Regulatory and Policy Changes for Distributed Renewable Energy

Balawant Joshi
Director, ABPS Infrastructure Advisory Pvt. Ltd.

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Background for this presentation

- Forum of Regulators engaged ABPS Infrastructure Advisory to develop new Policy & Regulatory Initiative for off-grid community based projects
- Shakti Sustainable Energy Foundation supported this initiative
- ABPS Infra proposed Off-grid Distributed Generation Based Distribution Franchisee Model and Off-grid REC Model for this purpose
- Currently ABPS Infra is developing Regulations for these two models with support of Shakti Foundation
- ABPS Infra is also developing 'Cluster based approach for development of DRE Project' in Bihar under 'UNDP – Access to Energy'
- Also working with SDC – TARA on 'Assessment of issues for private sector participation in DDG Scheme'

Agenda

- Policy & Regulatory Framework
- Challenges in Off-Grid Rural Electrification
- Technology and Commercial Assessment for DRE
- Proposed Initiatives for Community Off-Grid Projects
- Issues Involved

Policy & Regulatory Framework

Electricity Act, 2003 - Enabling Provisions (1/2)

Enabling provisions to accelerate development of RE based generation are:

- **Section 3**: National Electricity Policy and Plan for development of power system including renewable sources of energy.
- **Section 4** - Central Govt. shall, after consultation with State Govts, prepare and notify a national policy, permitting stand alone systems for rural areas.
- **Section 5** - for rural electrification and for bulk purchase of power and management of local distribution in rural areas
- **Section 6**: Concerned State and Central Government shall endeavour to provide access to electricity to all areas including villages and hamlets

Electricity Act, 2003 - Enabling Provisions (2/2)

- **Eighth provision under Section 14 of EA 2003** provides the framework for generation and distribution of electricity in Rural Areas:
  - *"Provided also that where a person intends to generate and distribute electricity in a rural area to be notified by the State Government, such person shall not require any license for such generation and distribution of electricity"*
  - Para 8.1 of Rural Electrification Policy clarifies that rural areas mean all areas identified pursuant to 73rd Amendment to Constitution
- **Section 61(h):** Tariff Regulations by Regulatory Commission to be guided by promotion of generation of electricity from renewable energy sources
- **Section 86(1)(e):** Regulatory Commission to Specify Renewable Purchase Obligations for Obligated Entities
- **Section 166 (5):** Committee in each district to be constituted by Appropriate Government,
  - *to coordinate and review the extension of electrification in each district;*
  - *to review the quality of power supply and consumer satisfaction;*
  - *to promote energy efficiency and its conservation.*

Policies related to Rural Electrification

- Rajiv Gandhi Grameen Vidyutikaran Yojana
- Rural Electrification Policy
- Decentralized Distributed Generation Scheme
- Remote Village Electrification Policy
- Village Energy Security Programme
- National Solar Mission
- Proposed Remote Village Electrification Programme

Proposed RVE Programme for 2012 -13

- Draft Scheme published in March 2012

Objective

- Basic lighting facilities through RE sources in ,
  - Un-electrified remote census villages,
  - Un-electrified hamlets of electrified census villages where grid connectivity is either not feasible or not cost effective
  - Electrified villages/hamlets where power availability is less than 6 hours per day averaged over the year

Project Design

- Basic lighting facilities with 2 light points (around 9 W each)
- 1 socket (around 40 W) for operating electronic gadgets
- If not possible, standalone solar lighting systems for each of the willing households in the village may be provided.
- In addition, street lighting systems with 11 W CFL may also be considered under the project

Key Points

- State Implementing Agencies/State Nodal Agencies (SNAs) may shortlist such unelectrified villages and hamlets, and
- Forward list through their Energy/Power departments to Ministry for verification by REC for non-coverage under RGGVY
- Selection of Project Developer(s) by SNA through competitive bidding process after sanction of the MNRE support.
- For mini/micro grid, the Project Developer(s) shall implement the project on Build, Operate, Maintain and Transfer (BOMT) basis for a period of 5 years
- Assets will be owned by State Government.
- Plant will be handed over to SNA in working condition after 5 years by the Project Developer(s).
- After 5 years, State Government will have the option to take over project or handover to the same agency or any other agency

Key Points

Agreement

- Bipartite agreement will be signed b/w State Implementing Agency & Project Developer(s) for agreeing to supply power 5 years

Tariff

- Project developers will charge tariff through metering/prepaid meter/flat rate basis.
- Tariff is to be fixed by State notified implementing agencies every year.

