Re-visiting the Decentralized Distributed Generation Guidelines under the Rajiv Gandhi Grameen Vidyutikaran Yojana

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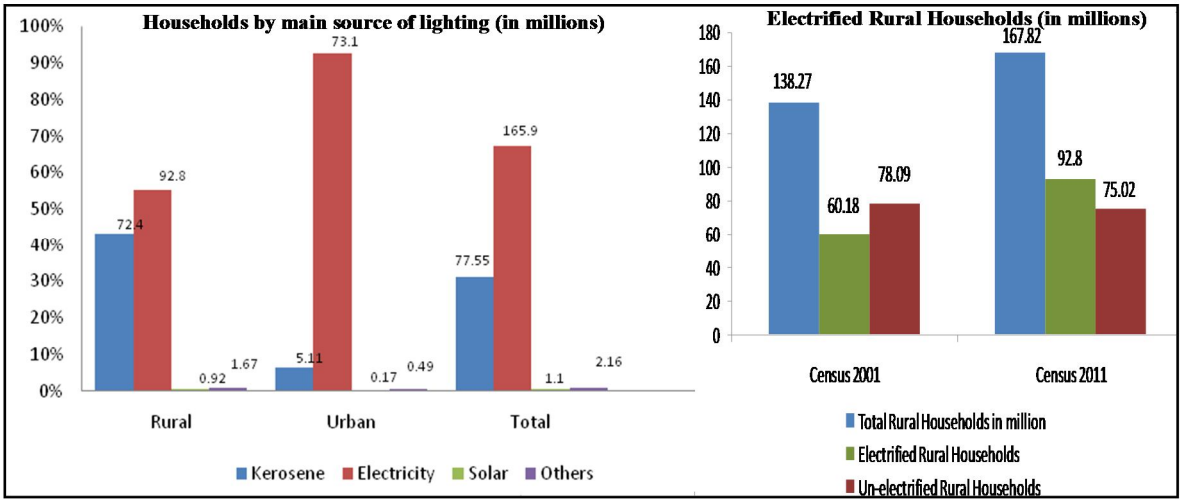
1 INTRODUCTION

As India, one of the leading emerging economies, continues to develop rapidly, its energy demand grows apace. The energy sector holds the key to accelerating the country's economic growth; inadequate supply of energy results in economic stagnation and, in turn, suboptimal development. In spite of over six decades of policies and programmes aimed at providing energy security to rural India, it continues to depend predominantly on such low-efficiency fuels as firewood and other forms of biomass energy, and kerosene; availability and use of modern forms of energy such as electricity and cooking gas remain limited. Improving access to modern energy remains a key development challenge for the country and can play a critical role in improving social and economic well-being of its rural population.

With this very intention, in 2001/02, the Government of India pledged to provide 'electricity for all by 2012'—a target later extended to 2017. To meet the target, two key ministries of the central government, namely the Ministry of Power (MoP) and the Ministry of New and Renewable Energy (MNRE), launched several programmes including flagship national programme for rural electrification, namely RGGVY, the *Rajiv Gandhi Grameen Vidyutikaran Yojana*, launched in 2005.

Although RGGVY had managed to extend grid infrastructure to most of the census villages by the end of the 11th Five-Year Plan (2007–2012), adequate and reliable power supply remains a distant dream. The failure has been attributed mainly to the wide gap between demand and supply, currently more than 10%, despite huge capacity addition in the last two decades. In parallel with RGGVY, MNRE launched the Remote Village Electrification Programme (RVEP) and the Village Electricity Security Programme (VESP), both aimed at providing electricity to remote villages with small-scale off-grid renewable energy technologies.



Source: Census of India, 2011, Household Amenities

In 2009, to provide electricity to villages and hamlets that are beyond the reach of the conventional grid, MoP launched the Decentralized Distributed Generation (DDG) Scheme as part of RGGVY. The scheme aims at identifying developers who will meet the electricity requirements of such villages and hamlets sustainably for five years and selecting those who require the least funding assistance. Since the inception of the scheme, 276 projects have

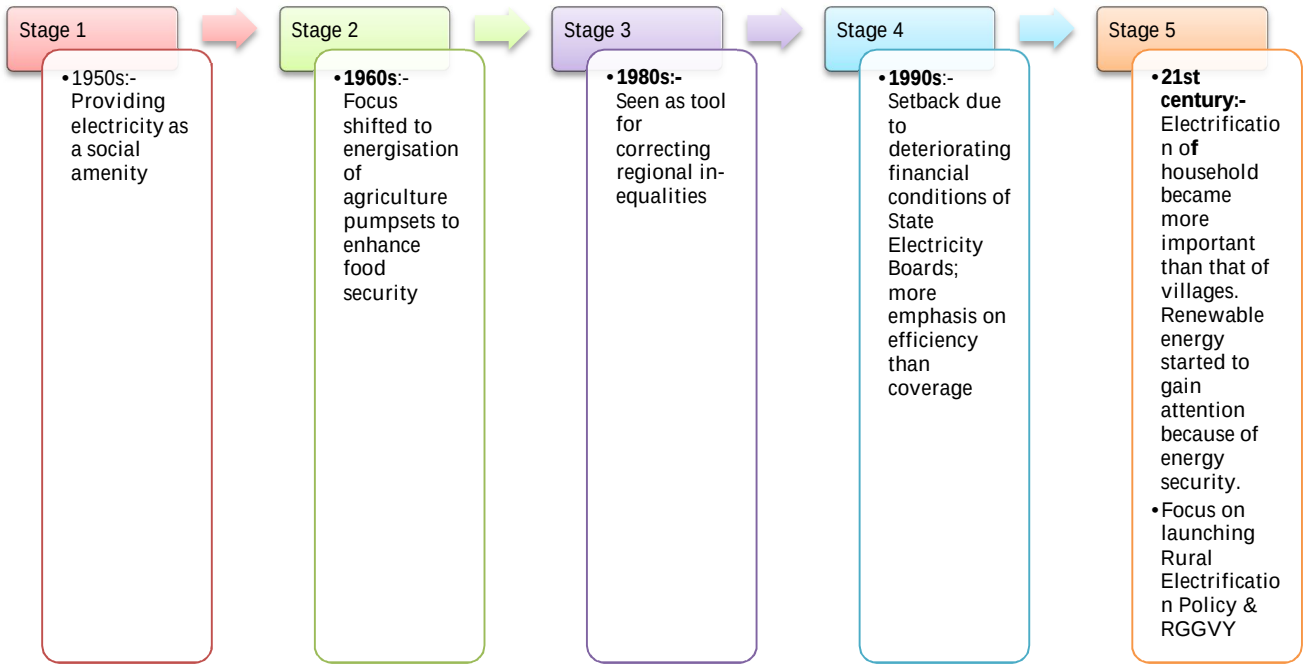
been sanctioned in different parts of the country. Of these projects, 48 are based on biomass energy whereas the rest are based on solar PV. However, the developers for a majority of these projects are the state nodal agencies, although the scheme has specific provisions to attract and encourage developers from the private sector. So far, fewer than a dozen projects, mainly small SPV-based projects– all of them in Andhra Pradesh – have been implemented on the ground. The current state of projects approved and implemented under the DDG scheme raises a larger question: Why has the scheme received such poor response despite a large sum (Rs 5400 million) being earmarked exclusively for providing implementation support? This report presents the findings of a study that sought to answer the question and offers a solution in the form of suitable modifications to the guidelines drawn up by the DDG scheme—modifications that, it is hoped, will attract developers from the private sector.

2 RURAL ELECTRIFCATION: A REVIEW OF POLICY AND REGULATORY FRAMEWORK

To bridge the widening demand–supply gap, the Government of India has taken a number of measures and launched a number of schemes for rural electrification from time to time. Two milestone measures are the Electricity Act, 2003 and the Rural Electrification Policy, published in 2006. This section provides a brief overview and analysis of select schemes, policies, and programmes as well as the key enabling provisions under the prevailing regulatory framework for rural electrification in India as a basis for developing innovative business models involving the private sector in rural electrification in future for effective large-scale deployment of decentralized power generation.

