Eco-innovations through renewable energy based decentralised energy interventions in India

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Why focus on eco-innovations

- Thrust on ecologically sustainable growth paths
- However, economic development and environmental considerations are often conflicting and require some degree of trade off
- Eco-innovations – the Guardian knot

DRE systems as windows for eco-innovations

- Renewable energy based decentralised energy systems as a major window of opportunity for environmental innovations

- Establishes the required synergistic link in reducing environmental burdens and meeting aspirations of higher economic development

- Drivers – state of energy market liberalisation, degree of environmental awareness, and availability of fiscal and investment incentives

Objectives

- To identify the key determinants in the form of policies, regulations, market elements operating at different scales in driving such innovations

- To map the change of environmental behaviours of users as an outcome of these interventions through case study research

Frame of analysis

- Qualitative research method

- Two different methodological approaches followed
- Extensive desktop based survey
- Supplemented through case study research

Eco-innovations – theoretical insights

- Emphasis on sustainable oriented innovations – since the publication of Brundtland Report
- Environmental innovation is interpreted in terms of innovations in the form of new or modified processes, practices, systems, products which contribute to the environmental sustainability (Rennings, 2000).
- Ecological modernisation paradigm has been put forward by scholars like Janicke (2008) and Pataki (2009) to illustrate that environmental innovations generated positive environmental outcomes.
- Several other scholars advocated the notion of 'socio-technological systems' to explain how environmental innovations occur.

What drives eco-innovations

- Scholars of environmental economics advocate that it is essentially the well designed and well executed regulation which propels environmental innovations (Rennings, 2000).

- On the other hand resource based theory of the firm espouses role of internal factors as key drivers of environmental innovations (Green et al, 1994).

Some key characteristics of cases

	Donor agency funded & NGO led	Husk Power System(HPS)
Location	Dhenkanal, Odisha	Champaran, Bihar
Technology	Solar pv	biomass
Typology	Donor agency supported NGO led	Private entrepreneur led
Average size of the plant	4 – 6 kWp	25 -100 kWe
O & M structure	outsourced	Cluster based approach
Energy provision	2 X 2w led & a plug point for mobile charging	2 X 15w CFL & a plug point
Energy applications	Lighting and mobile phone charging	Lighting & mobile phone charging
Tariff	USD 1 per month	USD 2 per month

Major determinants

Overarching law– Electricity Act 2003

- Off-grid rural electrification and rural energy services received a renewed priority
- Section 4 : standalone systems to operate in rural areas
- Section 6: Government should strive to supply electricity to all areas and hamlets
- Section 14: licensee exemption for generation and distribution of electricity in rural areas

Policy framework for off-grid electrification

- Rural Electrification Policy 2006, inter alia, states

- *that villages & habitations where grid connectivity would not be feasible or not cost-effective , off-grid solutions based on standalone systems may be taken up.. (Para 3.2)*
- *Mandates subsidy benefits to be passed on to the end consumers*
- *Tariffs should be set through negotiation*

- Integrated Energy Policy 2006

- *Stresses on removal of misplaced incentives like incentives available to mega power projects*

Policy initiatives at the state level

State	Specific state policy	Relevant Policy Element
Arunachal Pradesh	*Small Hydro Power Policy, 2007*	- The policy categorizes 'Category III projects' as standalone projects, where projects with installed capacities of 100 kW can be developed for distributing power to the habitats without high tension systems.
Chhattisgarh	*Solar Policy 2012 – 17*	- The Policy lays emphasis on promoting solar based decentralized energy systems.
	Energy Policy of Chhattisgarh	- The policy says that villages located in remote tribal areas where conventional electricity is not possible, non-conventional sources of
Haryana	*Haryana Solar Power Policy 2014*	- The Policy lays emphasis on promoting small capacity solar power plants for captive use on decentralized mode. It also makes provision of providing necessary financial assistance for the same
Himachal Pradesh	*Policy on Small Hydro and Other Renewable Source of Energy, 2006*	- The policy speaks of providing decentralised energy supply for households, agriculture, industry, and commercial purposes in the remote and tribal areas
J & K	*Policy for Development of Micro-Mini Hydro Projects, 2011*	- The policy emphasizes that small micro-hydro projects can be offered as a a solution to the energy problems in remote and hilly areas where extension of grid system is un-economical or un-viable
Karnataka	*Solar Policy 2014-21*	- The policy encourages decentralised generation and distribution of energy where access to grid is difficult.
Madhya Pradesh	Policy for Implementation of Solar Power based Projects in	- The Policy lays special emphasis on promoting decentralised and off-grid solar applications, including hybrid systems as per guidelines issued by MNRE.
Rajasthan	*Rajasthan Solar Energy Policy, 2014*	- The policy gives specific focus on promoting and incentivizing decentralised and off-grid solar applications.
Uttarakhand	*Uttarakhand State Government Policy for Harnessing Renewable Energy Sources, 2008*	- The policy lays emphasis on providing decentralised energy supply to agriculture, industry, commercial, and household sector.

Market based drivers

- CDM benefits – e.g HPS has registered under the programme of activities scheme of UNFCCC

However, the challenge is basically to combine these projects in meaningful ways

- Smart grid systems introduced – in both the projects

Donor supported NGO led project- optimise the use of energy

HPS – monitor the performance of the plant

Environmental innovations manifested through change in energy behaviour

- Behavioural changes get reflected in multiple ways such as social awareness for clean production, environmentally consciousness, and environmentally sound products and services
- Donor agency led vis-à-vis HPS
- Greater environmental consciousness versus less environmental consciousness
- Largely due to level of participation

Conclusion

- Policy and legislative drivers – major macro drivers
- Market elements – more recent ones
- Behavioral changes – depends on delivery model and also some extent on type of technology

Thank You