When the grid will reach

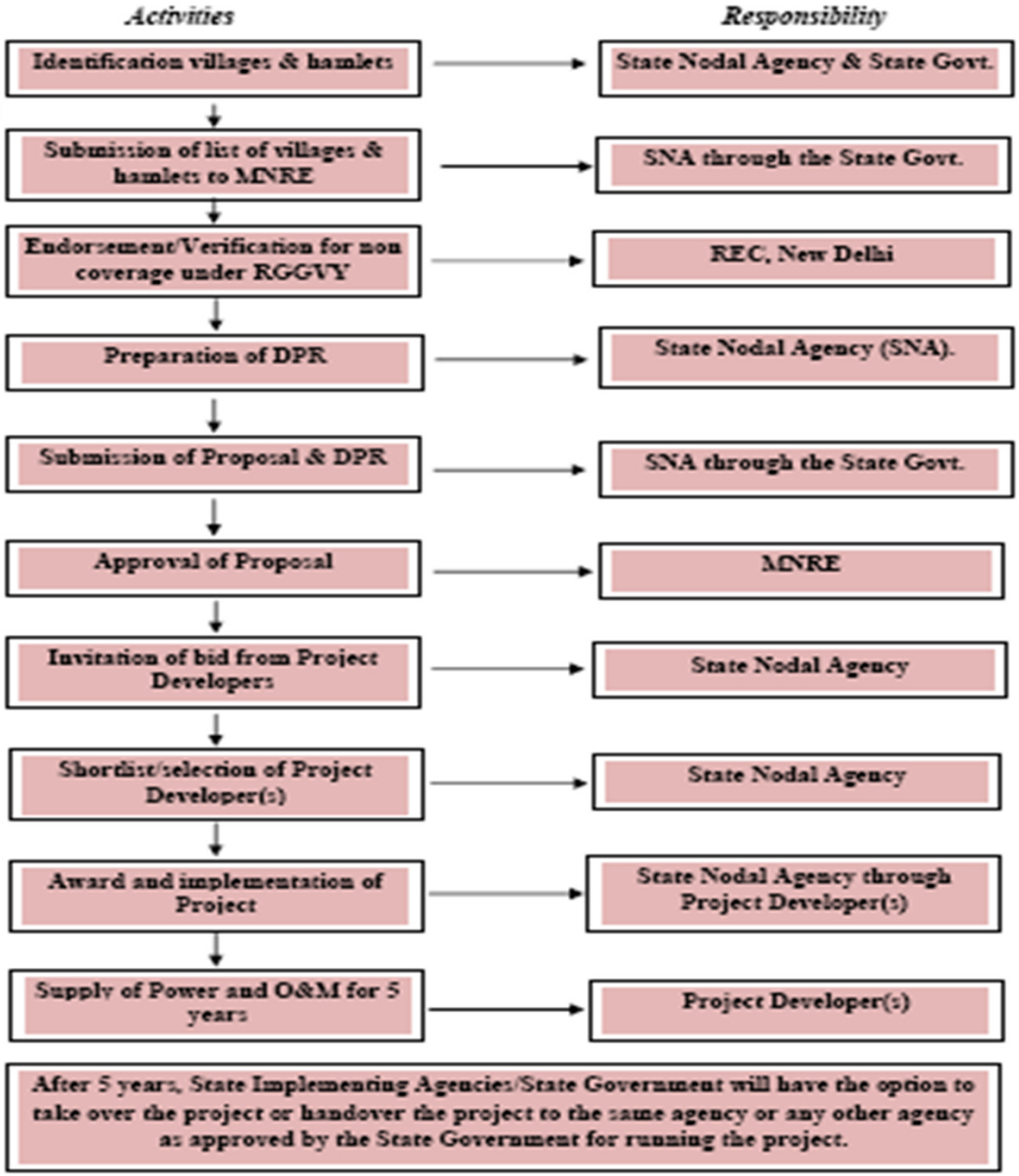
- If grid power reaches before 5 years, then State Government will have the option to handover project to concerned DISCOM or State Government may provide license to project developer(s) of mini/micro grid to act as a distribution company

Key Points

Certifications

- Certification by village panchayat/district level officials that work has been carried out as per the sanction order/DPR.
- Certification by SNA that project has been completed as per sanction DPR & systems installed are working satisfactorily for last one month.
- Third party monitoring covering 100% HH by government/independent autonomous institutions such as Universities, Regional Engineer Colleges, Public Sector Undertakings etc. & submission of report to MNRE.

Project Cycle



Key Learnings from Policy Analysis

- Several legal provisions for promotion of Renewable & Rural Electrification
- Attempt to promote every possible model
- No structure to implement "license exempt" framework
- Different ministries pursuing different approaches
- As a result, weak or no implementation framework prescribed

Challenges in Off-Grid Rural Electrification

Key Challenges

- Reliance on large share of subsidy
- Technology specific schemes
- Relies heavily on NGO, PRI, SNAs for implementation
- Limited, if any, role of private sector
- Lack of clarity on issues related to supply and collection of charges
- National level schemes could not account for local resource issues
- Large scale deployment & optimization of subsidy were not objectives
- Consequences of grid expansion are not considered

