inevitably have a larger developmental role. The State government would have part to play in facilitation of network transfer to the rural local bodies from the state utilities. Creation of State nodal agency as a counter-part body for facilitation of RE projects is also an essential role that the State Government would have to undertake. As discussed subsequently, in the opinion of the Commission the nodal agency would have an extremely important role in facilitating the rural electrification initiatives. The State Government should consider the establishment of a separate fund for rural electrification (akin to a USO fund) to provide capital subsidies and/or viability financing. The Annexure III to this report gives the detailed functions that the State Government can perform.

### 7.2 State Electricity Regulatory Commission

The Commission will have a role in the following:

- Providing policy inputs on rural electrification policy as required by the Act;
- Approving licenses and license exemptions;
- Approving retail and bulk tariffs, where applicable;
- Promoting co-generation and non-conventional energy;
- Waiving the additional surcharge under Section 42(2) of the Electricity Act, 2003 on open access for transactions involving generators undertaking distributed generation in rural areas (where applicable)

Specific activities for the State Commission in regard to rural electrification are elaborated in Annexure IV. The cost and intensity of regulation for the entities involved in rural electrification will have to be reduced, and these entities cannot

be regulated at par with the other licensees. The Commission will consider necessary measures at an appropriate stage.

### **7.3 State Nodal Agency**

- As has been discussed in the previous sections, creation of a dedicated Nodal Agency at the State level for facilitation of RE projects is essential for a focused approach to implementation of the program. The nodal agency is broadly envisaged to perform the following tasks:  
Appraise and prioritize projects for funding based on its commercial viability during a year in accordance with master plans created;
- Channelize the capital and operating subsidies to the identified projects through a dedicated fund as per the framework finalized by the State Government;
- Facilitate the necessary institutional capacity building, training and support to the local communities to undertake decentralized generation and distribution operations;
- Development of standard contractual structures between various entities under various options;
- Formulation of a standard organization structure for the local rural body to undertake operations.
- Preparation of tariff-related proposals and incentive proposals for the approval of the Commission; and
- Development of proposals for financing of schemes under various funding schemes of the Ministry of Power (GoI) / Ministry of Finance (GoI) / funding agencies. Annexure V provides the detailed description of the functions that a State Nodal Agency can perform.

## **7.4 Distribution Licensee**

The key roles of the distribution licensee are:

- Identify franchising opportunities and defining franchising mechanisms (where this is the preferred mode of operation)
- Transfer assets to license exempt or other service providers as per service model
- Encourage distributed generation and entering into contracts as necessary, including grid back-up to ensure reliability
- Develop up contracts with the circle level franchisees incorporating the performance obligations of all parties, investment levels, commercial arrangements, consumer safeguards, etc. (To be undertaken in conjunction with the Nodal Agency)
- Create (or facilitate creation of) schemes under RGVY or other avenues in rural areas to reduce system losses and improve supply quality

## **7.5 Developer/Service Provider**

The key roles of the developer are:

- Identify Opportunity
  - o Solicited (including franchising arrangements)
  - o Unsolicited - from Master Plan
  - o Unsolicited – Outside Master Plan
- Participate in bid process or in negotiations with Nodal Agency
- Develop Detailed Project Reports
  - o Pre-feasibility reports could be provided by Nodal Agency for solicited bids

- DPR templates would be standardised by Nodal Agency
- Enter into contracts for fuel (with local body if possible), EPC, O&M
- Arrange financing and undertake financial close
  - Obtain subsidies (if necessary) through Nodal Agency
- Construct project (self or through EPC contractor) and commission
- Operate and maintain
- Submit periodic reports to Nodal Agency for monitoring

### **7.6 Local Bodies (Zilla, Taluka and Village Level) /Self Help Groups/NGO**

The key roles of the developer are:

- Provide inputs for Master Plan creation and updation
- Provide fuel supplies from local plantations/fallow land (where applicable).  
Enter into Fuel Supply Agreements
  - Land leases could be provided by State Government upon recommendation from Nodal Agency/ZP
- Manage local distribution services (where applicable) as franchisee
  - Technical
  - Metering Billing Collection
- Provide feedback on service levels of service providers

### **7.7 Others**

- GoI to undertake the following roles
  - Provide funds for capital subsidies under various schemes through the Nodal Agency

- Facilitate technology development, cost reduction and proliferation
- Provide training support through central facility (training the trainers)
- CERC to harmonise approaches among States
- REC/NABARD to facilitate financing
  - Rural Development fund for seed capital
  - Project Loans
  - Refinancing arrangements
  - Standardise of procedures for Regional Rural Banks, Co-Operative Banks and other Scheduled Banks. Provide training on appraisal and monitoring

## 8 Key Takeaways from National and International Experience in Rural Electrification

Various case studies of rural electrification in different states in India and a few international rural electrification experiences have been studied in order to assimilate the best practices followed elsewhere. The key success factors and causes of failures have been analyzed to formulate the recommendations described in the previous sections.

The team also made a visit to Bangladesh to study the fairly successful rural electrification program in the country. The key ingredients of in Bangladesh are:

- (i) Focus on financial viability and sustainability and not merely on network expansion
- (ii) Highly professional management cadre – yet focussed on local issues
- (iii) Local participation and flexibility in PBS operations
- (iv) Strong systems and processes –in planning, construction, operations and performance management
- (v) Strong governance framework – De-politised and de-unionised
- (vi) High degree of accountability and transparency – ensured through (a) master plan (b) strong MIS (c) compulsory metering
- (vii) Emphasis on efficiency – has resulted in even semi-urban areas being transferred from BPDB/DESA to PBS
- (viii) Training of operating personnel and institutional capacity development

The model is however not free from concerns. The key factors of concern are:

- (i) Highly facilitated arrangements. Sustained support from aid agencies
- (ii) Low level of private participation and entrepreneurship. Dependent on management by REB cadre
- (iii) Prone to politicisation – has required intervention of external agencies to limit interference

- (iv) Large parts of the country (65%) are yet to be electrified. Financial criteria set out may not permit electrification of less remunerative areas
- (v) Wide performance disparities between rich and poor PBSs
- (vi) Success in rural electrification not solved the problem of inadequate Generation and T&D capacity
  - Potential of backlash from consumers
  - Risk of non-payments in future if supply does not improve

Study of five states of West Bengal, Karnataka, Jharkhand, Uttar Pradesh and Madhya Pradesh revealed some successes and failures. The case studies have been discussed separately in the Annexure II to this report. The key takeaways from various states are:

- (i) **Local participation is a key success factor** – West Bengal has been quite successful in mobilizing the local consumers by organizing the village populace into Self Help Groups who are carrying out the role of a franchisee. They are also instrumental in mobilizing the local populace for co-operation and create the necessary demand by instilling the willingness to pay by educating them on the benefits of electricity in day to day life.

Similar experience is that of the PRESK (Participatory Rural Energy Services for Karnataka) model in Karnataka where there is active participation at the local level. The BERI (Biomass Energy for Rural India) Project is also an example of effective project implementation structure spanning government, rural development ministry, NGO, funding agencies and local community.

- (ii) **Separate Rural Nodal Agency** – In West Bengal, West Bengal Rural Energy Development Corporation Limited” (WBREDC) has been formed in 1999 to undertake exclusive works of rural electrification. Their main

objective is to undertake, carry out, promote and sponsor Rural Energy Development, including any programme for promoting rural electrification. Currently it is the agency responsible for carrying out the rural electrification program according to the guidelines of the RGGVY scheme and considerable progress have been made so far.

