



# Empowering Rural India: Expanding Electricity Access by Mobilizing Local Resources

*Analysis of Models for Improving Rural  
Electricity Services in India through  
Distributed Generation and Supply of  
Renewable Energy*

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# Rural Electricity Access – A Critical Development Challenge

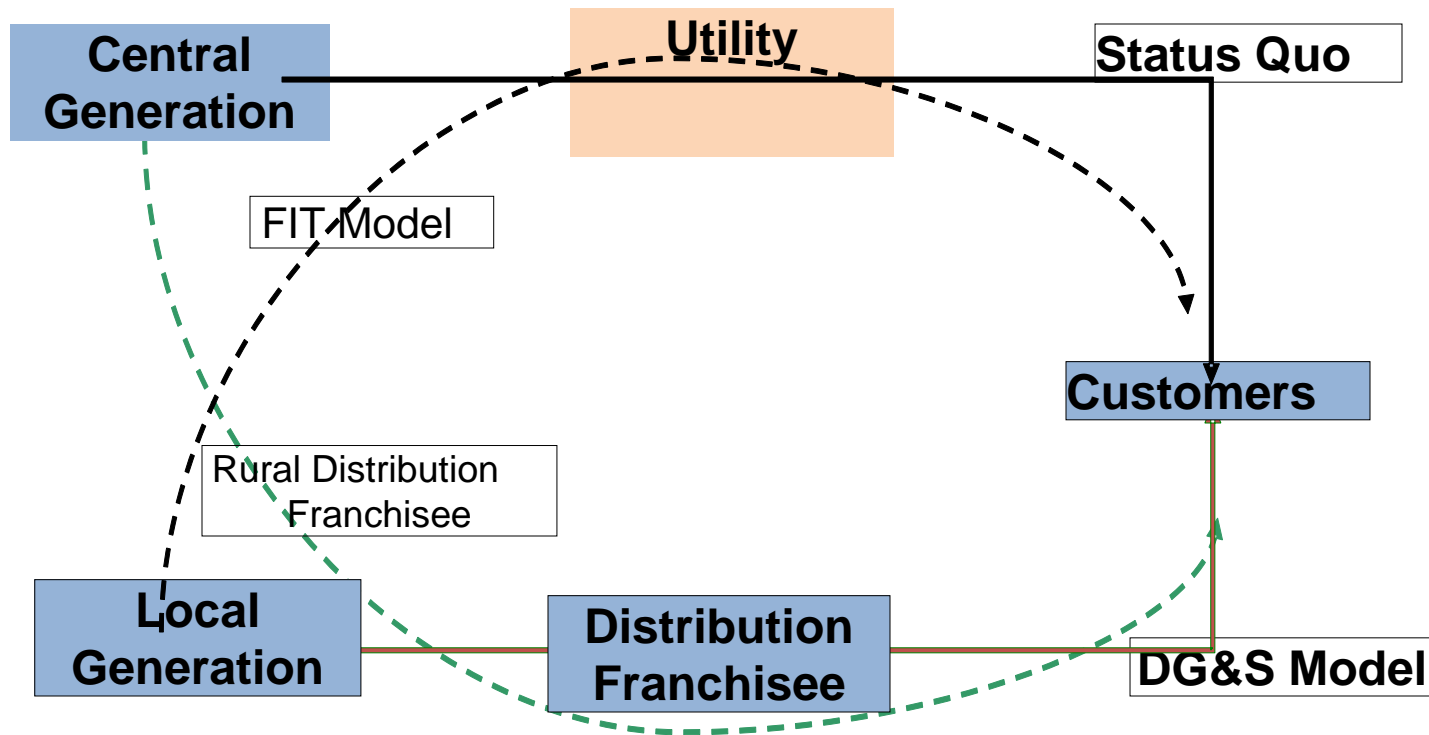
- 56% of rural households and 400 million people without electricity access
- Rural areas face major challenges of low per capita consumption and inadequate power supply: *6-8 hours of supply and poor quality of service*
- Several initiatives to improve access and quality of electricity in rural areas
  - Electricity Act 2003: Government obligated to supply electricity to rural areas. Distributed generation through stand-alone energy systems specified as a mode for rural electrification in addition to grid extension
  - Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) - Envisioned electrifying all villages, providing access to all rural households and free connections to all to below-poverty-line (BPL) families
  - Decentralized Distributed Generation (DDG) Program: Capital & operating incentives to off-grid distribution generation projects in villages without grid connections
  - National Electricity Policy: Decentralized distributed generation facilities with local distribution network wherever grid based electrification is not feasible

*Existing options to increase electricity access focus either on enhancing centralized generation or improving efficiency in the distribution business*

# The Approach

- Detailed analysis of various possible options to enhance access in 2 sites each in Haryana and Maharashtra
- Electricity Demand Assessment and Coping Cost Survey undertaken in selected states (Maharashtra - Radhanagari Taluk of Kolhapur district)
- Economic and Financial Analysis to assess commercial viability of Distributed Generation and Supply (DG&S)
- Interaction with Key Stakeholders: Government, Private Developers/franchisees, Power Utilities , Renewable Energy Development Agencies, Financial Institutions, State Regulators and Industry Associations