Present Scenario

- According to the recent survey more than 70% of DDG projects are not operational *(TERI Study)*
- Cost of providing connection in some remote villages is as high as Rs 10 lakh/customer *(World Bank Study)*
- Cost of supply in some villages is as high as Rs 91/Unit *(Mr. SP Gon Chaudhuri)*
- Private sector participation in DDG is minimal
- Private sector models are appearing on horizon though tariffs are far higher than DISCOM tariffs
- Large scale deployment of DDG as well as sustainable rural electrification continues to be the challenge

Key Reasons for development of new PRI

- Large number of villages and hamlets are yet to be electrified.
- Where grid has reached, supply is severely constrained.
- Liquid fuels (kerosene & diesel) are being widely used for basic applications such as lighting.
- Significant local renewable energy potential still exists
- RE though cheaper than kerosene, expensive than grid supply
- Social equity issue: Discrimination between sub urban consumers and off grid consumers on cross subsidization of tariff
- However, existing policies/programmes are inadequate for large scale deployment of off-grid generation projects

Technology Evaluation & Commercial Feasibility for DRE

SWOT Analysis of Technology Options

Solar Photo Voltaic

Clean, Sophisticated Matured, Modular Trouble-free	High capital, Lighting alone No productive load
Automation, Grid interaction Trouble free	No economic growth in absence of motive power

Biomass Gasifier

Local resource Modular	Not mature High O&M cost
Livelihood creation Local job generation Local cash recycle	Sustainable biomass supply, lack of after sale service network

Micro-Hydro

Mature, Clean, Grid quality	Resource site-specific Seasonal variation
Grid interaction , economic activity	Water flow may change

Solar-Wind Hybrid

Mature, Clean, Trouble-free	High capital, Lighting alone Resource site specific
Automation, Grid interaction	No economic growth in absence of motive power

Though focus of work has been on off-grid generation, it is necessary to promote systems supporting productive loads to ensure economic growth.

Assumptions for Commercial Analysis

- Developer designs, builds, finances, constructs and operates the renewable energy based off-grid generation plant
- Developer also builds and operates the network for distribution of electricity to rural consumers
- Network loss (technical and commercial) shall be around 20 per cent
- Consumption by Domestic and Commercial Consumers shall be in the ratio of 80:20
- Effective Tariff of Bihar and Jharkhand is Rs 1.86/kWh and Rs 1.30/ kWh respectively

Assumption Parameters

- Calculations for four different technologies have been carried out namely,
  - Biomass Gasifier
  - SPV
  - Micro Hydro
  - Wind + PV Hybrid
- Capacity of 40 kW systems for all technologies
- CUF appropriate for each technology has been assumed.

Analysis is based on assumption that 300 DDG systems are installed in Bihar and Jharkand

Assumption Parameters

Parameter Head	Sub-Head (1)	Sub-Head (2)	Unit	Biomass Gasifier	Solar PV	Micro Hydro	Wind PV Hybrid
Power Generation	Capacity	Installed Capacity	kW	40	40	40	40
		PLF/CUF	%	80.00%	19.00%	45.00%	18.00%
		Auxiliary Consumption	%	10.00%	0.00%	1.00%	1.00%
		T&D Loss in the Mini Grid	%	20.00%	20.00%	20.00%	20.00%
		Life of Power Plant	Years	20	20	20	20
Project Cost	Capital Cost	Power Plant Cost	Rs/kW	50000	150000	100000	250000
Sources of Fund	Debt : Equity	Debt	%	70%	70%	70%	70%
		Repayment Period	years	10	10	10	10
		Interest Rate	%	12.50%	12.00%	11.75%	11.50%
		Return on Equity	% p.a	19.36%	19.36%	19.36%	19.36%
		RoE Period	Year	10.00	10.00	10.00	10.00
		Return on Equity after 10 years		19.36%	19.36%	19.36%	19.36%
		Weighted average of ROE		19.36%	19.36%	19.36%	19.36%
		Discount Rate (equiv. to WACC)		14.6%	14.2%	14.0%	13.9%

Assumption Parameters

Parameter Head	Sub-Head (1)	Sub-Head (2)	Unit	Biomass Gasifier	Solar PV	Micro Hydro	Wind PV Hybrid
Financial Assumption	Depreciation	Depreciation Rate	%	5.28%	5.28%	5.28%	5.28%
		Depreciation from 11th yr	%	3.72%	3.72%	3.72%	3.72%
Fuel related	Biomass	Biomass Requirement	kg/kWh	1.50			
		Fuel Price	Rs/MT	1200.00			
		Escalation	%	5%			
Working capital	For Fixed Charges	O&M Charges	Months	1	1	1	1
		Maintenance Spare		15%	15%	15%	15%
		Receivables for Debtors	Months	2	2	2	2
		Fuel Cost	Months	4	-	-	-
		Interest On Working Capital	%	12.50%	12.00%	11.75%	11.50%
Operation & Maintenance		Power Plant	Rs Lakh	0.15	0.30	0.20	0.32
		Total O & M Expenses Escalation	%	5.72%	5.72%	5.72%	5.72%