- (iii) **Off- grid Village Electrification** - In Karnataka, a successful example of a sustainable RE project based on biomass gasification technology since 1988. The basic model involves provision of a decentralized biomass gasifier based power generation system in an un-electrified village to provide lighting, drinking water, irrigation water and flour mill services. Key success factors are reliable supply of power, financial viability and local buy-in especially involvement of women in project management / dispute resolution due to direct benefit provided by provision of piped drinking water.
- (iv) **Unsuccessful venture of rural electrification through village societies** – In Madhya Pradesh Rural Electric Societies (RES) were created to cater to the needs of the rural consumers. The model could not run successfully due to :
- a) Power Politics in the running of Cooperatives
  - b) Non cooperation from utility due to unviable tariffs fixed due to political reasons.
  - c) Encouragement to non- payment of bills due to election favours of past dues waiver.

The community based biogas plants have also not been successful in the state due lack of governance at local level leading to disputes over amount of biomass to be contributed / rights of biogas use / manure etc. However certain new schemes have been introduced such as the **Gou-shala Biogas Scheme** which has success oriented features such as:

- a) Institution framework – *Gou-shalas* operate under government support. Centralized coordination with *Gou-Sabha Aayog*.
- b) Financial participation by local people in form of donations in cash / kind (diesel for the generator) due to religious considerations
- c) No manpower costs – utilization of existing manpower in *Gou-shalas*

The key learning in this state is that an acceptable existing institutional framework preferable than trying to create a new one. Adaptation to prevailing local conditions is a vital factor for sustainability.

# ANNEXURES

## **Annexure I : Salient features of Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)**

### **1. The Scheme**

Scheme is for the attainment of the goal set for providing access to electricity to all households in five years.

- Ninety per cent capital subsidy would be provided for overall cost of the projects under the scheme.
- States must make adequate arrangements for supply of electricity and there should be no discrimination in the hours of supply between rural and urban households.
- For projects to be eligible for capital subsidy under the scheme, prior commitment of the States would also be obtained before sanction of projects under the scheme for: -
  - Deployment of franchisees for the management of rural distribution in projects financed under the scheme, and
  - The provision of requisite revenue subsidies to the State Utilities as required under the Electricity Act, 2003.
- The scheme would be implemented through the Rural Electrification Corporation (REC).

### **2. Scope**

Under the scheme, projects could be financed with capital subsidy for provision of:

- Rural Electricity Distribution Backbone (REDB)
  - Provision of 33/11 KV (or 66/11 KV) sub-stations of adequate capacity and lines in blocks where these do not exist.
- Creation of Village Electrification Infrastructure (VEI)

- Electrification of un-electrified villages.
- Electrification of un-electrified habitations.
- Provision of distribution transformers of appropriate capacity in electrified villages / habitation(s).
- Decentralised generation-cum-distribution from conventional sources for villages where grid connectivity is either not feasible or not cost effective
- 25,000 remote villages covered for financing under MNES not included
- REDB, VEI and DDG would also cater to the requirement of agriculture and other activities including
  - irrigation pump sets
  - small and medium industries
  - khadi and village industries
  - cold chains
  - healthcare
  - education and IT

This would facilitate overall rural development, employment generation and poverty alleviation.

- Rural Household Electrification of Below Poverty Line Households:
  - Electrification of un-electrified Below Poverty Line (BPL) households would be financed with 100% capital subsidy as per norms of Kutir Jyoti Programme in all rural habitations.
  - Households above poverty line would be paying for their connections at prescribed connection charges and no subsidy would be available for this purpose.
- The scheme covers the entire country

### 3. Franchisees

- In the management of rural distribution through franchisees who may be Non-Governmental Organisations (NGOs), Users Association, Cooperatives or individual entrepreneurs.
- The Panchayat institutions would be associated.
- The franchisees arrangement may be for system beyond and including feeders from substation or from and including Distribution Transformer (s).

#### **4. Revenue Sustainability**

Based on the consumer mix and the prevailing consumer tariff and likely load, the Bulk Supply Tariff (BST) for the franchisee would be determined after ensuring commercial viability of the franchisee.

- This Bulk Supply Tariff would be fully factored into the submissions of the State Utilities to the State Electricity Regulatory Commissions (SERC s) for their revenue requirements and tariff determination.
- The State Government under the Electricity Act is required to provide the requisite revenue subsidies to the State Utilities if it would like tariff for any category of consumers to be lower than the tariff determined by the SERC.
- While administering the scheme, prior commitments may be taken from the State Government regarding -
  - Determination of bulk supply tariff for franchisees in a manner that ensures their commercial viability.
  - Provision of requisite revenue subsidy by the State Government to the State Utilities as required under the Electricity Act.

#### **5. Release of Capital Subsidy**

The capital subsidy for eligible projects under the scheme would be given through REC and projects shall be implemented fulfilling the conditionality

In the event projects are not implemented satisfactorily in accordance with the conditionalities indicated above, the capital subsidy could be converted into interest bearing loans.

#### **6. CPSU's Services**

The services of Central Public Sector Undertakings (CPSUs) have also been offered to the states, under MOU s signed with REC, for assisting the states in the execution of rural electrification projects as per their willingness and requirement.

#### **7. Technology Development, Capacity Building, MIS etc.**

Up to 1 per cent of the total subsidy under the scheme would be used for associated works / efforts of the programme.

#### **8. Merger of Existing Schemes**

This scheme merges the existing *"Accelerated Electrification of one lakh Villages and One Crore Households"* and the *"Minimum Needs Programme"* for rural electrification.

#### **9. Evaluation**

The scheme will be subject to evaluation and a view on modification required for implementation during 11th Plan will be taken after a comprehensive review towards the end of 10th Plan.

Implementation Framework for "Rajiv Gandhi Grameen Vidyutikaran Yojana - Scheme for Rural Electricity Infrastructure & Household Electrification"

In the light of the launching of new scheme as also the concerned OM issued by the Ministry of Power, for effective and expeditious implementation of the programme, the implementation framework involving the following documents which constituted the implementation framework for the earlier scheme "Accelerated electrification of one lakh villages and one crore households" have been modified accordingly and finalized after discussions with all the concerned

states, union territories, state power utilities and CPSUs in the three regional workshops held at Bangalore(10.05.05), Kolkata(20.05.05) and Delhi(24.05.05):

- (i) MoUs with CPSUs (Powergrid, NHPC, DVC & NTPC)
- (ii) Quadripartite Agreement(s) amongst REC, State Government, State Power Utility and the concerned CPSU.
- (iii) Tripartite Agreement(s) amongst REC, State Government (s) and State Power Utility(s).
- (iv) Guidelines for project formulation for electrification of villages and rural households for grid supply system (P:RHhE).
- (v) Guidelines for procurement of goods and services
- (vi) Amendments to REC specifications and standards

The finalized documents have been forwarded to all states on 4th June 2005 with the request for immediate formulation of projects, submission of DPRs, signing of relevant agreements and implementation of the projects as per the agreed framework.

Response of the states has been encouraging. Most of the states have agreed in-principle to the conditionalities of the RGGVY and given their consent for participation in the programme except for the state of Goa which has declined to participate during 2005-06. The state of Tamil Nadu has not agreed to the condition of deployment of franchisee arrangement.

MOU entered into by REC with NTPC, POWERGRID, NHPC and DVC to make available, CPSUs' project management expertise and capabilities to states, wishing to use their services, to augment their implementation capacities for the programme.

