



## **OASYS SOUTH ASIA Research Project**

### **Papers presented at conferences/workshops/ Seminars**

**Joining the Dots: Regulating Off-grid Renewable Energy Sector in India**

Gopal K Sarangi, TERI University

Debajit Palit, The Energy and Resources Institute, New Delhi, India

And

Arabinda Mishra, TERI University, New Delhi, India

AES-2012 "Energy Security and Development – the Changing Global Context", held at Indira Gandhi Institute of Development Research (IGIDR) during 25-27 October 2012.



## Abstract

Off-grid renewable energy systems have recently been brought to the lime light on the face of mounting environmental burdens and ever increasing energy access concerns. It has been reflected in the fast changing energy policy directions in many countries of the world including India with specific focus on decentralized and off-grid small scale renewable energy systems as an effective and efficient mechanism of energy supply. At international level, UN's enunciation of the year 2012 as 'International Year of Sustainable Energy for All' is a clear manifestation of such a shift in direction and focus. A crucial issue concerning operation and management of the sector is to build consensus in designing an appropriate regulatory and governance framework and regulatory incentive schemes for the sector. Given the paucity of regulatory directions and regulatory mandates combined with limited practical experience with the sector, new forms of regulatory mechanisms like self-regulatory schemes, technological standards, certification schemes, and technological designs and protocols have evolved over years. However, existing limited practical experience with the sector suggests that electricity regulators in India have dealt with the sector in a cautious manner so far. In this context, the paper makes an objective assessment of the existing regulatory framework governing off-grid/decentralised energy systems in India. In order to assess the existing regulatory regime governing these systems, an extensive review of literature constituting legal, legislative and regulatory aspects of such systems is carried out. Then the paper attempts to demarcate the regulatory boundary to appraise the scope of regulation in the sector. A regulatory construct is prepared to identify and locate regulatory vacuum with the current regulatory regime. The paper finally proposes some innovative regulatory mechanisms to streamline the off-grid energy development in India aiming at enhancing greater social welfare.

Key words: *Off-grid renewable energy system; regulation & governance; sustainability; India*

Acknowledgement: The work reported in this paper is funded by an EPSRC/ DfID research grant (EP/G063826/2) from the RCUK Energy Programme. The Energy Programme is a RCUK cross-council initiative led by EPSRC and contributed to by ESRC, NERC, BBSRC and STFC. The author gratefully acknowledges the funding support.

Disclaimers: The views presented here are those of the authors and do not necessarily represent the views of the institutions they are affiliated with or that of the funding agencies. The authors are solely responsible for remaining errors or omissions, if any.

## I. Introduction

Decentralised energy systems are favourably weighed on the face of growing realisation of environmental hazards of hitherto large scale centralised power systems combined with the urgency to provide access to a significant chunk of rural populace devoid of any form of modern energy. Unfortunately, ‘increasing returns of adoption’ to the centralised plants generates disincentives for the small scale projects to be taken up at the desired scale. It is argued that small scale electricity generation systems have gradually become ‘locked out’ from our economic, political, legal and social arena [1]. In addition, it is contended that these centralised supply systems have generated large scale inequities, external debts and irreversible environmental degradation and nurtured a culture of inertia and inefficiency [2, 3]. Moreover, multiple barriers like institutional and regulatory etc. operate at different scales with different intensities posing additional threats to the development of off-grid energy sector [4]. Nevertheless, there have been renewed interests shown recently in decentralised energy systems, *albeit*, in a patchy and sporadic manner in many parts of the world. New set of policies, programmes and schemes are being crafted, both at international and national levels, to realise the power generation potential of these small scale energy systems. While United Nation’s (UN) declaration of the year 2012 as ‘International Year of Sustainable Energy for All’ reinforces the commitment at the global level to address the problem of electricity access, several new and innovative policy initiatives have been undertaken in countries where access to energy continues to persist as major roadblock in meeting the overarching goals of the economy. To illustrate the point, India has been striving to address the problem of access to energy by devising new set of policies and programmes from time to time.

In this context, the paper makes an objective assessment of the existing regulatory framework governing the decentralised energy systems in India and identifies areas where additional regulatory schemes and incentive mechanisms could play critical roles. The paper finds that a sensibly crafted regulatory regime could positively enhance the public interest in technical, economic, social and environmental spheres. The paper starts by elaborating the policy and legislative landscape governing the sector. Section III presents the state of the sector and the set of challenges in the emerging context. Section IV appraises the need and scope of regulation for the sector, largely drawing from the scientific literature and empirical evidences. Existing piecemeal approach to regulation for the sector is discussed in the section V. Section VI identifies areas where additional doses of regulatory control and regulatory incentives could produce better societal outcomes and proposes mechanisms of introducing such regulatory schemes and incentive mechanisms. Final section offers concluding remarks.