Tariff of Bihar & Jharkhand

State	Bihar	Jharkhand
FY	FY 12	FY 12
BPL Consumer Category		
Unmetered	Rs 50/connection/month	Rs 35/connection/month
Metered	Rs 1.5/unit subject to monthly min. charge of Rs 40/month/connection	Rs 12/connection/month + Energy charge of Rs 1.10/kWh
Non BPL Rural Consumers		
Unmetered	Rs 150/connection/month (for load upto 2 kW)	Rs 85/connection/month (upto 2 kW)
Metered	**0-50 units - Rs 1.80** 51-100 units - Rs 2.10 Above 100 units - Rs 2.50 Subject to monthly min. charge of 1st kW - 40 units per month 2nd kW - 20 units per month (for load upto 2 kW)	Rs 20/connection/month+ Energy charge of **Rs 1.25/kWh** (Upto 2 kW)
Commercial Consumers		
Unmetered	Rs 200/connection/month (upto 2 kW)	Rs 150 upto 1 kW, Rs 60 for every additional kW (upto 2 kW)
Metered	**1-100 units - Rs 2.10** 101-200 units - Rs 2.50 Above 200 units - Rs 2.85 Subject to monthly min. charge of 50 units per kW (for load upto 2 kW)	Rs 25/connection/month + Energy Charge of Rs **1.50/kWh** (upto 2 kW)

Capital Cost under various scenarios (Rs)

Technology	Case I (No subsidy)	Case 2 (30% capital subsidy)	Case 3 (50% capital subsidy)	Case 4 (90% capital subsidy)	Net Energy for Distribution (kWh/plant/yr)
Biomass Gasifier	20,00,000	14,00,000	10,00,000	2,00,000	50458
SPV	60,00,000	42,00,000	30,00,000	6,00,000	53261
Micro Hydro	40,00,000	28,00,000	20,00,000	4,00,000	124883
Wind + PV Hybrid	1,00,00,00	70,00,000	50,00,000	10,00,000	50458

Cost of Supply (Rs/kWh)

Technology	FIT I (No subsidy)	FIT 2 (30% capital subsidy)	FIT 3 (50% capital subsidy)	FIT 4 (90% capital subsidy)	Net Energy for Distribution (kWh/plant/yr)
Biomass Gasifier	11.66	9.26	7.66	4.45	50458
SPV	20.35	14.24	10.17	2.03	53261
Micro Hydro	5.21	3.64	2.6	0.52	124883
Wind + PV Hybrid	35.35	24.74	17.67	3.53	50458

Effective Tariff of Bihar and Jharkhand is **Rs 1.86/kWh** and **Rs 1.30 kWh** respectively

Impact of Retail Tariff on FIT

Bihar	Impact of Retail Tariff on FIT (Rs/kWh)				
Technology	FIT I (No subsidy)	FIT 2 (30% capital subsidy)	FIT 3 (50% capital subsidy)	FIT 4 (90% capital subsidy)	Retail Tariff (Weighted Avg. rate of supply)
Biomass Gasifier	9.8	7.4	5.8	2.59	1.86
SPV	18.49	12.38	8.31	0.17	1.86
Micro Hydro	3.35	1.78	0.74	1.34	1.86
Wind + PV Hybrid	33.49	22.88	15.81	1.67	1.86

Jharkhand	Impact of Retail Tariff on FIT (Rs/kWh)				
Technology	FIT I (No subsidy)	FIT 2 (30% capital subsidy)	FIT 3 (50% capital subsidy)	FIT 4 (90% capital subsidy)	Retail Tariff (Weighted Avg. rate of supply)
Biomass Gasifier	10.36	7.96	6.36	3.15	1.30
SPV	19.05	12.94	8.87	0.73	1.30
Micro Hydro	3.91	2.34	1.3	0.78	1.30
Wind + PV Hybrid	34.05	23.44	16.37	2.23	1.30

Cash outflow of DISCOM /system/year

Bihar	Cash outflow in Rs			
Technology	FIT I (No subsidy)	FIT 2 (30% capital subsidy)	FIT 3 (50% capital subsidy)	FIT 4 (90% capital subsidy)
Biomass Gasifier	494488	373389	292656	130686
SPV	984796	659371	442599	9054
Micro Hydro	418358	222292	92413	-167343
Wind + PV Hybrid	1689838	1154479	797741	84265

Jharkhand	Cash outflow in Rs			
Technology	FIT I (No subsidy)	FIT 2 (30% capital subsidy)	FIT 3 (50% capital subsidy)	FIT 4 (90% capital subsidy)
Biomass Gasifier	522745	401646	320913	158943
SPV	1014622	689197	472425	38881
Micro Hydro	488293	292226	162348	-97409
Wind + PV Hybrid	1718095	1182736	825997	112521

Comments on Commercial Assessment

- Even with 90% capital subsidy, FIT is far more than the retail tariff except for micro hydro project.
- As a result, scheme with only CFA and supply at retail tariff by DDG is not financially viable for operator.
- Gap between FIT and cash outfow of DISCOM varies with state. As a result, central scheme with fixed subsidy is likely to create distortion in the market.
- If FIT is calculated for period shorter than 20 years, impact on profitability of the project will be even higher.
- For any fixed central subsidy mechanism, shock absorber in the form of FIT or state subsidy would be required to take into account state level resource issues and retail tariff differentiation.