# Combining Generation & Distribution: Potential to be an Important Part of the Solution



*DG&S Combines generation and distribution, i.e., in addition to distributing power and collecting revenues, the franchisee also generates power locally and supplies to the franchised area*

# **Distributed Generation and Supply (DG&S) is Economically Viable & Encourages Inclusive Growth**

- **Current coping cost higher than economic cost of DG&S based on renewable energy**
  - Average rural household spends almost Rs 11/kWh to meet its lighting needs, significantly higher than about Rs 4.6/kWh for small hydro, Rs 5.7/kWh for biomass, and Rs 6.1/kWh for wind
  - Economic cost of Diesel-based generation system is higher than most expensive renewable source for commercial and industrial consumers
- **Facilitates Rural Development and Inclusive Growth**
  - Significant impact on socio-economic status of rural population due to improved power supply
  - Encourage local entrepreneurship and innovation in rural areas
  - Enhance income generation and job creation by providing new opportunities for commercial/industrial activities

# DG&S: Win-Win For All

## Example: Raddhanagari subdivision in Maharashtra

			Utility supply	Short- Term PPC	DG&S (Biomass)	DG&S (small hydro)
1	Distribution loss	%	36.81%	36.81%	15.00%	15%
2	Per unit Power Purchase Cost (including transmission charge)	Rs/kWh	2.82	7	4.06	2.3
3	Power purchase cost (with loss)	Rs/kWh	4.46	11.08	4.78	2.71
4	Distribution cost	Rs/kWh	0.48	0.48	0.2	0.2
5	Return	Rs/kWh	Included in PPC & distribution costs		0.55	0.8
6	Franchisee fee @3% average revenue	Rs/kWh	Nil	Nil	0.12	0.12
7	<b>Average cost of supply (3+4+5)</b>	<b>Rs/kWh</b>	<b>4.94</b>	<b>11.56</b>	<b>5.65</b>	<b>3.83</b>
8	Average tariff	Rs/kWh	4.21	4.21	4.21	4.21
9	Collection efficiency	%	91	91	95	95
10	Average revenue collected (8X9)	Rs/kWh	3.83	3.83	4	4
11	Tariff or full cost recovery (7 X9)	Rs/kWh	5.2	12.17	5.94	4.03
<b>12</b>	<b>Gap (11-10)</b>	<b>Rs/kWh</b>	<b>1.37</b>	<b>8.33</b>	<b>1.94</b>	<b>0.03</b>
13	Gap met by utility	Rs/kWh			1.37	1.37
<b>14</b>	<b>Viability Gap (12-13)</b>	<b>Rs/kWh</b>			<b>0.57</b>	<b>Nil</b>



- *May help meet RPO target or generate cash with trading of Renewable Energy Certificates*
- *Extension of RGGVY capital subsidy to this model could also reduce Viability gap*

# Huge potential for economic savings for Maharashtra using DG&S

- **Total unexploited potential:**

Wind: 2828 MW

Biomass: 551 MW



- **Economic gain if this power replaces kerosene and other current expensive sources**



**Savings in Coping Costs = Rs 4700 Crore**

# Implementing the model with adjustments to current schemes would bring economic benefit

- **Capital subsidies under RGGVY to (i) strengthen distribution and (ii) promote DDG (Decentralised Distributed Generation) to be extended to localized Generation and Supply**
- **Second option is to have Viability Gap Funding in the form of Operating Subsidies that is competitively determined can bridge the financial viability gap.**
- **Significant unmet demand in rural areas**
  - At National level, with average retail domestic tariff of Rs 3-4/kWh, utility loses Rs 6-9/kWh if it uses Short Term power to increase supply to rural areas
  - With DG&S operator, the gap is likely to be maximum Rs 4/kWh with most expensive RE resource



# Specific Actions required to operationalise DG&S model in Maharashtra

## Mahadiscom/Govt. of Maharashtra

- Select DG&S operator through competitive framework
- Provide access to distribution network and substations
- Monitor DG&S operator to ensure regulatory compliance
- Create Viability Gap fund to provide operating subsidies for bridging gap between cost of supply and tariffs if any
- Pursue extension of capital subsidies under RGGVY and DDG scheme to DG&S model

## Maharashtra Electricity Regulatory Commission

- Ensure appropriate technical standards to synchronize DG plants along with standard interconnection process
- Guarantee “take-or-pay” for surplus after meeting service obligations
- Promote transparent and competitive framework for cost-effective solutions at the embedded network level

## Maharashtra Energy Development Agency

- Select site for DG&S operator based on resource availability
- Streamline approval process of setting up of DG plants in selected site

# International Experience in Combining Generation & Distribution Successful in Increasing Rural Access in Large Countries

## ■ China

- Extended electricity grid and exploited hydropower & solar to achieve electrification rate of 99% in rural areas (2009) compared to 50.6% (1975)
- In about 800 of 1467 counties, almost 80% supply is met through small distributed renewable projects

## • Philippines

- Off-grid electrification with private-sector participation covers areas that distribution utilities waive off as financially unviable for the utility to serve
- Small-scale energy generation with various attendant services offered to community entrepreneurs. The project also recovers US\$0.26/kWh from the subsidy fund as the difference between the full cost recovery rate and the existing tariff



# Thank You