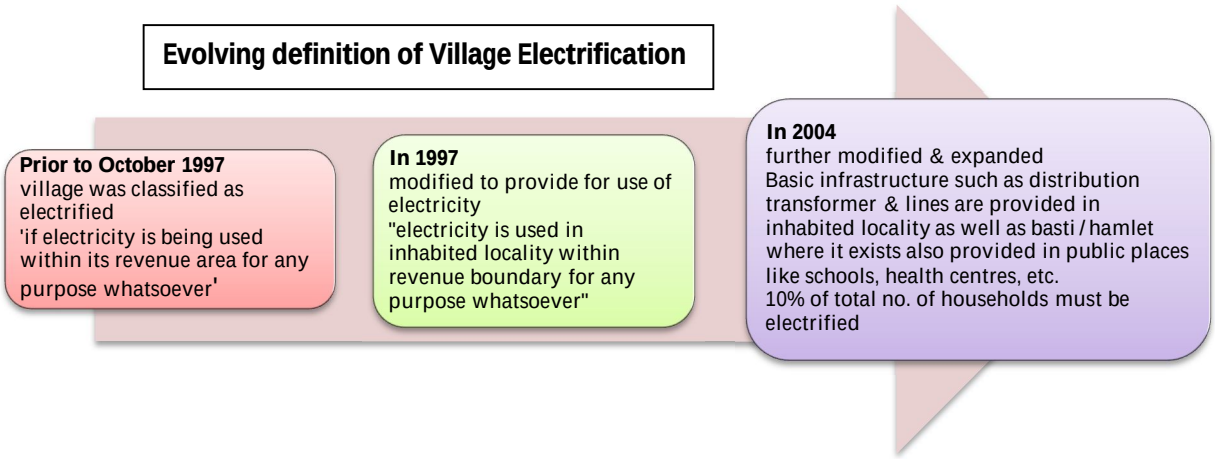
2.1 Evolution of Rural Electrification in India

India's rural electrification programme was initiated in the 1950s, and its evolution can be divided into five distinctive stages.



The definition of village electrification has changed with time in an effort to make the definition more meaningful to the ultimate goal of providing electricity to all. With the emergence of renewable energy, MNRE also implemented several programmes to promote cleaner and renewable energy technologies such as solar, biomass, and biogas for providing electricity to remote un-electrified villages and hamlets to support rural electrification through grid extension. The major programmes include VESP (which focused on biomass-based technologies), RVEP (which shifted its focus with time to solar home lighting), and the recently launched Jawaharlal Nehru National Solar Mission (JNNSM).

Evolving definition of Village Electrification



Major Rural Electrification Programmes

Minimum Needs Programme

- Started in 5th FYP (1974-79) with SEB as implementing agency
- 100% central assistance to states in the form of grants and loans for last mile connectivity
- Targeted states with village electrification lower than national average
- Discontinued in 2004-05 because of lack of response from States

***Kutir Jyoti* Programme**

- Initiated in 1988-89 with 100% grant with SEB as implementing agency
- Single point connection to BPL households (71.7 lacs BPL household connected in 16 years)
- Merged with AREP in 2004 and later with RGGVY

***Pradhan Mantri Gramodaya Yojana* (PMGY)**

- Launched in 2000-2001 with funding as additional central assistance (90% grant and 10% loans for special category states, 30% grant and 70% loan for other states)
- Funding provided for minimum services in rural areas (health, education, drinking water and electrification etc) through implementing agencies viz SEBs, electricity departments, power utilities
- Flexibility to states to decide on inter-allocation amongst basic services
- Discontinued from 2005

Accelerated Rural Electrification Programme (AREP)

- Launched in 2002 with 4% interest subsidy from financial institutions like REC,PFC, RIDF, NABARD, etc
- Implementing agency: state government through electricity board and power utilities
- Applicable on loans given through PFC / REC and NABARD

Accelerated electrification of 1 lakh villages and 1 crore households

- Launched in 2004 with 40% capital subsidy and 60% loan
- AREP and *Kutir Jyoti* schemes merged with this and later with RGGVY

Remote Village Electrification Programme (RVEP)

- MNRE's programme to electrify all remote census villages & hamlets through renewable energy sources
- Aimed at bringing benefits of electricity to people living in most backward and deprived regions.
- Cumulative sanctions of villages and hamlets since its inception reached around 12,369 (31 / 12 / 2011)

Village Energy Security Programme (VESP)

- Launched by MNRE with WB-TA in 2005 with pilot phase of about 80 test villages
- Objective to go beyond electrification, provide total energy security (lighting, cooking, & motive power)
- Focus on exploitation of locally available renewable resource with involvement of local community by transforming locally available biomass energy use in rural remote areas in a sustainable manner.
- However, after the closure of the pilot phase in 2009-10 most of the project became redundant, and therefore non-operational, as soon as grid reached the village.

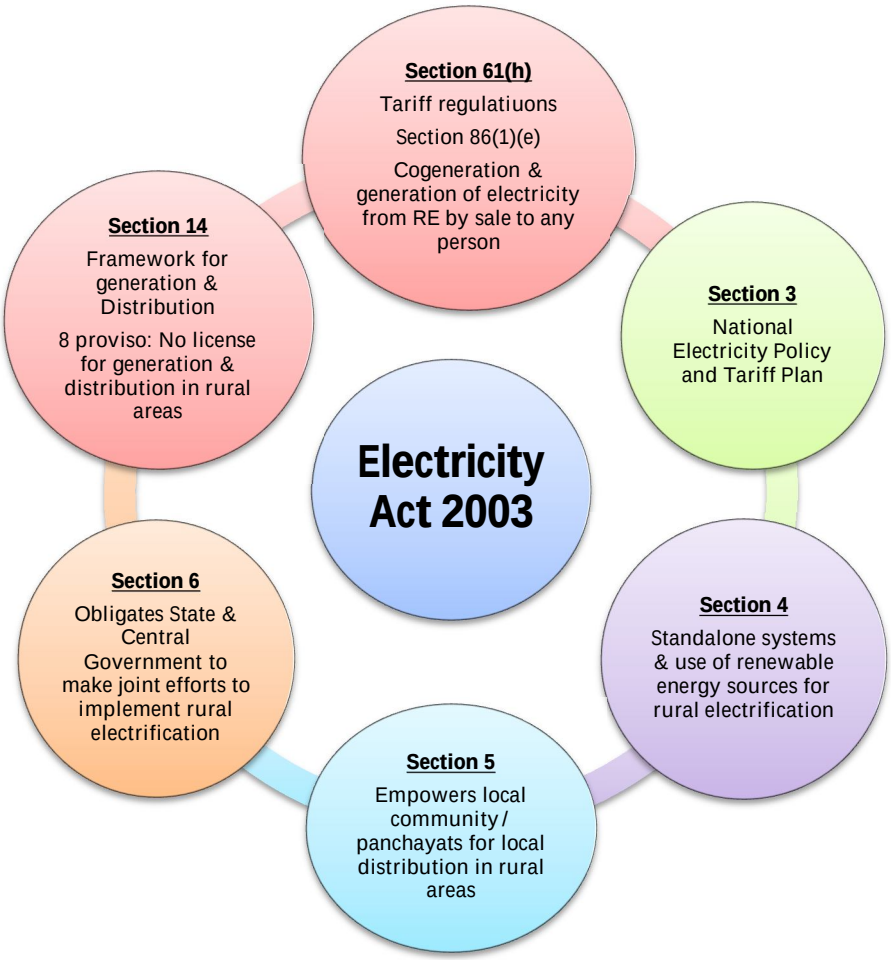
Guidelines for Off-Grid & Decentralized Solar Applications

- JNNSM was launched in 2010 as one of eight national missions under NAPCC announced in 2008.
- Twin objectives: contributing to India's long-term energy security & its ecologically sustainable growth
- MNRE, as a part of JNNSM, has launched a scheme to promote off grid application of solar energy.
- Focuses on promotion of off-grid and decentralized systems, including hybrid systems to meet lighting, electricity and heating / cooling requirements.
- First phase, scheduled to be completed by 2013, has a target of 200MW off-grid capacity installation

2.2 Enabling Regulatory Framework: Provisions under the Electricity Act, 2003

Enactments prior to the Electricity Act, 2003 (EA 2003 or 'the Act') had no specific provisions for promotion of renewable or non-conventional sources of energy. Similarly, the guiding framework prior to the EA 2003 did not have any specific provision for enabling rural electrification, which was the responsibility of state electricity boards (SEBs) created under the Electricity (Supply) Act, 1948. However, the enactment of EA 2003 changed the legal and regulatory framework for the renewable energy sector. The Act provides for policy formulation by the Government of India and mandates state electricity regulatory commissions to take steps to promote renewable and non-conventional sources of energy within their area of jurisdiction. Further, EA 2003 explicitly mentions the formulation of a national electricity policy (NEP), a national tariff policy, and a plan for the development of power systems to ensure optimal utilization of all resources including renewable sources of energy. The Act has also created several other enabling provisions to accelerate the development of renewable-energy-based generation and also lays special emphasis on rural electrification. The Act mandates the central government to formulate policies permitting stand-alone systems, including systems based on renewable and non-conventional energy, for rural electrification.

The key Sections of EA 2003 are summarized below.



Enabling provisions under the Electricity Act, 2003

Section 3

- Empowers central government to formulate two policies: tariff plan and National Electricity Policy.
- Also empowers CEA to prepare a National Electricity Plan.

Section 4

- Mandates the central government to formulate policies for stand-alone systems utlizing renewable and non-conventional energy sources.
- Section 2(63) of EA 2003 defines stand-alone systems as electricity systems to distribute power to specifies areas without connection to grid.