#### **10. Signing of agreements**

The quadripartite/tripartite agreements for implementation of the projects under RGGVY in respect of the following states have been signed:

- (i) Uttaranchal – 23.06.2005

- (ii) West Bengal - 24.06.2005 and 04.07.2005
- (iii) Chhattisgarh - 30.06.2005
- (iv) Rajasthan - 08.07.2005
- (v) Haryana - 09.07.2005
- (vi) Uttar Pradesh - 13.07.2005
- (vii) Kerala - 21.07.2005
- (viii) Assam - 21.07.2005

The relevant agreements in respect of the states of Jharkhand and Karnataka are expected to be concluded by end of July 2005.

### 11. DPR s received

To facilitate the process of project formulation, REC has been organizing state-wise workshops for formulation of project. Such workshops have already been conducted in the states of Assam, Arunachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Uttaranchal and similar workshops are being organized in other states.

The draft DPRs have been received from the states of Assam, Arunachal Pradesh, Haryana, Himachal Pradesh, J&K, Kerala, Karnataka, Madhya Pradesh Maharashtra and Uttaranchal. The details of the draft DPRs received are given below.

**Table: Draft DPRs Received under RGGVY**

S.No.	State	Date of receipt	No. of Projects	Cost of Project (s) (Rs. Lakh)	Proposed	
					No. of un-electrified villages	No. of habitations / electrified villages
1	Kerala	30.05.05/ 07.06.05	19	47723.51	-	3579/931
2	Assam	13.06.05/1 5.06.05	3	16342.00	824	-
3	Arunachal Pr.	21.06.05	4	14782.88	367	-

S.No.	State	Date of receipt	No. of Projects	Cost of Project (s) (Rs. Lakh)	Proposed	
					No. of un-electrified villages	No. of habitations / electrified villages
4	Uttaranchal	30.06.05/1.07.05	4	2986.34	-	6278 / 4463
5	Karnataka	27.06.05/08.07.05	14	45012.65	-	-
6	Haryana	01.07.05	6	30444.21	-	927 / 927
7	Himachal Pradesh		1	4257.36		
8	Jammu & Kashmir		1	4096.44		
9	Maharashtra		8	18930.98		
10	Madhya Pradesh	24.06.05	5	38445.96	71	4224/4962
	<b>Total</b>		<b>65</b>	<b>223022.33</b>	<b>1262</b>	<b>13959/ 9109</b>

## 12. Progress achieved

Electrification work in 17 villages in Raebareli and 9 villages in Sultanpur district of UP have been completed as on 20th July, 2005.

To facilitate deployment of franchisee for management of rural distribution by the states as envisaged under the concerned OM issued by MOP, REC has formulated draft guidelines for franchisee arrangements and shall be finalized after discussions with MOP and the participating states.

For effective monitoring and concurrent evaluation of programme, on line monitoring system is being formulated in consultation with NIC.

**Table: Status of implementation of RGGVY**

(Amount in Rs. Lakh)

S.No.	State	Projects Sanctioned					NITs Issued					Work Awarded			
		No. of Projects	No. of Districts	No. of un electrified villages Covered	No. of un-electrified households covered	Total Project Cost	No. of Projects	No. of Districts	No. of un electrified villages covered	No. of un-electrified households covered	Total Project Cost	No. of Projects	No. of Districts	No of un-electrified villages covered	No. of un - electrified housed olds covered
1	West Bengal	13	13	4283	145918	38503.56	12	12	4280	145855	3847375	4	4	1 950	6172 3
2	Uttar Pradesh	62	65	30802	1258844	229140 61	61	64	30274	1187705	223774 75	37	40	17964	644783
3	Bihar	28	28	18602	928217	161803.8 6	28	28	18602	928217	161803 86	4	4	2974	128863
4	Rajasthan	8	8	472	12433	3109.76	7	7	426	10817	2818.10				
<b>Sub-Total (1-4)</b>		<b>111</b>	<b>114</b>	<b>54159</b>	<b>2345412</b>	<b>432557.7 9</b>	<b>108</b>	<b>111</b>	<b>53582</b>	<b>2272594</b>	<b>426870.4 6</b>	<b>45</b>	<b>48</b>	<b>22888</b>	<b>835369</b>
5	Kerala	7	7	1847*	227320	22175.75									
6	Uttaranchal	4	4	437	88475	22059.38									
7	Haryana	2	2	511**	51128	2639.57									
8	J& K	2	2	46	35115	7246.65									
9	MP	1	1	499**	35853	3754.66									
<b>Sub-Total (5-9)</b>		<b>16</b>	<b>16</b>	<b>483</b>	<b>437891</b>	<b>57876.01</b>									
<b>Total (1-9)</b>		<b>127</b>	<b>130</b>	<b>54642</b>	<b>2783303</b>	<b>490433.8 0</b>	<b>108</b>	<b>111</b>	<b>53582</b>	<b>2272594</b>	<b>426870.4 6</b>	<b>45</b>	<b>48</b>	<b>22888</b>	<b>835369</b>

## Annexure II Case Study of Five States

### A) Uttar Pradesh

#### State Overview

State Profile	Uttar Pradesh	
<b>Total Installed Capacity</b>	8385	As on 31/01/06
Hydro	14%	
Thermal	83%	
Renewable	1%	
<b>Current Demand Supply Position</b>		For April05-Jan06
Peak Deficit	19.40%	
Energy Deficit	21.70%	
<b>Anticipated Demand Supply Position</b>		For 2006-07
Peak Deficit	28%	
Energy Deficit	21%	
<b>Rural Electrification Status</b>		As on 12/12/05
Village Electrification	58%	
Household Electrification	20%	

Uttar Pradesh is the most populous state in India. The state has one of the worst power situations in the country as is evident by the large demand supply gaps. The state continues to suffer from poor operational parameters including low PLF of generation plants, high T&D losses and poor collection efficiency. The AT&C loss figures for the state are expected to be over 40%. Commercial viability is also a far fetched goal with the deficit between the ARR and the average cost of supply as high as 88paise / kWh.

However the government has shown strong support towards the reform and restructuring initiative and all utility has been unbundled into five Discoms. There have also been regular infusions in the utilities.

Not surprisingly, the state has one of the worst records in rural electrification with 80% of all rural households and 42% of villages with no access to electricity.

### ***Case Study: Distributed Informal Power Market in Rural UP***

#### **Introduction**

In many villages in UP, an informal power market is operated by private operators.

#### **Basic Model**

Provision of 4/5 hours of electricity primarily for lighting purposes in the evening using a diesel genset and a crude distribution network using wires drawn out to individual homes. The operator then collects the nominal amount for example Rs 5 / home, dismantles and removes the system.

#### **Key Learnings**

1. Highlights the need for electricity in rural areas.
2. Showcases the ability and willingness of rural people to pay for electricity if supplied to them in their hour of need.
3. Temporary services provided at a pay per use basis to overcome the law and order and administration issues.
4. Applicability of market oriented solutions to address immediate and basic needs relating to rural power.

#### **Other Examples**

Another example that demonstrates the need for power amongst the rural people and their ability to pay for it is the existence of some mobile phone owning

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population in un-electrified village. These villagers visit the nearest district / block every 3 to 4 days and pay Rs. 2 to a private operator in order to get their phones recharged.

### **Suggested Takeaways**

The above examples exemplify the need for electricity in the rural population. It also suggests the ability to pay for power if provided with reliability. Informal arrangements like these can be built upon and supported using innovative models. For example, provision of subsidized battery storage, to enable night long provision of electricity and slowly expand electricity usage. These can be charged using the current pay per use diesel genset schemes where applicable or be taken by villagers themselves to the nearest electricity point.