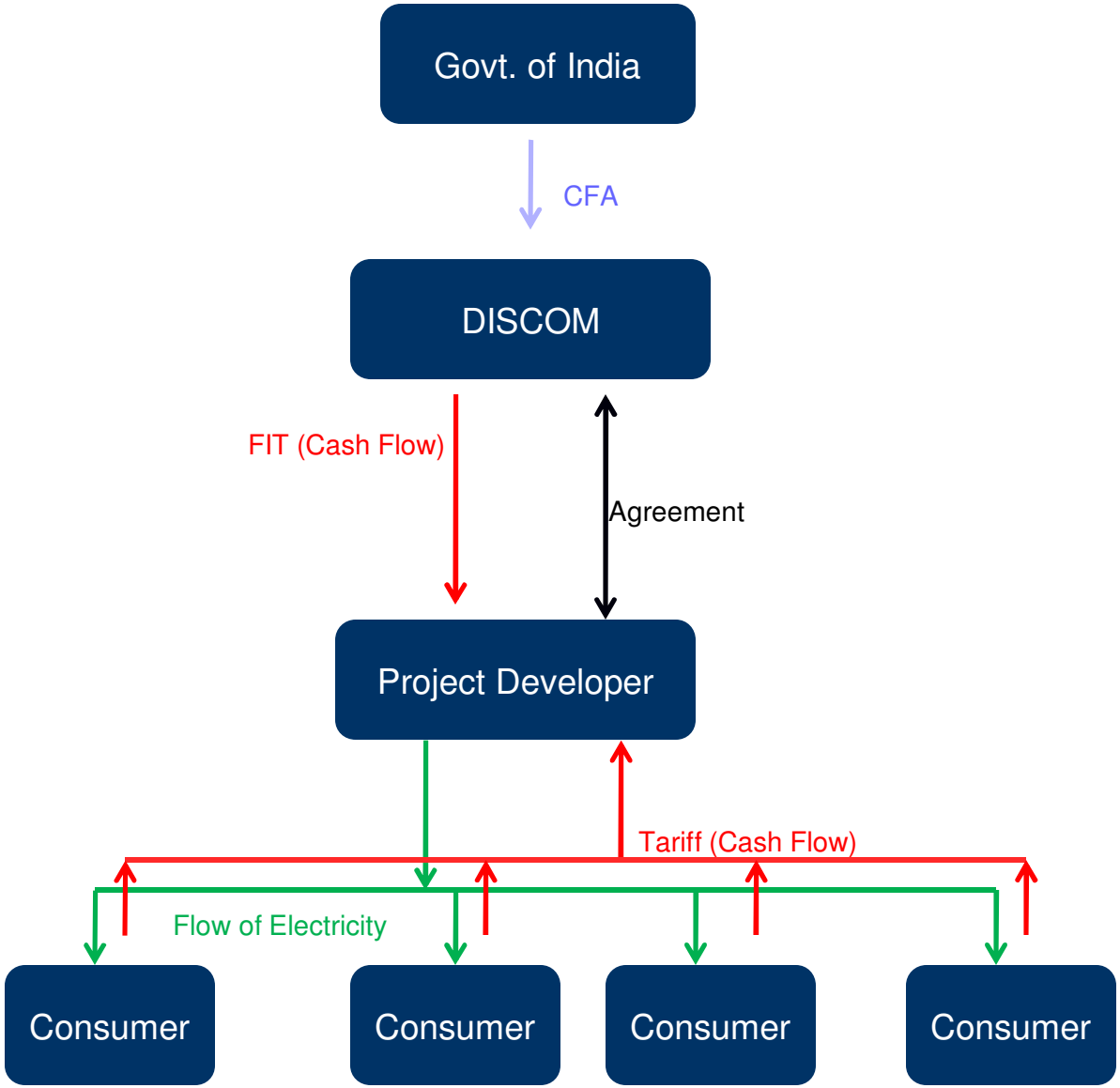
Business Models for Community Off-Grid Projects