Section 5

- Mandates the central government to formulate a policy for empowering panchayat institutions and local community to purchase power and manage its distribution in rural areas. To make rural electrification effective, such policy measures shall focus on decentralized distribution of electricity involving panvhayats, NGOs, cooperative societies, and users associations.

Section 6

- Amends EA 2003 obligating the state and central governments to make joint efforts to implement policies for rural electrification.

Section 13

- Read with section 5 of EA 2003 provides that 'Appropriate Commission on recommendation by Appropriate Government shall exempt local authority, Panchayat Institutions, users associations, NGOs, cooperative societies, from taking license from Appropriate Commission for distribution of electricity in rural areas.'

Section 14

- Provides a framework for generation and distribution of electricity in rural areas.
- 8 proviso Section 14 read with Section 4 of EA 2003 provides that a person undertaking generation based on renewable and non-conventional energy sources and distribution of electricity in rural areas specified by state government shall not require any license.

Section 61(h)

- Prescribes the philosophy to be followed by state electricity regulatory commissions while determining tariffs stating that the Commission shall be guided by promotional aspects as regards renewable energy sources.

2.3 Rural Electrification Policy

In compliance with Sections 4 and 5 of the Electricity Act, 2003, the central government notified the Rural Electrification Policy on 23August 2006. This policy aims at

- providing access to electricity to all households by 2009,
- providing quality and reliable power supply at reasonable rates, and
- ensuring minimum lifeline consumption of 1 unit/household/day as a merit good by 2012.

The policy recommends grid connectivity as the primary way of electrification of villages. However, where grid connectivity is neither feasible nor cost-effective; off-grid solutions based on stand-alone systems may be developed. Further, where neither stand-alone systems nor grid connectivity is feasible, isolated lighting technologies such as solar lanterns may be adopted. The policy also advocates utilization of non-conventional sources of

energy, even where grid connectivity exists, after evaluating their cost-effectiveness. With the aim of fulfilling this objective, the policy mandated state governments to prepare and notify a rural electrification plan.

Because RGGVY was initiated a year before the Rural Electrification Policy (2006), the national rural electrification programme was adjusted to address the provisions of the policy.

2.4 Rajiv Gandhi *Grameen Vidyutikaran Yojana*

The Ministry of Power's flagship programme, namely RGGVY, for rural electricity infrastructure and household electrification was launched in April 2005 and is being implemented through the Rural Electrification Corporation (REC). The scheme aims to achieve the goal of providing electricity to all households by providing capital subsidy amounting to 90% of the overall cost of a project. The infrastructure under RGGVY includes a rural electricity distribution backbone (REDB) with 33/11 kV (or 66/11 kV) substations of adequate capacity and lines to be established in blocks where these do not exist and village electrification infrastructure (VEI), which involves electrification of un-electrified villages and habitations. The scheme provides for a distribution transformer of appropriate capacity in such villages and habitations and decentralized distributed generation (DDG) based on conventional and non-conventional energy sources where grid supply is not feasible or not cost-effective.

It is proposed to continue RGGVY during the 12thFive-Year Plan (2012–17) with 90% capital subsidy.[1] During the Plan, the scheme aims to cover all remaining habitations and all households.[2] It is also proposed to increase the electricity load for below-the-poverty-line (BPL) households from 40–60 watts to 240 watts and to provide lamps based on light-emitting diodes (LED) to each BPL household. The Plan also proposes a separate new scheme for productive loads, mainly agricultural loads.

2.5 Decentralized Distributed Generation (DDG) Scheme

RGGVY has set aside Rs 5400 million for subsidizing, through a scheme for DDG, electrification of hamlets and habitations not being covered under the scheme on account of their remote locations.[3]

Decentralized distributed generation aims to deploy suitable locally available technologies for generation of electricity and distributing it to nearby hamlets or habitations. By nature, such projects rely more on small hydro and renewable sources. The Ministry of Power has published a set of guidelines consisting of a standardized format for preparation of DDG projects and guidelines for procurement of goods and services for implementing those projects. The scheme aims at identifying developers who will meet the electricity requirements of such villages and hamlets sustainably for five years and selecting those who require the least funding assistance.

[1] http://powermin.nic.in/JSP_SERVLETS/jsp/newsdis.jsp

[2] As against the target, electrification works in 1,05,851 un/de-electrified villages have been completed and 2,01,18,431 free electricity connections to BPL households have been released under RGGVY (as of 30/09/2012)

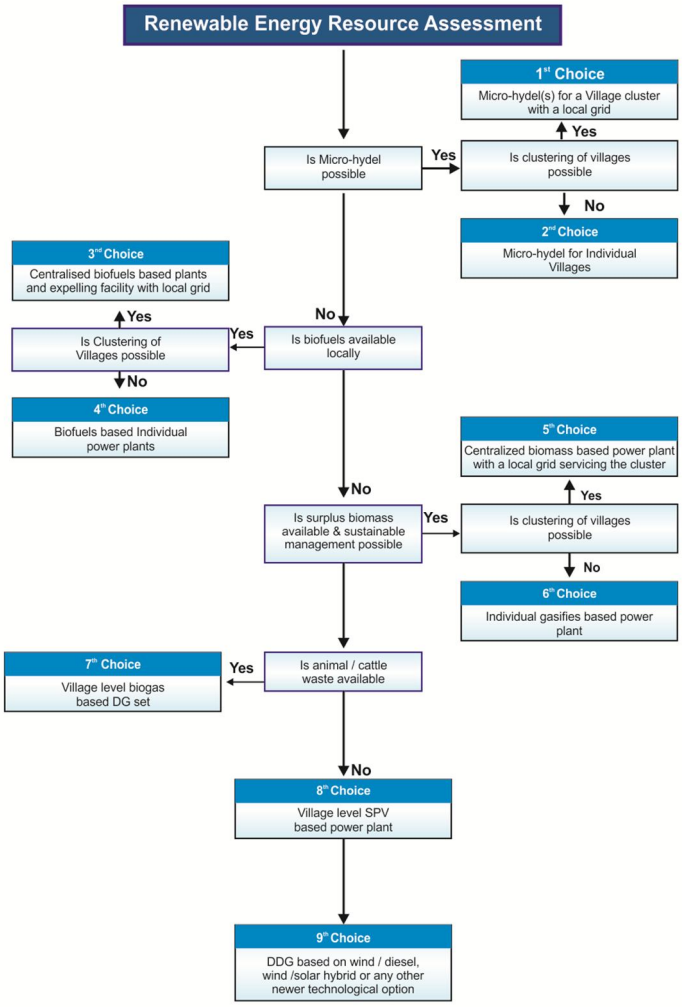
[3] http://pib.nic.in/newsite/efeatures.aspx?relid=82077

2.5.1 Salient features of the RGGVY-DDG scheme guidelines

The salient features of the DDG guidelines issued in 2009 and subsequent amendments to the guidelines are summarized below.

Overall framework

- Rural Electrification Corporation (REC) is the nodal agency for implementing DDG, and the capital subsidy for eligible projects is to be routed through REC.
- The technology suitable for DDG will be specified. The choices include both conventional sources (diesel generator sets) and local renewable sources, based on their cost-effectiveness and availability in required quantities.
- The projects of DDG will be owned by the state government, which, in turn, would decide the implementing agency for the state: either a state renewable energy development agency (SREDA) or the department responsible for promoting renewable energy, a state electricity utility, or a central public-sector undertaking (CPSU).
- The projects under the scheme will be subjected to a three-tier quality monitoring mechanism.
- The Rural Electrification Corporation will be paid service charges amounting to 1% of the project cost for developing the implementation framework, pre- and post-award appraisal and evaluation, and monitoring and supervision as per the three-tier quality control mechanism.
- State implementing agencies and CPSUs will be paid service charges amounting to 8% and 9% of the project cost respectively for meeting implementation expenditure, additional monitoring costs as per the first tier of the quality control mechanism, and service charges to be paid to developer towards meeting the cost of providing power for five years.



Selection of a village or hamlet

- The state agency or department promoting RE will finalize the names of villages or hamlets to be electrified through DDG.
- Villages comprising migrating or floating population or those with fewer than a hundred households will not be covered. However, the villages covered earlier under RVE with solar home lighting systems and those connected to grid (but without electricity supply) will be covered. Priority will be given to villages likely to remain unconnected to the grid in next 5–7 years (so that the investment on DDG is not wasted) and the possibility of clustering will be explored to the extent possible.

Selection of technology

- Both conventional (diesel generator sets) and non-conventional options are eligible. Site-specific choices will be made subject to sufficient availability of resources. Where resources are surplus, more electricity may be generated without any additional subsidy and supplied to the grid (again without any additional subsidy).
- Infrastructure should be grid compatible so that the investment will continue to be useful once a village is connected to the grid.