**B) Karnataka**

**State Overview**

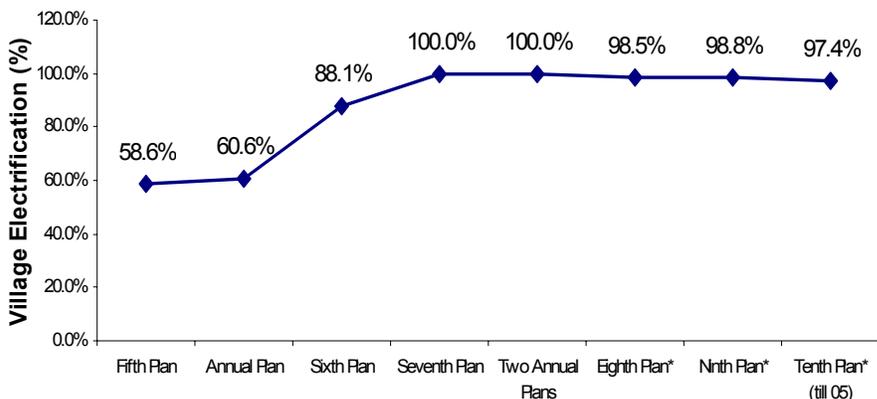
State Profile	Karnataka	
<b>Total Installed Capacity</b>	7766 MW	As on 31/01/06
Hydro	45%	
Thermal	43%	
Renewable	12%	
<b>Current Demand Supply Position</b>		For April05-Jan06
Peak Deficit	2.40%	
Energy Deficit	0.30%	
<b>Anticipated Demand Supply Position</b>		For 2006-07
Peak Deficit	21%	
Energy Deficit	15%	
<b>Rural Electrification Status</b>		As on 12/12/05
Village Electrification	97%	
Household Electrification	72%	

Karnataka enacted the electricity reform act in 1999, furthering the unbundling of Karnataka Electricity Board (KEB) into a transmission company and four distribution companies. A regulatory commission was also established.

The power situation in Karnataka is better than majority of the other states. With a total installed capacity of around 7766 MW, the state had a peak demand deficit of 2.4% and energy deficit of 0.3%. However the forecast for the next fiscal is bleak with the forecasted peak deficit to rise to 21% and the energy deficit to rise to 15%. One of the key reasons for the wide variation in Karnataka’s demand supply position is the high proportion of hydro power capacity (45% approximately) which is dependent on the monsoons.

In terms of rural electrification too, Karnataka is one of the leading states in India. Of the 27481 villages in Karnataka, only 710 remain to be electrified achieving a village electrification level of 97.2%. Karnataka also has 72% of rural households electrified which is well above the national average of 44%.

**Planwise Progress of Village Electrification**



Primary rural energy needs in Karnataka is summarised below:

- Lighting – 72% Electricity, 27% Kerosene
- Cooking – 85% Firewood, 7% Crop residue

The economic indicators of rural Karnataka are the following:

- Access to Banking Services – 35%
- Radio / Transistor – 42%
- Television – 21%

## **Case Study1: Off-grid Village Level Biomass Gasifier Electrification**

### **Project Introduction**

Project undertaken by Centre for Sustainable Technologies, IISc, Bangalore, are under funding from several funding sources under various projects. Project installed in 1988, continuing even now.

### **Area of Coverage**

Village Hosahalli, Taluk – Kunigal, District – Tumkur.

### **Village Statistics**

Number of unelectrified household – 35

### **Basic Model**

Provision of a decentralized biomass gasifier based power generation system in an un-electrified village to provide lighting, drinking water, irrigation water and flour mill services.

### **Key Features**

Local community ownership and participation, self sustaining, Reliable power supply for essential services

### **Methodology**

1. Discussion meetings with village community explaining the technology, roles, responsibilities, benefits and the need for participation.
2. Agreement of village community to undertake raising and protecting an energy forest for the secure supply of biomass for the plant.
3. Raising of the forest, installation of the generation systems and phase wise installation of end use systems including flour mill, and provision of pipe drinking water

4. Training of local youth to operate and undertake minor maintenance of the system.
5. Formation of village communities to manage the systems, taking decisions on operations, supervision of the operator, protection of the forest and ensuring payment for the services provided.

### **Project Investments**

1. Power Generation system (capacity 20 KW) – Gasifier, Diesel Engine, Generator, Building
2. Distribution and End Use systems – lighting (load 4 KW), irrigation water pumps (18.5 KW), Flour Mill (5.6 KW), Drinking Water (2.6 KW)
3. Energy Forest and Plantation – 4 hectares (on community lands)

### **Operating Costs**

Key Cost components include diesel costs, biomass costs (including transportation from forest to plant), engine and gasifier maintenance costs, labour cost of the operators' salary. Depending on load utilization, the per unit cost ranged from Rs 5.85/kWh at 6 KW load to Rs 3.34/kWh at 20 KW load. (2003 cost data)

### **Tariff Structure**

Financially Viable End use – Service based tariff structure.

1. Lighting – Rs. 5/ bulb-point/month
2. Piped Water Supply – Rs. 10/ household/month for 2hours/day

Irrigation – Rs. 40/hour (based on diesel pumping rates)

## Performance

1. Power generation system operational over 90% of days, dual mode operation for 70% days indication availability of biomass, diesel only mode for 25% days to provide reliability. Electricity generation per year – 12 to 22 MWh.
2. Piped drinking water provided for over 85% of days, flour mill operated twice or thrice a week depending on need, irrigation provided as per requirement only. Demand Side management at the community level to alter between competing usages.

Reliable service oriented tariff structure well accepted by village community with domestic services realization between 94% - 99% and agriculture realization between 76% and 82%.

## Problems Encountered

1. Technical Problems – gasifier and engine related problems. Resolved and addressed using R&D group.
2. Input Supply – non availability of wood chips in cut and dried form was a dominant problem especially during rainy season. Also labour availability during peak crop season an issue. Closest diesel supply also 30 kms away. Mitigation measures – creation of storage capacity, mechanized cutting of wood, drying of wood using engine exhaust gas. Problem of diesel availability may be solved by adoption of gas engine technology (in advanced R&D stages).
3. Social problems – disagreement between managing committee due to political rivalry, unauthorized grazing of livestock in forest, unauthorized removal of trees, encroachment of forest land, opposition to operator from one section of society etc.

However the problems were infrequent and resolved amicably without any interruptions in the system mainly due to the ownership amongst the village community especially women for the project on account of crucial services such as piped water, lighting and access to flour mill.

### **Key Takeaways**

1. Biomass Gasifier based engine: Technological and Financially Sustainable solution for village electrification.
2. Provision of reliable supply to crucial services such as drinking water, creates a buy in for the project. Availability of fuel (diesel and biomass) and timely operation and maintenance.
3. Revenue realization to be facilitated by reliability of power and end use service tariffs.

### **Project Replicability**

1. Technology – can be installed and operated anywhere where biomass is available or grown. Different sizes also available from 5 to 200 KW.
2. Management – relatively easy at the individual village level.

Funding available under MNES biomass program, MNES remote village electrification program, other rural development schemes.

### ***Case Study2: Grid Connected Rural Electricity Distribution Franchises***

#### **Project Introduction**

Participatory Rural Energy Services for Karnataka (PRESK), pilot project under USAID SARI/Energy program – 2003 to 2005.

#### **Area of Coverage**

Four taluks covering 112 gram Panchayats (GP).

## Basic Model

Empowerment of the GPs to undertake metering, billing and collection activities under a MoU with the distribution company.

## Key Features

Integrated approach to water and energy issues.