Characteristics of PRI

- Business model proposed in PRI must work in off-grid & grid connected set up
- Consumer should not pay more than
  - Electricity tariff in adjoining areas (not more than DISCOM tariff)
  - Existing expenditure on lighting load
- Compliant with EA 2003, existing policies
- Create structure for flow of subsidy
- As far as possible, internalization of costs of Rural Electrification
- Should make use of existing institutional structure
- Avoid conflict between programmes of two ministries
- Should promote private sector involvement

In view of these requirements and the analysis carried out, two potential models have been proposed

Off-Grid Distributed Generation Based Distribution Franchisee

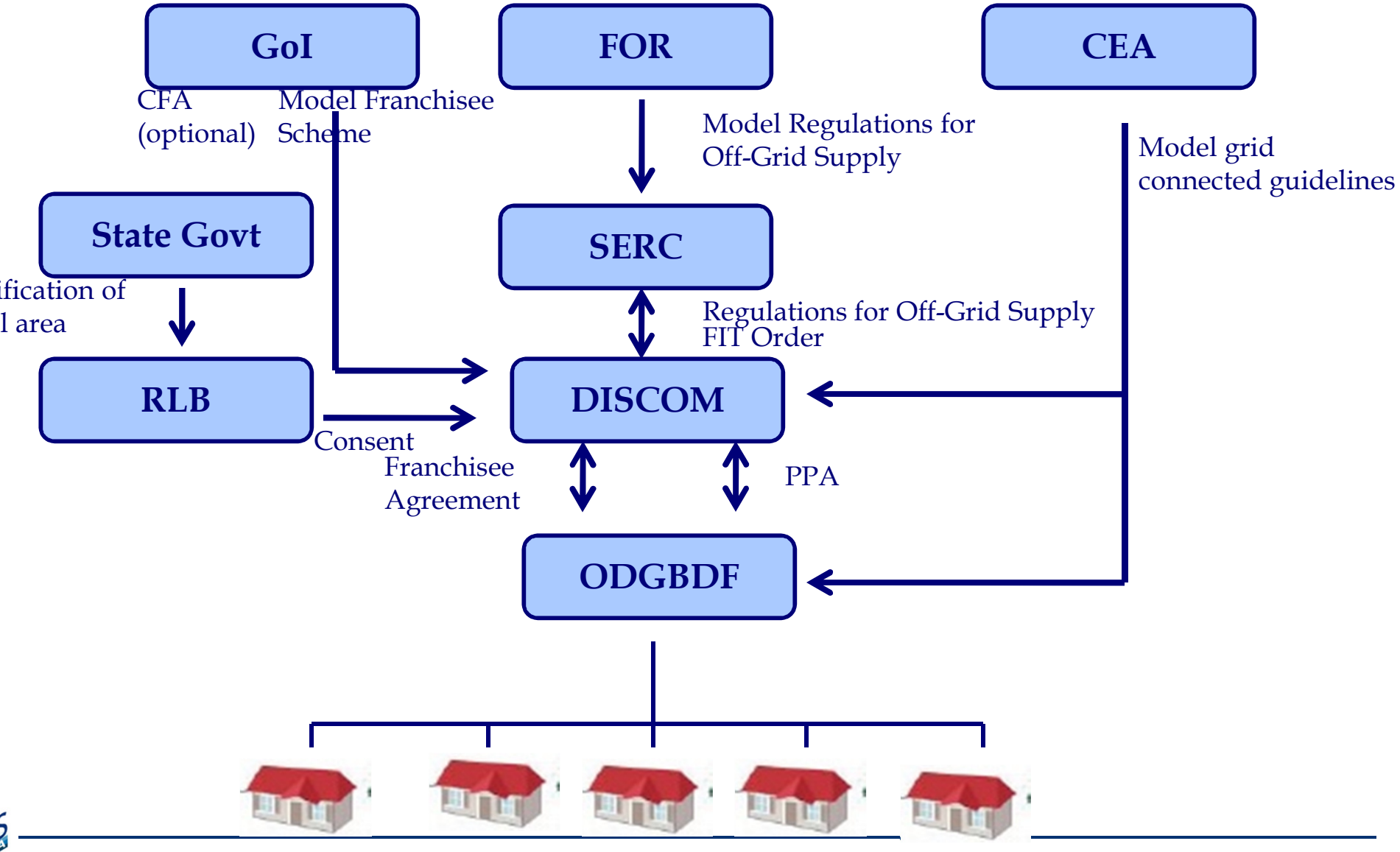


ODGBDF – New Comprehensive Solution for Rural Electrification

ODGBDF

- Rural electrification challenge is combination of two different challenges i.e. generation & supply
- Two problems represent two distinct activities under the EA 2003
- Policy / legal/ regulatory framework for these two are different
- Hence, special policy / regulatory dispensation would be required to implement the same
- Proposed model addresses both challenges

Institutional & Contractual Structure



Roles & Responsibilities of Key Stakeholders (1/3)