Project financing and payment pattern

- Financial assistance for implementing DDG projects includes the following items.
  - Capital cost comprising plant equipment, accessories, civil works (excluding land cost), Public Distribution Network (PDN) with necessary control equipment, initial capital cost of plantations (for biomass-based projects), and non-domestic loads specified by the implementing agency
  - Revenue cost of spare parts for five years of operation excluding labour and consumables
  - Cost of providing power for 5years taking into account the amount recovered from households for supplying electricity at the tariff (not less than that prevailing in the neighbourhood) decided by the state implementing agency as identified in the detailed project report (DPR)
  - Soft cost of pre-selection of villages, technology, and preparation of DPR as well as the cost of social engineering

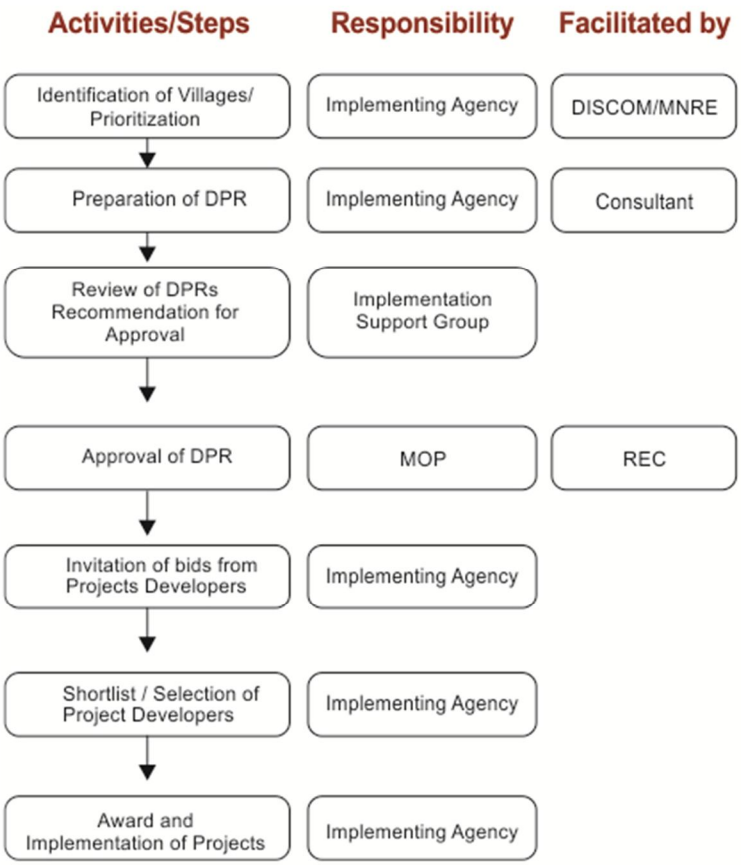
- Financial assistance: 90% of the total project cost as subsidy to the implementing agency; the rest should be arranged by the implementing agency or taken as loan from REC or any other financial institution.

- Pattern of payment
  - 70% of the capital cost until commissioning will be reimbursed in phases, the repayment being linked to the completion of project milestones.
  - The remaining30% of the capital cost will be paid back over five years from commissioning (including 6% interest)
- The cost of providing power will be reimbursed annually taking into account the amount recovered from village households by the implementing agency from its service charges (subject to a maximum of 8%–9% of the project cost). A later amendment mentions that if this gap exceeds, the amount may be funded out of the subsidy; however, it is not clear how this could be done later.

Approval and implementation

- An implementation support group (ISG) created by MoP will coordinate and supervise implementation of the scheme as per the guidelines and the process of approval.
- Implementing agencies will assist project developers in acquiring land and social engineering (community mobilization and awareness creation).
- Eligible project developers will be state agencies, technology suppliers, corporate houses, self-help groups (SHGs), users associations, individuals, registered societies, cooperatives, *panchayats*, local bodies, and their consortia or special purpose vehicles (SPVs) or joint ventures (JVs) and so on.

DDG Scheme – Approval Process



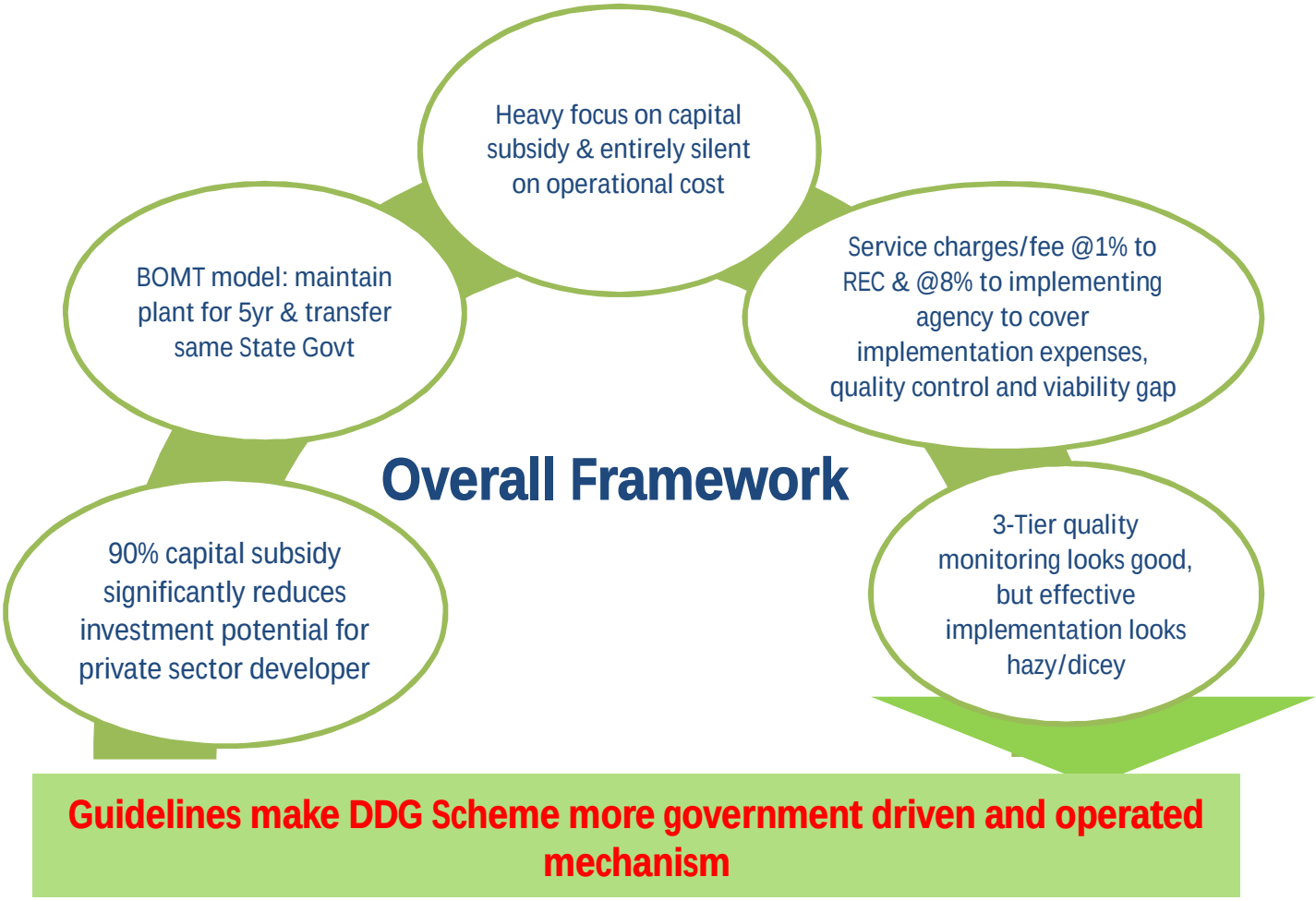
- The developers will be selected on the basis of tenders with bids in two parts: the first part will cover the capital cost and the second part will cover the cost of providing power for 5years; the second part cannot exceed the service charges (8% of the project costs for state governments and 9% for CPSUs) of implementing agencies.
- A tripartite agreement will be signed between REC, the implementing agency, and the project developer setting out the commitments and conditions for the RGGVY-DDG sub component.
- The project developer will implement the project on BOMT basis (build, operate, maintain, and transfer) supplying electricity for 6–8hours a day for 25days in a month and collecting tariff from villagers for 5years. Thereafter, the project – in working condition along with all the replaced parts– will be handed over to the state government.

Miscellaneous

- The project developer 'will be permitted' to mobilize additional support or funds.
- A consultant will prepare the DPR estimating electricity load, plant size required, etc.
- If grid reaches the village within five years, power can be exported to the grid or imported from the grid 'as and when required'.
- A specified amount will be paid for each light point or for each month, a method preferred to conventional meters. The implementing agency will issue guidelines on electricity charges to the project developer.
- The implementing agency can explore possibilities of earning carbon credits by bundling certified or verified emission reductions (CERs or VERs) for a number of villages.

3 KEY ISSUES IN THE DDG GUIDELINES

To understand the issues with the present DDG guidelines and reasons for the lukewarm response from the private sector, selected DDG projects in a few potential states, namely Bihar, Chhattisgarh, and West Bengal, were visited. Detailed consultations were held with key stakeholders (SERCs, SNAs, DISCOMs, manufacturers, project developers, and subject experts) to gain valuable insights based on their vast experience in formulating DDG projects and implementing and operating them in the field. The major learnings and insights gained are summarized below.