## Methodology

1. Organization of public meetings, workshops and training sessions for GP representatives and farmers in collaboration of Karnataka Department of Rural Development and Panchayat Raj, the Department of Energy and the Bangalore Electric Supply Company (BESCOM).
2. Local surveys of water usage and crop revenues were conducted along with capacity building efforts were initiated to train GP representatives on how to manage electricity billing and collections at the local level.
3. Information dissemination and awareness using movie, information booklets in local language, talks by representatives from Bangladesh Rural Electricity Board.
4. Development of an Indo-American technical assistance and venture capital NGO, the Small Scale Sustainable Infrastructure Development Fund to establish a presence in the four talukas, to identify small projects for energy and related infrastructure investments. It acts as an social merchant bank providing financing and know-how from its own resources as well as by creating access and linkages to others including local partners like activist and NGOs, academic groups, equipment suppliers etc.

## Performance

20 GPs out of a total of 112, expressed specific interest in taking over Metering, Billing and Collection (MBC) activities from BESCO, while 6 GPs passed formal resolutions to do so.

### **Key Takeaways**

1. Using information, awareness and capability building to facilitate local community participation. .
2. Program done with the support of the utility. Create a business case for the utility to support the rural franchises as it reduces their effort and improves their realization.

### **Project Replicability**

1. Applicable to areas / states with a history of community level cooperation, strong cooperative culture and a strong and effective GP administration.
2. Also applicable where grid extension is feasible and the utility is able to provide cheap and reliable power.

### **Case Study3: Biomass Energy for Rural India Project (BERI)**

#### **Project Overview**

1. Supported by GEF-UNDP, India Canada Environment Facility (ICEF), GoI and GoK. 2001 – 2006.
2. Total Funds – Rs. 40.06 crores
3. Area of Coverage - 24 villages covering 5 talukas covering nine village Panchayats.
4. Basic Model - Large scale demonstration project for decentralized biomass based energy solutions and holistic rural development through community participation

## Project Components

1. Technology Demonstration (Biomass gasifiers, Biogas plants)
2. Biomass Development
3. Community Mobilization and Institution Building
4. Information Dissemination, Training and Capacity building
5. Rural livelihood and entrepreneurship development

## Implementation Framework

1. Functionally Independent Program Management Unit housed in Karnataka State Council for Science and Technology.
2. Agreements and MoUs with
  - a. Cluster NGO for community mobilization and institutional building.
  - b. Forest Dept. for technical support in community based sustainable biomass production and management.
  - c. Zilla Panchayat for Hydro-geological survey for ground water mapping and bore-wells drilling
3. Issuance of government order to grant functional autonomy.
4. Regular review of project at the state level being done by the Project Steering Committee headed by Additional Secretary and Development Commissioner.

## Community Participation Framework

1. Nodal Agency – Identified cluster NGO.
2. Establishment of
  - a. Village Bio-energy Management Committees (VBEMC) for overall management of village bio-energy systems. 15 members including 30% women members elected Panchayat members and landless agricultural workers.

- b. Village Forest Committees (VFC) for sustainable biomass production, supply and management of forest resources.
- c. Water Users Associations (WUA) for management of community irrigation systems
- d. Biogas Users Group (BUG) for management of community biogas units.
- e. Self Help Groups (SHG) comprising mainly women involved in micro-credit and income generating activities.

**Key Takeaways**

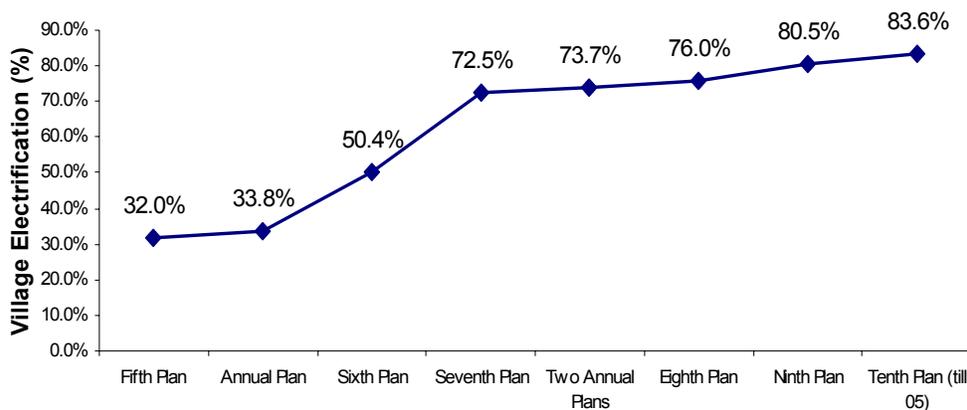
1. Effective project implementation structure spanning government, rural development ministry, NGO, funding agencies and local community.
2. Holistic rural development through intensive rural community participation.

### C) West Bengal

#### Rural Overview

In West Bengal, 72% of the total population in the State resides in rural areas. The total number of villages is 37,945 and there are 294 households per village. Rural poverty ratio is 32% as compared to the national average of 27%. Population Density is 904 persons per square km (compared to national average of 324). The current village electrification level is at 86.3% as per the old definition. However, the household electrification is substantially low.

**Planwise Progress of Village Electrification**



#### Case I: Nodal Agency for Rural Electrification (WBREDC)

In 1999, the State Government set up a Nodal Agency, West Bengal Rural Energy Development Corporation Limited” (WBREDC) to undertake the exclusive works of rural electrification. It was formed with a few top officials and other technical experts on deputation from WBSEB.

#### Main Objectives of WBREDC

1. To undertake, carry out, promote and sponsor Rural Energy Development, including any programme for promoting rural electrification
2. To incur any expenditure on any programme on rural electrification
3. To assist execution and promotion there of either directly or through an independent agency or in any other manner;
4. To promote social and rural development by providing energy electricity through conventional and non-conventional sources of energy
5. To promote, own acquire, erect, construct, establish, maintain improve, manage, alter, carry on, control, take on hire/lease rural electrification infrastructure
6. Function as a licensee and deal in electrical power energy with the State Electricity Board, State Government, Appropriate Authorities licensees, Electricity/Energy Cooperative specific industrial units and other consumers for industrial, commercial, agricultural household and any other purpose in West Bengal.
7. To create Subsidiary Companies at District or Sub-districts level for the programme of Rural Energy Development.
8. To organise formation of Rural Energy Development Cooperatives at Districts/ Sub-districts level with object of Rural Energy Development.

#### **Schemes under RGGVY**

1. *Electrification of virgin Mouzas* - Electrification of hitherto unelectrified villages
2. *Intensification of Mouzas* – Increase the number of household connections in a village already electrified
3. *Re-vitalization program* – Reinforcement of the transmission and distribution network in rural areas

#### **Basic Model**

1. *Conventional grid extension* to almost all parts.

2. *Distributed generation* facilities in some remote locations such as the Sunderbans with the help of renewable sources of energy are being set up by WBREDA.
3. At the village level, an *input based franchisee model* is being followed where local Self Help Groups (SHG) are being formed primarily with the local women.
  - a. SHGs can take the following roles (in step wise approach according to their capability) in an franchise:
    - i. Step 1 - Mobilization of the local populace for co-operation and create the necessary demand by instilling the willingness to pay by educating them on the benefits of electricity in day to day life.
    - ii. Step 2 - Bill distribution and collection
    - iii. Step 3 - Meter reading , bill distribution and collection
    - iv. Step 4 - Complete role of a distribution franchisee O&M, billing, meter reading and collection
  - b. Performance Monitoring and Capability Building of SHGs:
    - i. In West Bengal, there are 17218 SHG s for different activities.
    - ii. For Rural Electrification, SHG s are graded on a 6 monthly performance review.
    - iii. Based on the grade the SHG s are allotted the tasks according to the categories mentioned above.
    - iv. Only the graded SHG s are selected.
    - v. Non- graded SHG s are selected only as an exception where there are already existing cooperatives with good credit linkage with cooperative banks and if at least one member of the group has passed the Xth standard.