ODGBDF

Government of India

- Provide CFA to DISCOM to support Off-grid RE projects

Forum of Regulators

- Model Regulations for Off-grid Renewable Energy Generation and Supply
- Develop guidelines for development of feed-in tariff for small scale renewable energy generators used for off-grid supply

Central Electricity Authority

- Develop model grid connectivity guidelines for small RE systems

State Electricity Regulatory Commission

- Notify State Regulations for Regulations for Off-grid Renewable Energy Generation and Supply
- Adoption of Model Regulations with suitable adjustments to take into consideration state specific factors
- Issue Tariff order for Off-grid renewable energy generation
- Guidance to various stakeholders participating in the scheme

Roles & Responsibilities of Key Stakeholders (2/3)

DISCOM

- Must allow each project on "first come first serve" basis
- DISCOM submit tariff petition to SERC;
- Enter into Franchisee Agreement and PPA with PD
- Provide FIT to PD;
- Request to GoI for CFA if / as required
- Take into consideration off-grid schemes while planning grid expansion

Rural Local Body

- Confirm un-electrified status of village / hamlet / pada
- Confirm number of households & establishments
- Provide consent to PD for generating and distributing electricity

Roles & Responsibilities of Key Stakeholders (3/3)

ODGBDF

- Identification of Project Scheme;
- Finalization of technology based on resource availability
- Confirm State Government's notification of rural area from RLB
- Undertaking of prefeasibility study;
- Development of DPR;
- Agreement b/w DISCOM and PD;
- Financial Closure & project commissioning;
- Provide electricity to consumers and receive tariff as paid by consumer of local DISCOM;
- Receive FIT minus consumer tariff from DISCOM

Consumer

- Pay charges to ODGBDF

Recommendations

- Advantages of ODGBDF Model
  - Maximum certainty of revenue to the developer
  - Proper integration of off-grid projects with grid as and when is feasible
  - Internalisation of costs of rural electrification
  - DISCOM can meet meet twin objective of electrification and RPO
  - Possible to customise model according to local requirements
  - Optimum utilisation of the government subsidy, if offered
  - FIT guidelines at national level would bring in uniformity.
  - Distribution franchisee framework under RGGVY could be adopted
  - Model could be used for off-grid as well as on-grid supply augmentation
  - Would enable large scale deployment of off-grid projects

Therefore, ODGBDF Model is recommended for development of Policy & Regulatory Initiative.