3.1 Overall Framework

- Decentralized distributed generation is more of a government-driven and -operated mechanism. A 90% capital subsidy, although intended to attract the private sector, actually limits the investment potential for the private sector developer significantly. Raising the remaining 10% as the state government's share or as loan from REC, the implementing agency, or financial institutions limits the role of the private sector even further, reducing it to that of a technology supplier. Therefore, one of the foremost issues with the DDG guidelines, as identified by the stakeholders, is the overall packaging of incentives in the framework.

- According to the guidelines, DDG projects are to be owned by the state government and implemented on BOMT basis. This model requires the project developer to maintain the power plant for 5 years and then transfer it to the state government, which means that the project developer runs the plant in the initial 5years during which a plant usually experiences maximum problems—once its operation stabilizes, the plant is transferred. This condition offers little motivation to the developer to resolve the teething problems adequately because that investment will bring no returns. The same condition also prevents the developer from earning a profit after streamlining plant operations. This is the second most critical issue in the framework as identified by the stakeholders.
- The present scheme focuses heavily on capital subsidy to take care of capital costs and is entirely silent on operational costs, wages, working capital, etc.Providing90% capital subsidy, by itself, might not serve to ensure that a DDG plant is viable. Especially in the case of biomass-based projects, the initial capital expenditure is lower than that in the case of solar PV projects but the operating costs (fuel, wages, and maintenance) are much higher. It is obvious that the capital subsidy mechanism alone is insufficient to ensure viability of projects with higher operating costs.
- The cap on service charges or fees to the state implementing agencies (8% of the project cost for state agencies and 9% for CPSUs)is likely to be inadequate in bridging the viability gap between the cost of providing power for 5 years and revenue collection at the pre-determined tariff from users. For example, in the case of biomass-based projects the viability gap will be far wider than what can be bridged with 8% of the project cost. Secondly, this amount is to be used for covering the expenses related not only to implementation and overall supervision but also those incurred onthe3-tier quality control mechanism. Thus, the provision is insufficient to achieve the desired objective.
- Although the concept of a3-tier quality monitoring mechanism looks good, its effective implementation appears doubtful considering that the associated costs have to be carved out from service charges or fees paid to the implementing agency.

3.2 Village/hamlet Selection

- The state agency draws up a list of villages and hamlets to be electrified through DDG taking into consideration the possibility of such villages being connected to the grid in the next5–7 years. However, it is felt that this responsibility should have been given jointly to state utilities or DISCOMs and the state agency promoting renewable energy because a utility or a DISCOM is better informed about the plans to extend the grid.
- Although the guidelines emphasizes clustering of hamlets or un-electrified villages, limiting the choice to only those habitations that are not likely to be connected to the grid over the next 5–7years makes it difficult to identify the villages to be included in a cluster. Thus, clustering looks only a distant possibility. The consequence is that since only a single village or a hamlet, or at the most 2–3 adjoining hamlets, are to be covered, only a few households need to be served, which means that only a small DDG plant would be necessary. This has **two adverse implications** for the viability of business. First, small DDG plants are less attractive to the private player; second, the low energy

requirements– since only domestic lighting needs are to be met – mean a low capacity utilization factor (CUF). The result is very high cost of electricity generation, and the higher the cost of generation and supply, the more vulnerable the operation once grid-supplied electricity enters the picture. Higher costs also mean lower margins for the equipment supplier or for any local enterprise or entrepreneur that would like to act as an energy service company (ESCO). These interlinked factors make it difficult to manage and maintain a DDG plant sustainably.

3.3 Selection of Technology for DDG

The present approach to technology selection is far too prescriptive and limited. It also fails to consider various technologies suitable for difference sizes or capacities, and also does not relate the size of a DDG plant to a given technology. The guidelines need to avoid imposing a particular technology; instead, they should create an enabling framework.

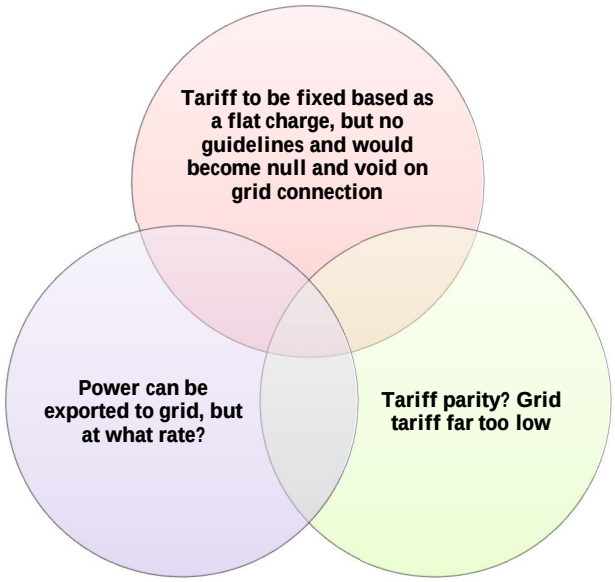
- The technology decision tool given in the present guidelines puts biofuels ahead of biomass (gasifier) or biogas. Biomass-combustion-based plants are suitable for large (megawatt-size) capacities whereas biofuels, community-level biogas, or solar PV may be the more feasible or preferred options for smaller capacities.

- The guidelines also mention that the infrastructure needs to be grid compatible. Here too, the capacity or size of a DDG plant might play a decisive role for evacuation of power in small quantities in a generally unstable rural grid, especially below 33kV / 11kV substations.

3.4 Sustainability of DDG Projects on Grid Extension

At present, it is almost impossible for any RE-based DDG power plant to survive once grid power reaches the project site, mainly because tariffs for grid-supplied power are low. For consumers with low power consumption (in the case of multi-layered tariffs), for BPL households, and for such categories as agriculture, the tariffs are even lower. As a result, as soon as grid-supplied power is available, consumers prefer to switch to the grid and abandon the DDG project.

- Although the guidelines mention that '*if grid power reaches the village before 5years then the power produced from the DDG project can be exported to the grid as and when required*', the price that such exported power would fetch is far from clear. Secondly, the quantum of power generated and supplied (sold),that is the CUF of a DDG plant, a crucial parameter for the cost of generation, will be lower if there is no assurance that power generated by the DDG plant would be



Sustainability of DDG project on grid extension

bought, and bought at a reasonable price, once the plant is integrated with the grid.

This uncertainty puts a big question mark on the viability of the DDG plant in the event of grid reaching the site.

- Given the vast difference between the costs of generation using RE-based DDG and the DISCOM tariff applicable to rural customers; it is inevitable that customers would switch over to grid as soon as it reaches the project site. Further, it has been noticed that as soon as consumers get used to electricity generated through DDG, the demand for grid extension becomes more strident as consumers become aware of the advantages of electricity and the low cost of grid electricity—which makes private-sector developers generally wary of getting into DDG.
- If it is assumed that grid extension is inevitable in most parts of the country, at what rate should a DDG project supply the electricity to consumers and then to the grid once it is available? To ensure that DDG is viable, the guidelines recommend a fixed tariff based on the number of electric points or for each month, rather than that based on metered consumption. The guidelines also leave it to the implementing agency to devise ways for fixing these tariffs. However, once a plant is connected to the grid, these tariffs no longer apply and are replaced by those fixed by the state electricity regulatory commission, as is mandatory.

This uncertainties related to the operation of a DDG plant and the condition that, on integration with the grid, power has to be sold at the rates applicable to grid electricity deter private developers from investing in DDG projects. Also, the uncertainty regarding metering, billing, and collection for the power generated and exported to the grid creates risks that are nearly impossible to manage.