- vi. The SHG s are trained with the help of an NGO and made eligible for undertaking all the activities of a distribution franchisee.
- c. Future Plans – To make the SHG s self sufficient as a franchisee
  - i. A contract with built – in incentives and penalties would be signed
  - ii. Incentives would consist of
    - commission of 15% on T%D loss reduction to 7% ;
    - Rs 2/ month per new connection added;
    - Rs 50 / km of distribution line serviced
    - A one time incentive of Rs 500 for achievement of 80% electrification in one village;
  - iii. Benchmark of minimum 600 connections per SHG - To ensure viability
  - iv. Identification of the villages and SHG selection is carried out by the local District Committee in consultation with WBREDC.

### ***Case 2: Distributed Generation through Renewable Energy Schemes***

#### **Project Overview**

1. Carried out by West Bengal Renewable Energy Development Agency (WBREDA)
2. Distributed generation facility (biomass / wind / solar PV) with a mini- grid
3. Individual Household (Scattered Demand) - Solar home lighting facilities
4. 90% loans from MNES under Remote Village Electrification Program and the remaining from State Funds

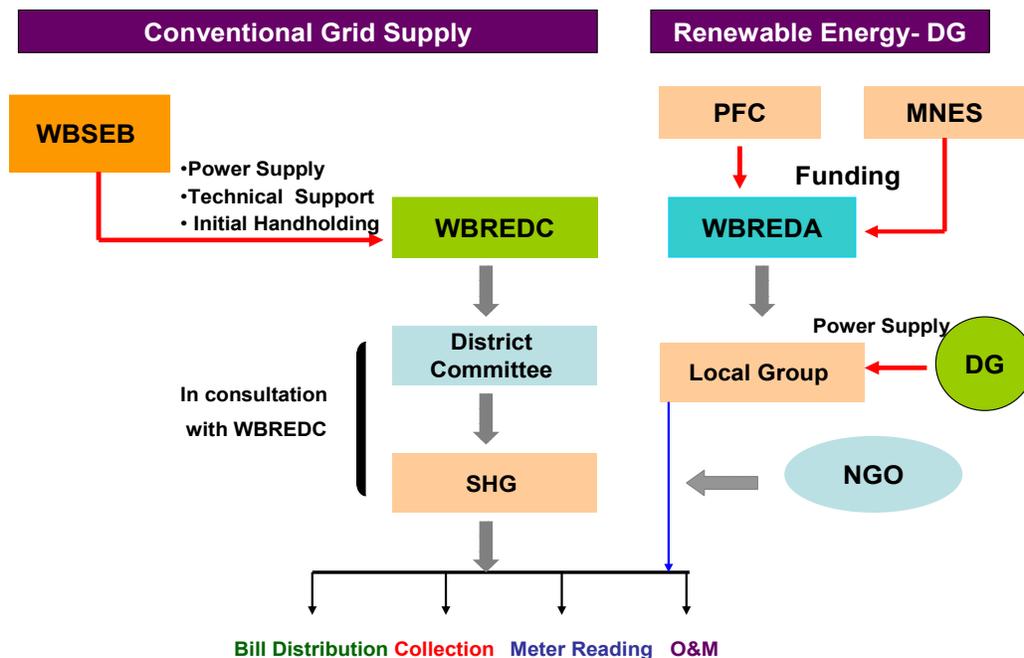
#### **Basic Model**

1. WBREDA has adopted the franchisee model in 5 villages in Sunderbans

2. DG facilities to be set up with grant from MNES.
3. Construction of plants would be undertaken by interested parties and allotted through bidding process.
4. The distribution franchisees will be chosen from interested private parties like local business houses or any local community including Panchayats.
5. NGO s will be involved for mobilization and training of local groups.
6. So far, 11131 villages have been identified through surveys conducted with the help of village Panchayat for further implementation.

### **Institutional Set – up for Rural Electricity Provision in the State**

In West Bengal, two generic models of rural electrification are followed viz. Conventional Grid Supply and Distributed Generation with renewable energy. WESEB supplies power and technical support to WBREDC, the state nodal agency for extending rural supplies to remote areas through conventional grid extension. District Committees have been formed as per the RGGVY schemes, which are responsible for implementing the scheme at each district level. The District Committees implement the franchisee models at the village level through the Self Help Groups (SHG) who carry out O&M, meter reading, collections and bill distribution. Rural electrification through renewable energy is carried out by the separate agency, West Bengal Renewable Energy Development Agency (WBREDA), with grants and loans from MNES. WBREDA collaborates with NGO s to organise local groups to perform the tasks of an input based franchisee. The following diagram shows the institutional set –up for rural electrification in West Bengal



### Case 3: Singur- Haripal Co-operative

#### Background

- Formed in 1980 under the Cooperative Society Act
- Current consumer base
- 97 thousand (domestic, commercial, industry)
- 33 thousand Lokdeep (Kutir Jyoti)
- Current assets worth Rs 29 Crores of which Rs 49 lakhs worth of assets were inherited from SEB s

#### Initial model

- Bulk purchase from SEB
- Sold at tariffs applicable for rural areas set by the SEB
- Carried out complete O&M, metering, billing & collection
- Functioning successfully since inception

- After constitution of WBREC , bulk supply tariff was increased
- Franchisee route opted by the Cooperative as per the Electricity Act in August 2005

**Current impediments**

- Sep 2005 Commission passed order setting consumer tariff at par with SEB consumers.
- Arrears to be recovered from consumers in the cooperative area in 6-7 instalments
- Led to considerable discontent among consumers and members of cooperative
- Bulk supply tariff increased as a result surplus investible funds for system improvements have reduced

## **D) Jharkhand**

### **Rural Overview**

78% of population residing in rural areas

Rural Poverty Ratio – 44% (as compared to national average of 27%)

Population Density of 338 persons per square km (compared to national average of 324)

Number of villages = 29,354

Average number of households per Village – 130

### **Rural Household Characteristics**

Rural Household Electrification – 10% (lowest amongst the states, next only Bihar)

#### **Primary Energy Needs**

- Lighting – 90% Kerosene, 10% Electricity
- Cooking – 68% Firewood, 13% Coal / Charcoal, 11% Cow Dung, 5% Crop residue

#### **Rural Economic Indicators**

- Access to Banking Services – 21%
- Radio / Transistor – 24%
- Television – 7%

### **Progress on Rural Electrification**

- Separate data for Jharkhand not available for past plan periods
- Current village electrification level at 26% (as per old definition)
- Data as per new definition not available
- Jharkhand at a worse situation than its parent state – Bihar (50% village electrification)
- Access to Grid
- Lack of Grid Access (no transmission network) in vast regions of west, mid-west and south-west Jharkhand
- Districts of Garhwa, Palamau, Latehar, Gumla, Lohardagga, Simdega amongst the regions having no grid access

- 3,824 villages are declared to be unavailable for grid connectivity.

### **Case 1: Standalone Distributed Generation**

#### **Overview**

- DG Options for the state - Micro-hydel, solar, biomass being tried out through Pilot Projects in selected areas.
- Efforts at promoting local participation in development of non-conventional energy generation
- Gumla and Simdega areas targeting ex-army and government officers as potential operators of DG plants.