REC for Off-Grid Generation

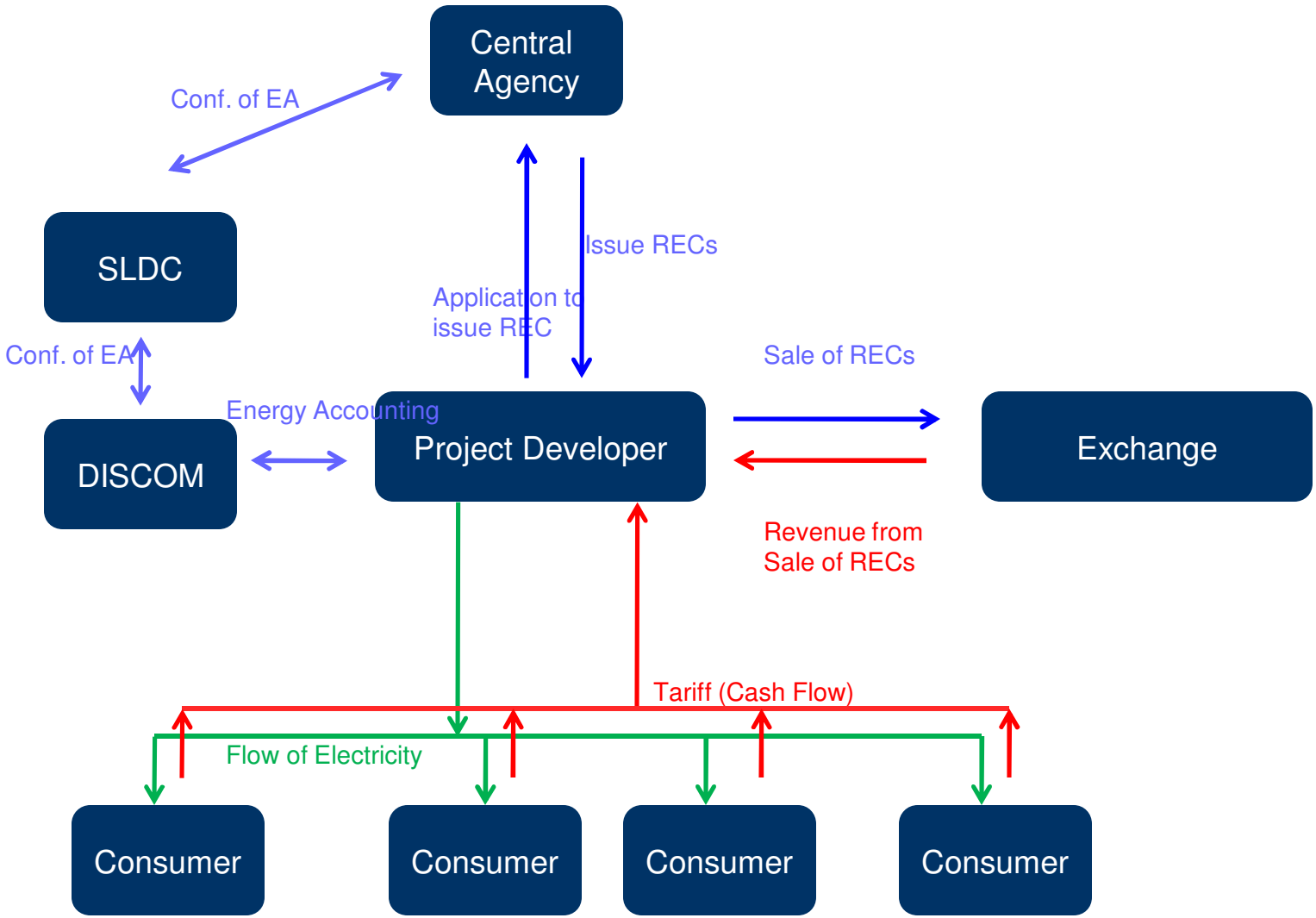
REC based Model 1/3

- In ODGBDF model, costs of rural electrification are socialized among all consumers of the distribution companies
- Distribution company may not be able to recover all costs through increase in tariffs
- Further, capability and political will at each DISCOM could be issue in implementation of ODGBDF
- At the same time, REC market has developed and thriving
- Hence, FOR suggested that option of developing DRE projects using REC mechanism may be explored.

REC for Off-Grid Generation

REC based Model

2/3



REC for Off-Grid Generation

- Can be a viable business model if
  - PD get sufficient benefit from sale of electricity to the consumer
  - And sale of RECs on the Exchange to recover all his
- Energy accounting to be carried out by DISCOM
  - Projects are very small in size,
  - Located at far off places connected at distribution voltage levels
  - Difficult for SLDC to do energy accounting at this level
- Need to develop Off grid REC regulations,
  - Regulations allow off-grid RE generators to receive RECs & sell on Exchange.

Purchase of RECs by obligated entities be allowed to meet compliance of RPO target

Way Forward

- In Oct 2011 meeting, FOR accepted recommendations
- Development of off grid regulations is under process
- A few issues are yet to be resolved

Subsequent slides presents the discussion points on key issues

Issues Involved

- Selection of Project Developer
- Enhancing Private Sector Participation
- Preferred mode of subsidy by Central / State Govt.
- Grid Integration of DRE Projects
- Mutually agreed tariff

Selection of Project Developer

- Who will select the project developer
  - PRIs (RLBs)
  - DISCOM
  - District Committees
  - State Nodal Agencies
- Competitive Bidding
  - Reverse Auction
  - Viability Gap Funding
- First come first serve basis
- What would be the selection criteria

Enhancing Private Sector Participation

- Reasons for no/little private sector participation
- Is proposed model adequate to address concerns of private sector?
- Preferred subsidy mechanisms
  - Capital subsidy from Government of India
  - Revenue subsidy
- Financing issues
  - Risk coverage for investment
  - Concessional debt

Preferred mode of Subsidy

- Capital Subsidy
  - Even with 90% subsidy, CoG higher than retail tariff
- Revenue subsidy

Issues:

- On what basis; technology, capex / O&M costs
- How much subsidy
- For how many years
- By whom; Central / State Govt., MNRE/MoP/any other
- To whom? Directly to DISCOM / PD

Grid Integration

- Distribution infrastructure standards for PD
- Utilization of infrastructure after extension of grid
- Compensation to PD on acquisition of grid infra
- Use of existing / separate distribution infrastructure
- Role of of DISCOM/PD in further development of distribution infrastructure
- Compensation to PD in case of non availability of grid

Mutually Agreed Tariff (Off-grid REC Model)

- Principles for determination of mutually agreed tariff
- Agreement b/w PD & each consumer or with VEC
  - Agreement for how may years
  - Different tariff for different consumers
- Dispute resolution mechanism
- Role of the regulator
- Status on extension of grid

REC Integration (Off-grid REC Model)

- Project viability using REC Revenue
- Process for integration of off-grid REC into market
- Ability of the developer to access REC market
- MRV of REC generation
- Role of the the regulator
- Status on extension of grid

ABPS Infrastructure Advisory

Practical Solutions to Real Life Problems

ABPS Infrastructure Advisory
A-309, Kohinoor City
Kirol Road, off LBS Marg
Kurla (West), Mumbai 400 070
Ph: +91 22 6124 0400/ 6124 0444
Fax:+91 22 6124 0499
Email: contact@abpsinfra.com