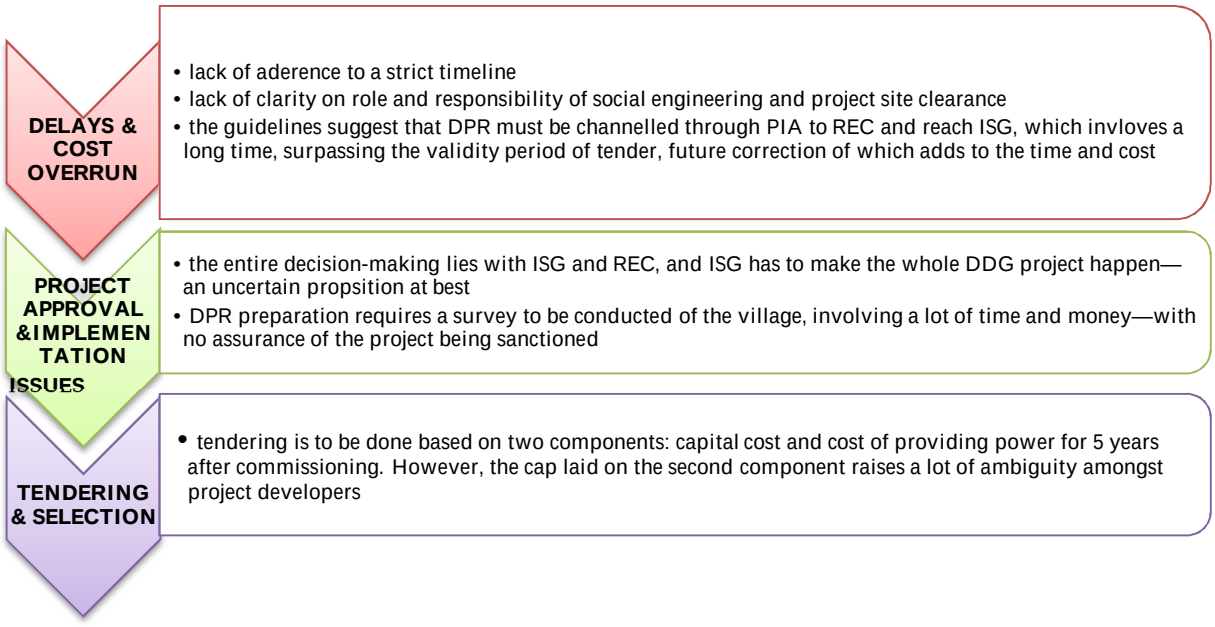
3.5 Project Financing and Payment Pattern

- The capital cost of a DDG project includes civil work, the cost of which varies from plant to plant. The guidelines are silent on the type and requirement of civil structures for different types of DDG technologies as well as on the size or scale of DDG plants, whether small-scale plants of a few kilowatts or large, megawatt-size plants.
- The guidelines stipulate that the charges for providing power will be paid annually to the project developer by the implementing agency. The amount is expected to be paid out of the service charges or fees received by the implementing agency, which are fixed at 8% of the project cost for a state agency and 9% for CPSUs.

3.6 Programme Management: Approval and Implementation Process

- Although the guidelines lay down elaborate procedures for approving DDG projects and for implementing them, the guidelines are silent on the need to adhere to strict timelines in executing those procedures and taking decisions, and on fallback options in the event of delays. Such disregard for time-bound actions results in delays in approving projects and in implementing them, leading to cost overruns.

- The guidelines are vague on the role and responsibility for social engineering and obtaining the required clearances for the project site. This lack of clarity not only delays a project but also increases its costs and affects the cost-sharing mechanism—yet another deterrent to developers from the private sector.
- The current institutional mechanism for implementing and monitoring the DDG scheme consists of the following components: the Implementation Support Group (ISG) of MoP, REC, the project implementing agency (PIA),project developers, and technology providers. However, most of the decisions are made by the ISG or REC while the PIA is saddled with the onerous responsibility of making DDG a reality.
- Because DPRs are channelled through the PIA to REC and then to the ISG for final approval, it takes a long time to get the approval. By that time the validity period of the tenders or bids floated on the basis of a preliminary DPR is usually over, leading to further revisions of time and costs. As a result, although more than 275projects have been sanctioned, fewer than a dozen – mostly based on solar PV and all of them in Andhra Pradesh – could be implemented on the ground after getting a final formal approval from the ISG.
- The project developer has to submit a DPR while seeking the approval. For this purpose, the developer has to undertake a detailed survey of the proposed village or villages to choose the right technology and to assess the overall viability of the project. Although the guidelines allow the cost of preparing a DPR as part of the project cost while seeking financial assistance, project developers maintain that it is difficult, even impractical, to expect a project developer to invest in conducting an in-depth field survey, an expensive proposition in terms of time and money, without any assurance that the project would be approved—and approved in time.
- The guidelines stipulate that the project developer be chosen by the implementing agency based on a two-part tendering process involving separate bids for(a) capital cost and (b) cost of providing power for 5 years after commissioning. However, the second part cannot be more than 8% of the first part.



3.7 Miscellaneous

- The guidelines recommend that 'for DDG projects, a flat rate in terms of money to be paid for each light point or for each month is a more practical way of setting the tariff than the classical sale of electricity/kWh'. The guidelines also mention that 'the *concerned Implementing Agency will issue guidelines for electricity charge to* the project developers. However, so far, there seems to be no effort towards bridging the viability gap between the income from for project and the cost of providing power for 5 years. Instead, the guidelines maintain that the viability gap should be bridged by using some amount from the service charges or fees paid to the implementing agency. However, whether such an arrangement would be honoured by the implementing agency – and honoured in time – is a moot question, which jeopardizes profitable operation of a DDG plant.
- The guidelines mention the need to go beyond lighting and recommend inclusion of some non-productive workloads and also mention that such workload can be part of the project cost for financial assistance (capital subsidy). Such a provision, although it allows higher total project costs, remains unclear about what can be included in the capital cost and whether it can be capped.
- The guidelines do say that the implementing agency can explore the possibility of raising addition funds by claiming carbon credits for a project in the form of CERs and VERs. However, the guidelines are silent on who should bear the associated soft costs of preparing the elaborate documentation that is required in claiming carbon credits and also the transaction costs. Secondly, the insistence on flat charges instead of billing metered consumption can weaken the case for CERs or VERs, which generally demand rigorous MRV mechanism to ensure that the emission reductions are real and additional.

3.8 Conclusions

The present guidelines focus strongly on subsidizing the capital costs of a project but fail to provide a clear ownership or equity structure for attracting participation from the private sector. Typically, such participation or intervention is expected to bring in greater efficiency and optimal utilization of resources to make the project more cost-effective. However, in the case of DDG projects, capital subsidy has failed to attract the private sector. Besides, given the technical and operational issues mentioned above, a DDG project may not be able to meet the requirement of uninterrupted operation, especially in the event of electricity grid reaching the villages. Although the guidelines emphasize that the project infrastructure be grid compatible, they are unclear on how a project developer or a private sector investor can ensure that the project remains profitable even after being integrated with the grid.

The major barriers to private-sector participation in the present DDG scheme, in light of past experience and stakeholder consultations, are as follows.

- Lack of substantial volume and long-term business due to the BOMT framework, 90% capital subsidy, and uncertainty of business after grid connectivity
- Smaller plants due to the inability to make sizeable clusters because of the grid reaching most census villages (although in many cases there is no power supply)
- The high cost of generation using renewable-energy systems making it impossible to compete with the prevailing grid tariff
- Cap on bridging the gap between the cost of generation and income from revenue collection even with 90% subsidy for most renewable technologies and even more so for biomass-based systems where the capital costs are low but operating costs are high
- Poorly defined roles or responsibilities of the many players, delays in sanctioning projects, cost overruns, and lack of guidance on payment to bridge the viability gap
- Uncertainty of business, and hence in cash flow, coupled with non-parity with grid tariff, making it impossible to make a bankable business proposal

The chief conclusion from the consultations carried out with key stakeholders including DDG project developers is straightforward: ensuring sizeable business along with profitability and long-term business viability of a DDG plant should be at the core of the scheme. This focus will be crucial in creating interest among project developers and attracting private-sector investment for rural electrification. It was also felt that DDG cannot supply electricity to consumers at DISCOM tariffs, even with 90% capital subsidy. There is a need to explore different financing options such as combining capital and revenue subsidy, long-term power purchase agreement(PPA) on feed-in tariff(FIT), and reducing the burden on DISCOMs through central financial assistance or RECs (renewable energy certificates) or additional cess on other categories of a DISCOM's consumers. Apart from clustering, widening the customer base might be good idea for promoting RE-based DDG under the emerging scenario of large-scale electrification (grid extension) envisaged in RGGVY. A large number of villages, which now have access to electricity, are under-electrified, that is they receive unreliable power supply and that too for only a few hours.