#### **Micro Hydel**

- Technology developed by NEPRA (Pakistan) and IIT, Kharagpur
- Based on a preliminary study, around 50 sites have been identified for micro-hydel project development
- DPRs are being prepared by JREDA (Jharkhand Renewable Energy Development Authority)
- Jharkhand Electricity Regulatory Commission has recommendation to the Government of Jharkhand that JREDA should be the sole agency looking after the development of micro-hydel projects in Jharkhand.
- JERC has also recently carried out site-inspection of innovative micro-hydel projects i.e. one in Sri Lanka (Near Kandy) to assess its technological suitability for the state.

#### **Biomass Gasifier**

- Two biomass gasifier plants have been set up near Jonha Falls (20 km from Ranchi)
- Run by a local NGO with the help of JREDA.
- These plants are still under observation in order to assess their physical (raw material procurement) as well as financial (tariff) feasibility.

### Progress under RGGVY

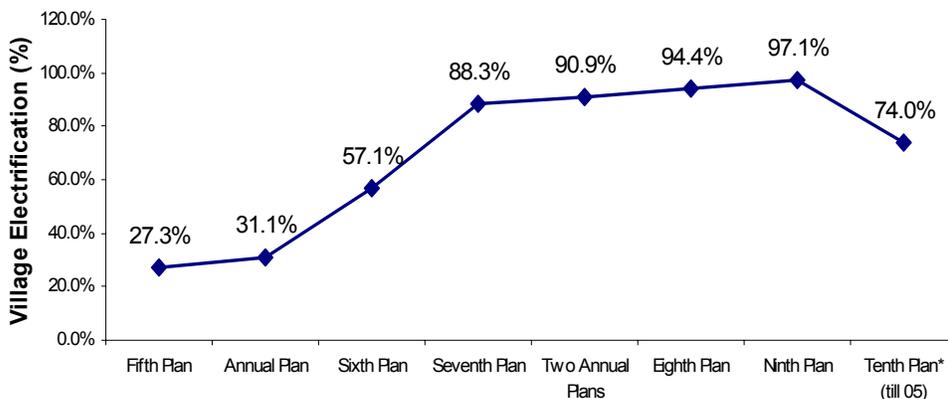
- 19 DPRs under RGGVY submitted by the Government of Jharkhand
- 11 DPRs have been approved for development by the monitoring committee of MoP on RGGVY.
- Hopes for an approval for around 22 projects under RGGVY should be attained by August 2006.
- Though in-principle approval has been obtained, funds have not been disbursed to agencies responsible for in the turn-key implementation of the project.
- Reasons for non-disbursal of funds include:
  - Delayed submission of DPRs
  - Less number of bidders
  - Constraints in material procurement
  - Uncertainty regarding forest department clearance etc.

**E) Madhya Pradesh**

**Rural Overview**

- 74% of population residing in rural areas
- Rural Poverty Ratio – 37% (as compared to national average of 27%)
- Low Population Density of 196 persons per square km (compared to national average of 324)
- Number of villages = 52,117
- No of Electrified Villages (As per old definition) – 50474 (96%)
- No of Villages Identified as Unsuitable for Grid Electrification – 1255
- Electrification Level (As per new definition) – 74%
- Average number of households per Village – 156

**Planwise Progress of Village Electrification**



**Rural Household Characteristics**

- Rural Household Electrification – 10% (lowest amongst the states, next only Bihar)
- Primary Energy Needs
- Lighting – 62% Electricity, 37% Kerosene
- Cooking – 76% Firewood, 13% Cow Dung, 7% Crop residue

### **Rural Economic Indicators**

- Access to Banking Services – 21%
- Radio / Transistor – 17%
- Television – 17%

### **Case 1: Rural Electric Societies**

#### **Project Overview**

- 14 Rural Electric Societies existed in the State
- Formed in 1980s under the Ministry of Agriculture
- An RES covered the area of one block encompassing around 80/100 villages
- Unit price was originally fixed at 10 paise / unit. Currently at Rs. 2 / unit. (no fixed charges)

#### **Reasons for Failure**

- Power Politics in the running of Cooperatives
- Non cooperation from utility due to unviable tariffs fixed due to political reasons.
- Encouragement to non- paying of bills due to election favours of past dues waiver.

#### **Result**

- 10 Rural Electric Societies wound up and merged with the utility by a regulatory order in 2002

### **Case 2: Community Based Biogas Plants**

#### **Project Overview**

- Scheme under the MNES
- Provide for setting up bio-gas plants in villages to provide for energy needs (cooking and electricity)

### Reasons for Failure

Lack of governance at local level leading to disputes over amount of biomass to be contributed / rights of biogas use / manure etc.

### Result

- Almost all biogas plants are in non-functional state.
- MPUVNL has stopped undertaking activities under this scheme

### Case 3: Solar Lighting Scheme

#### Project Overview

- MNES Scheme under IREP - “Usha Kiran Urja Gram Scheme”
- Scheme to electricity forest / remote / tribal villages / hamlets through solar based systems
- 90% capital grant from MNES, 10% share from beneficiaries / other sources including M.P development funds etc/ donations from institutions
- 30 villages covered so far

#### Key Features

- Provision of one Solar House System – 18 watts in each household and street lights
- Charge Rs 40/- per household and Rs 100 per village Panchayat for creating fund to pay for battery replacement in future
- One village person (unemployed youth from the village) responsible for maintenance, collection and coordination of 3 to 4 villages
- Selected person provided 5 days technical training at MPUVL training centre, provided with a bicycle to take care of surrounding villages.

#### Success Factors

- KSF Identified - Continued O&M and collection of User tariff
- Rs. 50,000 Fixed Deposit created (as part of project cost). Interest earnings to provide for timely salary of the village operator
- Operator responsible for collections and depositing in the bank account opened under the village scheme.

#### **Field Trip to Pili Talai Village**

- Un-electrified Hamlet in a forest area. Inaccessible by road. Nearest village / road – Kajlikheda – 30 kilometers from Bhopal.
- 19 households; Population – 110; 17 households – Below poverty line
- Occupation based on forest products and related activities
- Provided with Model 1 – Solar light System – 18 watt panel. Street lights – 6
- User Satisfaction level – High.
- Payment Record – Very Good
- Key Benefits – Allow them to work during night thereby helping in raising economic levels, street lights provided safety from forest animals during night

#### **Case 4: Gou-shala Biogas Scheme**

##### **Project Overview**

- State Government Scheme - “Gou Sambhardhan Se Swavlamban Pariyojna”
- 52 Gou-shalas in the state selected (out of a total of 700 existing)
- State providing 90% capital subsidy, 10% borne by beneficiary
- Provision of a bio-gas plant, drinking water pump, and a electric generator (3kVA – 10 kVA) and civil works for a generator room.

### **Success Oriented Features**

- Institution framework existing – Gou-shalas operate under government support. Centralized coordination with Gou-Sabha Aayog.
- Financial participation by local people in form of donations in cash / kind (diesel for the generator) due to religious considerations
- No manpower costs – utilize existing manpower in gou-shalas

### **Result**

- Help the Gou-shala achieve independent for its energy and electricity needs.
- Provide additional income stream by sale of manure and informal sale of surplus electricity to neighbouring shops / market place.

### **Key Takeaway**

Use of an acceptable existing institutional framework to be preferred than trying to create a new one.

### ***New Initiatives in Madhya Pradesh***

#### **Rural Distribution Franchise Scheme**

- Being implemented by “MP Madhya Kshetra Vidyut Vitaran Company Ltd”
- Two different schemes are being finalized
- Basic objective to improve revenue realization from rural areas by outsourcing rural distribution activities.