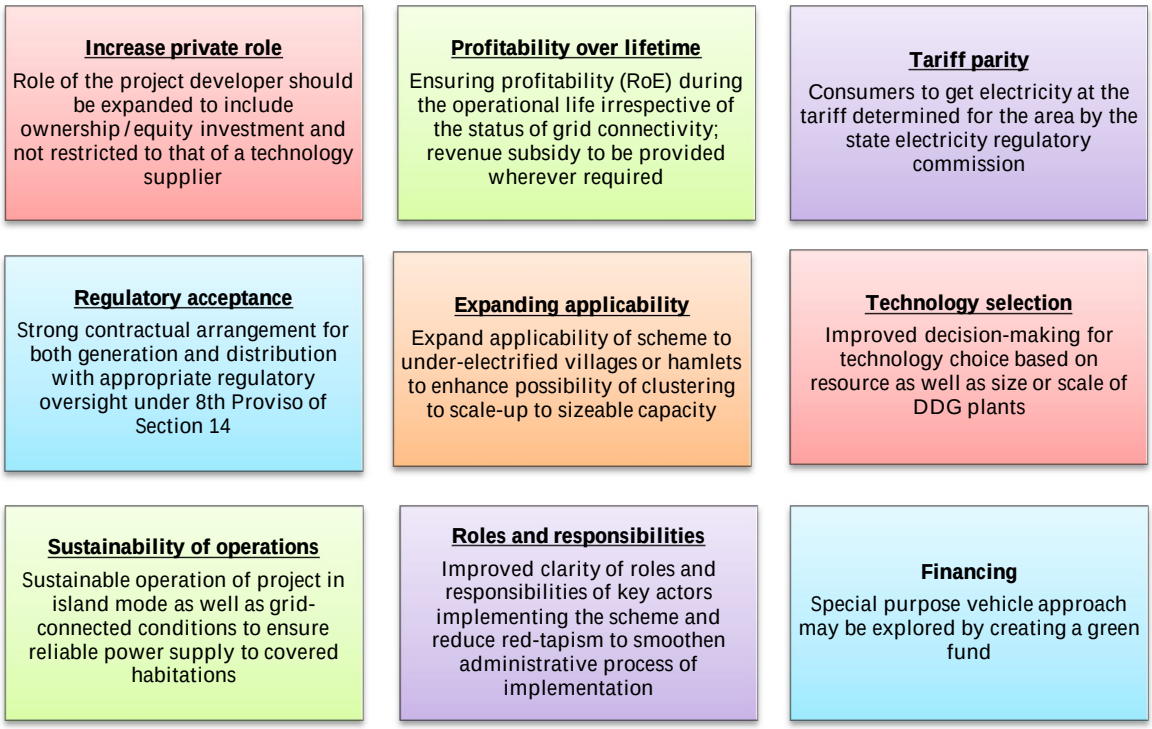
These issues have serious implications not only for effective implementation of DDG projects but also for attracting private-sector investments, which is essential for faster, more efficient and economical development of the sector.

4 SUGGESTIONS FOR IMPROVEMENT IN DDG GUIDELINES

Based on the insights gained during field visits to selected DDG projects and consultations with key stakeholders and extensive analysis of policy and regulatory framework for rural electrification in the country, some possible improvements in the existing DDG guidelines are suggested here, aimed at enhancing private-sector participation in the scheme.

4.1 Overall Approach and Framework

The overall approach to and framework of implementing the DDG scheme need to be looked at afresh to make the scheme amenable to large-scale private-sector participation. We suggest that the following issues be addressed while redesigning or restructuring the scheme to make it attractive for private sector investment.



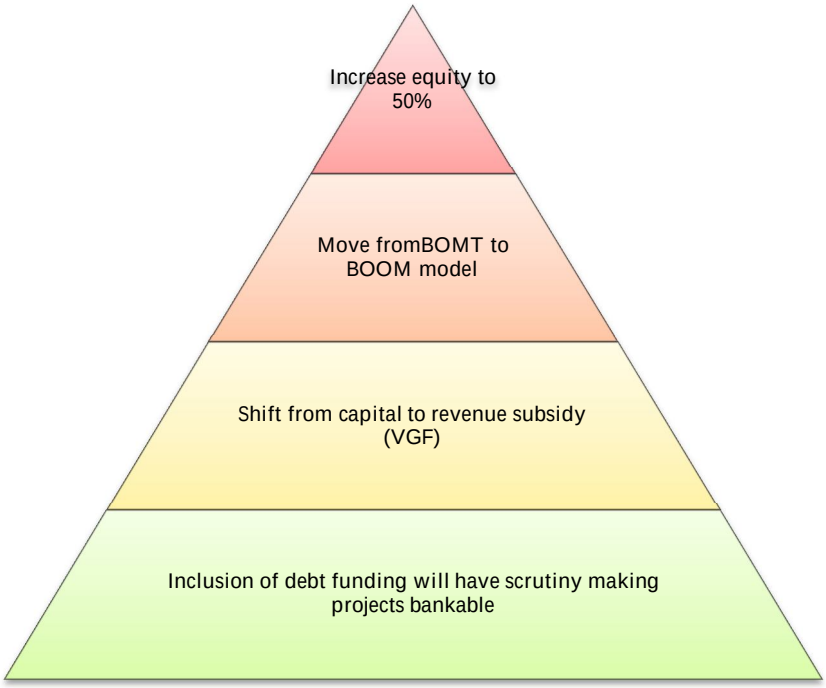
4.2 Increased Ownership Interest of the Project Developer

With the present structure of 90:10 capital subsidies:state loan ratio in place, the role of the private sector has been limited to that of a technology supplier whereas it is important to ensure significant buy-in of project developers to keep them seriously interested in the business. Private-sector participation is best attracted when project developers have an equity stake since their primary business interest is to maximize the return on equity (RoE).

The financing structure of the DDG scheme needs to be changed. The government should strive to reduce capital subsidy and increase equity investment from the private sector. One of the capital structures could be that in which capital subsidy, equity, and debt account for respectively 50%, 30%, and 20% of the project cost. Similarly, equity investors should be assured a RoE of 14%–16% on their investment. This will bring the investment structure in off-grid rural electrification in line with power sector policies. Given that DDG or rural

electrification as a business is more risky than conventional generation, additional incentives are required for those who willing to undertake that business.

Further, debt funding would ensure increased scrutiny of the project by an independent agency with strong interest in the business activity. Such scrutiny will ensure increased ownership by the project developer as well as the commitment to keep the project operational so that it can provide electricity throughout the lifetime of the project. Return on equity and interest on debt might widen the viability gap, but it should be noted that even with capital subsidy of 90% the projects are not financially viable because the cost of generation continues to be far higher than DISCOM tariff. As a result, a revenue subsidy mechanism would be required in any case.



However, the proposed financing structure would ensure that plants are maintained properly because significant business interests are involved and the ultimate goal of generation and distribution of electricity over the lifetime of any RE-based DDG project would be achieved.

Further, the implementation model for the project should be build, own, operate, and maintain (BOOM) over the life of the project rather than the BOMT model preferred by the current guidelines. This change will ensure continued and long-term involvement of the private sector in the project.

4.3 Profitability of DDG Projects over Lifetime

Under the prevailing circumstances of a low PLF and the vast difference between grid tariff and the cost of power generated using RE-based DDG, even a 90% capital subsidy would not be sufficient to cover the cost of supplying DDG-based power to rural customers at grid-based tariffs. As discussed earlier, this gap would be far higher than the present cap of 8% or 9% mentioned in the guidelines, especially in the case of renewable resources like biomass and bio-oil where the variable cost of generation is high. Also, it is neither reasonable nor realistic to expect that the implementing agency would pay the project developer this difference from its service fees. And even if it does, such payment may adversely affect the quality assurance and quality control (QAQC) mechanism mentioned in the guidelines as the costs of QAQC are also to be borne through the service fees.

It is obvious that the government will have to put in place an additional and variable compensation mechanism to ensure that DDG projects are viable. This additional compensation would vary with technology. Therefore, the guidelines also need to establish a

mechanism to determine the cost of supplying power through different renewable energy sources under various operating conditions and parameters.

4.4 DDG Project Operation on Grid Extension

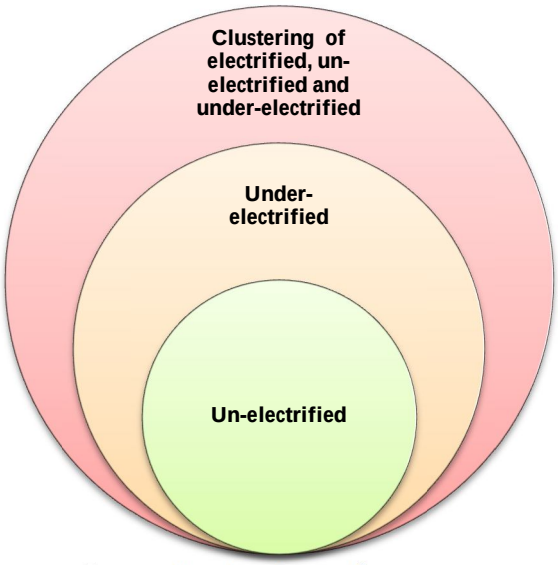
Experience with DDG in programmes such as VESP shows that RE-based DDG becomes defunct or redundant once the customers are connected to the grid because grid-based power is cheaper. Although the guidelines mention that DDG should be grid compatible, small DDG plants and poor rural infrastructure casts serious doubts on such compatibility in reality. Further, the guidelines on technical standards for synchronization of small systems with the grid at 400V are yet to be issued by the Central Electricity Authority.

On commercial front, although the guidelines mention that a DDG plant can export power to the grid 'as and when required', the guidelines do not specify the quantum of assured power that would be absorbed in the grid and the price at which that power would be procured by the grid. The guidelines need to incorporate these two parameters to assure project developers of continued and profitable operation over the lifetime of their projects.

4.5 Expanding Horizon to Cover Under-electrified Villages or Hamlets

Under RGGVY, most of the census villages were covered and grid infrastructure extended to these villages in the 11th Five-Year Plan. This coverage, however, makes it difficult to find sizeable numbers of 'un-electrified' census villages for future implementation, making a cluster of contiguous un-electrified villages even rarer. At the same time, the hamlets or other small settlements, variously referred to as *pada*s or *basti*s, that surround these census villages have no access to grid electricity.

On the technology side, very small plants adequate for a single village lower the economic viability of the business. If the plants are made larger so that they can supply power to a few villages and hamlets, the projects are likely to be sustainable. For this purpose, a DDG plant needs to include under-electrified villages along with un-electrified villages and hamlets in the coverage area so as to form a sizeable cluster of contiguous villages or habitations.



Expanding horizon of coverage

4.6 Robust Criteria for Technology Selection

The DDG technology decision tool, which is part of the present guidelines, ranks biofuel-based DDG much higher than that based on biomass gasifiers or biogas. However, it is felt that the technology decision tool needs to be modified to take into account the size or scale of the RE-based power plant as well. Such a modification becomes particularly important if the clustering approach suggested in this report is adopted. Power plants using biofuels, biogas, or solar PV can be smaller, 10–50 kW for example, to serve an un-electrified village and its associated hamlets; grid-interactive RE-based DDG plants can be larger, 1–2 MW for example, and can serve a cluster of un-electrified and under-electrified villages or hamlets and would basically work as tail-end augmentation of electricity supply.

4.7 Legality of the Structure

The guidelines leave it to the implementing agency to draw up an agreed-upon normative and simplified tariff structure for DDG plants in which the tariff would be higher than that charged by a DISCOM. However, the Electricity Act, 2003, states that only the electricity regulatory commission has the authority to determine tariffs or to set guidelines for determining tariffs. This discrepancy needs to be removed.

The scope of regulatory jurisdiction over off-grid generation and supply is not clear either. Generally, only grid-connected plants are held to be within the purview of the regulatory commission. The source of this ambiguity is Section 14(8) of the Act, which appears to leave off-grid generation and supply out of the purview of regulatory oversight. However, this interpretation is not correct because Section 14 deals with *licensing* issues and exempts off-grid generation and supply from licensing requirements and not from regulatory oversight. Further, the only available forum to settle any dispute between the generator and the consumer is the electricity regulatory commission. It is essential to clear up this ambiguity early and completely. The government should put in place a regulatory framework in future DDG policies that will allow planned development, implementation, monitoring, and evaluation of DDG schemes.

4.8 Clarity of Roles of Key Actors

The present guidelines fail to specify clearly the roles and responsibilities of key stakeholders in the process. The guidelines recommend that un-electrified villages be shortlisted by state nodal agencies (SNAs) or other implementing agencies in consultation with DISCOMs or SEBs. However, the capability of SNAs to do so is doubtful; since such short listing of villages involves issues related to the grid, the list should ideally be drawn up by a DISCOM, preferably in consultation with MNRE or an SNA.

With the suggested 'clustering' approach, it is even more important that such short listing be done by a DISCOM, which is more likely to be privy to any plans of extending the grid, taking into consideration the possibility of grid extension, transmission infrastructure requirement, and the current and future status of electricity supply.

The role of SNAs will be more important in selecting the right RE technology and in specifying a suitable size for the power plant. The implementing agency's role can be to ensure greater transparency and time-bound decision-making in implementing the scheme. With such widening of the scope of DDG to cover under-electrified villages, the role of DISCOM becomes more crucial to the success of the scheme because the PDN is going to be finally the DISCOM's asset, and DDG projects should be seen as an assisting programme and mechanism to help DISCOMs to achieve their obligation of providing sufficient and reliable power to all customers cost-effectively.

4.9 Adoption of the DGBDF Model for Rural Electrification

From the earlier discussions, it is evident that the future of the DDG scheme lies in ensuring a long-term business prospect by ensuring in turn sustainable business operations before and after grid extension to the project area. To ensure reliable generation and distribution of electricity, DDG project developers need to take on both generation and distribution on behalf of DISCOMs instead of confining themselves to generating power and supplying it to

off-grid consumers or to the grid once the plant is integrated with the gird. Therefore, we believe that in future, DDG projects will have to be promoted as an integrated generation and franchisee business, or a distributed-generation-based distributed franchise (DGBDF).

In the DGBDF model, a project developer will not only generate electricity but also undertake metering, billing, and collection (MBC) on behalf of the DISCOM within a given cluster. Thus the developer will be a generator as well as a franchisee. As a result, the developer and the DISCOM would need to draw up two agreements:

- a PPA for the lifetime of the proposed RE-based DDG power plant
- a franchisee agreement for MBC on behalf of the DISCOM.

The project developer will commission a generation project in accordance with the terms and conditions of the PPA and would supply electricity to the local grid by connecting the plant at 11kV or above at the substation serving the selected cluster. The DISCOM will pay the agreed-upon FIT to the developer. As per the current practice, the DISCOM will distribute electricity to rural consumers and the project developer will undertake MBC under the franchisee agreement.

5 CONCLUSIONS AND WAY FORWARD

Despite the several programmes for rural electrification launched by the Government of India, the ambitious goal of electricity to all by 2012 could not be achieved. Providing reliable and sufficient electricity appears a distant dream even now. Although RGGVY can claim to have taken grid infrastructure to most of the census villages by the end of the 11th Five-Year Plan, providing sufficient and reliable electricity remains an elusive and challenging task mainly due to the wide demand–supply gap, more than 10%, despite huge capacity addition in the last two decades.

The issues identified in the existing DDG guidelines and recommendations to address those issues are summarized in the table below.

ISSUES	RECOMMENDATIONS
Overall framework government-driven; 90% capital subsidy and remaining 10%as state government's share or loan from REC or the implementing agency limits the role of the private sector to that of a technology supplier.	Restructure the framework to increase ownership and interest of private sector. ➢ Limit capital subsidy to 50%. ➢ Insist on a minimal equity of 30%. ➢ Make up the balance through a debt fund.
The present build, operate, monitor, and transfer model involves ➢ ownership by the state government ➢ only a small role and interest on part of the project developer.	Move from BOMT to BOOM (build, own, operate, and maintain). Ownership of the project developer over the project's lifetime ensures that the plant is operational throughout.
A plant's operation over its life is uncertain despite 90% capital subsidy, as the issue of the high operational and maintenance costs has not been tacked.	Provide revenue subsidy as required instead of capital subsidy to cover viability gap between grid tariff and cost of renewable power generation, e.g. Rs 5–6 per unit for biomass-gasifier-based DDG.
Village selection: state nodal agency to finalize the list of villages to be electrified through DDG.	In order to ensure that investment is not wasted, the task of selecting villages must be given to DISCOMs or state utilities.
Although clustering approach is recommended, reduced potential for clustering with widespread grid extension under RGGVY. Reduces economic viability of business owing to low CUF and small plants catering to small clusters.	Expand horizon of coverage: clustering of un-electrified, under-electrified and even electrified villages or hamlets, resulting in larger plants and greater business potential.
Technological decision tool is silent on the size of a DDG plant.	For implementation, it is important to modify the technological decision tool to take into account the size or scale factor, especially in clustering.
Clarity of roles and responsibilities of key actors: Capability of SNAs to shortlist un-electrified villages doubtful.	DISCOM's role critical considering grid-related issues; may act in consultation with SNA. SNA's role must be confined to renewable energy technology selection and plant specifications. Implementing agency must ensure greater transparency and time-bound decision-making in implementation.
Guidelines suggest that DDG plants must be grid compatible but lack clarity on what happens after grid integration or extension.	CEA must be directed by the government to issue technical standards and guidelines for synchronization of small RE power plants with grid at 400V.
Sustainability and profitability are uncertain, lowering the project's viability on grid extension.	Need clear guidance on this with assured purchase of power (both quantum and price). Guidelines for price under the DDG mode and bringing it under some regulatory system.

Therefore, for achieving the goal of electricity for all in its true sense and making rural electrification a massive mission with large-scale private-sector participation for effective implementation of the DDG scheme in future, the following essential tasks need to be undertaken on priority.

- Widening the horizon of coverage by including under-electrified villages or hamlets to make sizeable clusters.
- Bringing in regulatory interventions to promote business models (such as the DGBDF model proposed here) by bringing in not only clarity and assurance of long-term business profitability but also legality of the proposed model.
- Bringing in parity between grid tariff and renewable-energy-based tariff by providing generation-based financial assistance instead of capital subsidy to ensure that DDG projects are not only installed but also remain operational with reasonable profitability over their lifetime.
- Estimating the rational cost of electricity supply to rural areas to obtain a realistic estimate of the viability gap between the cost of generating power through various renewable-based DDG systems and income from supplying such power.
- Estimating the cost of electricity supply through DDG based on various sources of renewable energy under various sets of parameters to calculate the amount needed to bridge the viability gap and developing a mechanism to ensure that the amount is paid to the project developer through appropriate regulatory interventions by way of FIT as mentioned earlier.

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