#### **Scheme 1: Outsourcing of M, B, C activities**

- At the 11 KV feeder level
- Franchise to be selected - EoI invited from Panchayats, NGO, Individuals
- Franchise responsible for Meter Reading, Bill Distribution, Collections, education and awareness, help in getting new connection
- Franchise to deploy Village Contact Person

- To form Village Level Samiti – for theft reduction, dispute resolution etc.
- Baseline parameters established – Billing Efficiency \* Collection Efficiency  
= Overall Efficiency

### **Scheme 2: Complete Franchising**

- At the 11 KV feeder level
- Franchise responsible for everything including operation & maintenance.  
Only bill to be generated by Discom
- Looking at interest from small companies / retirees SEB officials etc.
- Targets on Increase in Per Unit Realisation of the feeder
- 1% in first three months
- 5% for next three months
- 10% in the next 6 months
- Discom to provide for transformer replacement if failure rate below 2%.  
(would recover cost of repairing from franchise)

### **Key Success Conditions**

- Response to invitation for undertaking operations
- Commitment of utility in the entire process
- Improvement in supply reliability parameters

## Annexure III Functions of the State Government

The Act has laid down certain specific responsibilities on the State Government to facilitate RE in the State. These include:

- Inputs on the national policy to be prepared and notified by the Central Government in consultation with the State Government, permitting stand alone systems (including those based on renewable sources of energy and non-conventional sources of energy) for rural areas;
- Inputs on the national policy to be prepared and notified by the Central Government in consultation with the State Government and the State Commissions, for rural electrification and for bulk purchase of power and management of local distribution in rural areas through Panchayat Institutions, users' associations, co-operative societies, non-Governmental organizations or franchisees;
- Notification of rural areas in the State, under eighth proviso to Section 14 of the Act, where a person would be allowed to undertake stand-alone generation and distribution activities without requirement of a license;
- Recommendations to be provided to the State Commission, under Section 13 of the Act, for non-applicability of provisions of Section 12 of the Act to any local authority, Panchayat Institution, users' association, co-operative societies, non-governmental organizations, or franchisees, for undertaking rural electrification and distribution operations in rural areas. A draft rural policy has already been issued by the Central Government for comments by various stakeholders. Apart from the above, as mentioned in this report, the State Government would also need to establish a State-level dedicated Nodal Agency to facilitate rural electrification initiatives in the State. The Agency is also envisaged to have a dedicated fund at its disposal for pooling of the funds made available by the State Government

for RE along with the funds available from the Central Government for rural electrification purposes.

The State Government would also need to provide necessary support and guidance to the State nodal agency during the initial phase to ensure smooth implementation of RE projects by way of providing inputs in formulation of necessary organization structure, competitive framework for implementation and funding of various RE projects, framework of transfer of rural distribution network to the local entity, among such others.

## Annexure IV Functions of the State Regulator

- **License Exemption:** Facilitate the State Government in formulation of terms and restrictions, including the period of applicability, for license exemption u/s 13 applicable to any local authority, Panchayat Institution, users' association, co-operative societies, non-governmental organizations, or franchisees, for undertaking rural electrification and distribution operations in rural areas.

Such terms and restrictions could include consumer tariffs applicable in the area, record keeping, compliance with codes and standards applicable to licensees relating to consumer service, grid connection, consumer grievance redressal etc.

The terms could also include annual information filing by the licensee exemption holder to the Commission to validate retail tariff applicable in the area and provide information on cost of service, financial and technical performance in a pre-determined format. However, the format, procedure and applicable charges associated with the annual submissions need to be designed pragmatically for easier compliance by local rural bodies.

- **Grid support for DG facility:** The provision of grid support for the decentralized generation facility is important to improve reliability of supply and better asset utilization. This would enable the DG facility to draw power from the grid in case of failure or to supplement its own generation during deficit periods and energy injections into the grid during surplus periods. The Act also requires the State Commission, under Section 86(e), to promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licence

Considering that the State faces a significant demand deficit, such energy injections by DG facilities operating in the State would be helpful to the State utility. However, considerable care needs to be taken in formulating the structure and level of grid support charges applicable to DG facilities to facilitate viability of RE projects.

Such charges could be energy based and may be time-differentiated for peak and off-peak hours, so as to enable exchange of energy by the rural entity with the grid at a reasonable rate.

- **Charges for open access:** Determination of open access terms and charges for transmission and distribution network of the State utility including determination of cross-subsidy and other applicable surcharges applicable on distribution open access would also play an important role in encouraging private investments for RE purposes.

The open access would allow sale of surplus power of the DG facility to third parties and trading to other areas. Revenues from such third-party sales/ trading could be successfully used in rural supply operations for cross-subsidizing retail tariffs.

- **Bulk Supply tariff:** The Commission could also be required to determine Bulk Supply Tariff applicable (BST) to rural licensees or license exemption holder in case of the local rural body procuring power from the State utility at a single point for further distribution in the area. There are already certain successful instances of Rural Electricity Supply Co-operatives acting as distribution licensees in Andhra Pradesh, Karnataka etc. Such supply arrangements allow better targeting of State revenue subsidies apart from empowering the rural community.

However, the format, procedure and applicable charges associated with the filing for determination of BST need to be designed pragmatically for easier compliance by the local rural bodies.

## Annexure V Functions of the State Nodal Agency

The State Nodal agency is envisaged to act as the State counter-part body for receiving the funds available with the Central and State Government for various projects under Rural Electrification in a dedicated fund and for channelizing these limited funds to selected projects assessed and prioritized for viability based on a transparent, pre defined criteria to ensure that the most deserving projects are funded. The criterion would also need to ensure that the various regions in the State develop in an equitable manner with no regional imbalances. The competitive framework and detailed appraisal of individual projects during selection of projects for funding by the State nodal agency would ensure that reasonable performance expectations by the local rural body at reasonable costs.

The agency is also envisaged to develop standard contractual documentation between entities required for various options, clearly laying out the rights and obligations of the parties involved, performance guarantees, payment security mechanisms, compliance with statutory codes, service and safety standards of the Regulator and CEA applicable to the utilities etc. The development phase of these contractual documents would require consultations with the lending/ donor agencies, State Government, local rural bodies and the Regulator to ensure early buy-in of the various stakeholders and to ensure that their concerns are adequately addressed. Such contractual documents would include, among others:

- i. Distribution Franchising Contract;
- ii. Bulk Power Purchase Agreement between the State utility/ IPP with the local rural body undertaking distribution operations as a licensee or license-exempt entity;
- iii. Distribution network O&M contract for a rural area outsourced to a third-party;
- iv. Open Access Agreement with the State utility to enable third-party sales and trading;

- v. Agreement for grid back-up arrangement for the decentralized generating station to enhance reliability of supplies;
- vi. Terms and Conditions for transfer of distribution network of the State utility to the local rural body undertaking distribution operations in rural areas.

Development of such standardized documents for the various options would avoid separate time-consuming approvals for each project; ensure transparency of the risk mitigation framework envisaged and expeditious implementation of the projects.

It is also understood that for the initial few projects, considerable institutional strengthening and training support would be required to the local rural bodies to undertake the complex activities involved in decentralized generation and distribution operations. The nodal agency would play a critical role in the process in development of structured and documented training modules for educating the local communities involved in the project of its benefits, performance obligations and the operational framework. For this purpose, the agency could seek necessary assistance from certain identified State-level NGOs for handholding the local bodies during the implementation stage. We understand that there are already certain eminent NGOs operating in the States who could be willing to provide assistance in this regard.