## **II. Policies, programmes, and schemes governing off-grid renewable energy systems in India: a snapshot**

The need for policy and legislative support for the promotion of decentralised renewable energy systems in India has long been realised with the creation of a separate Ministry (initially named as Ministry of Non-conventional Energy Sources (MNES) and re-designated as Ministry of New and Renewable Energy (MNRE) in 2006) in 1992 with specific priority on promotion of non-conventional sources of energy. India became a harbinger among countries across world in creating an independent ministry for non-conventional energy. However, off-grid renewable energy sector received only a peripheral focus and characterised by sporadic and non-uniform pattern of development. Nevertheless, there were important policy enshrinements with specific thrust on decentralised renewable energy development in the country. In particular, two important pieces of policy developments need worth mentioning. Rural Electrification Supply Technology (REST) Mission 2002 with an objective of ‘Power for All by 2012’ was the first and foremost pioneering effort to focus on decentralised renewable energy systems in the country. Next important initiative was the Gokak Committee on Distributed Generation 2003. The Committee asserts that decentralised renewable energy systems should be used even in areas where grid connectivity exists for the effective management of rural power distribution. However, initiatives to promote off-grid rural electrification by using renewable energy sources were limited by any standard and in majority of cases combined with other rural developmental programmes [5].

Electricity Act 2003, in fact, was the first systematic attempt to bring back off-grid renewable energy to the forefront of discussion and reflects a coalesced thinking to mainstream the sector as an important part of the country’s energy portfolio. This has been articulated in many innovative provisions of the Act and in creating a series of supportive legislations as offshoots of the Act. The Act has specific emphasis on off-grid rural electrification through renewable energy sources. Section 4 of the Act specifically speaks of ‘stand-alone’ systems for rural electrification and utilising renewable or non-conventional sources of energy. Section 14 of the Act abolished the licensing requirements for generation and distribution of electricity in rural areas. The relevant portion of the Act says *“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”*.

Apart from the Act, there are several other policy pronouncements promulgated from time to time with changing needs and priorities. Important among them are Rural Electrification Policy 2006, Integrated Energy Policy 2006, National Electricity Policy 2006 etc. While a substantial part of each of the policies deals with the centralised power system development in the country, there are specific sections/elements cover aspects of off-grid renewable energy development. Even at the state level, elements of policy could be traced in state renewable energy policies [6].

## Joining the dots

Besides policies promoting off-grid energy systems in the country, there are a set of programmes which strive to mainstream the off-grid renewable energy systems in the country. One of the earliest programmes is the remote village electrification programme (RVE) of MNRE, Government of India. The programme has been continuing since 2005 and still operational. It has the provision of providing lighting facilities to rural areas through off-grid modalities. The programme is implemented with the financial assistance up to 90 % of the cost from MNRE. More than 7000 villages and about 2000 hamlets have been electrified through this programme by December 2011. Decentralised Distributed Generation (DDG) scheme of Ministry of Power (MoP) is another dedicated scheme, aiming at providing energy through off-grid energy facilities. The scheme is a part of the mega rural electrification programme i.e. RGGVY (Rajiv Gandhi Grameen Vidyutikaran Yojana) of MoP. The scheme gets financial support from the Government of India and has the provision of using both conventional as well as non-conventional sources of energy. Importantly, it emphasizes not only on providing lighting facilities to the off-grid localities rather it also envisages of creating some form of small scale productive activities through the provision of energy. Village Energy Security Programme (VESP) of MNRE is quite a recent initiative to provide complete energy requirements through standalone energy systems. As of now 79 test projects are under implementation and 65 test projects have already been commissioned. However, it has been decided to discontinue this scheme during 12<sup>th</sup> Plan Period (2012 – 2017) [7]. The most recent initiative in this direction is the Jawaharlal Nehru National Solar Mission (JNNSM). The scheme focuses on producing 2000 MW of off-grid power by 2022 by optimising available solar resources of the country. Under the off-grid solar scheme of JNNSM, 32826 solar lanterns, 26264 SHL, 18583 solar street lights, 76 water pumping systems and standalone SPV power plants have been installed so far [7]. The scheme operates within the institutional framework of RVE programme of MNRE.

### **III. Magnitude of the problem and challenge**

Despite efforts to address the problem of access to energy, it continues to prevail in many parts of the world. Notably, two important regions of the world i.e. South Asia and Sub-Saharan Africa pose serious threats in terms of lack of access to a large mass of rural population. International Energy Statistics reveal that about 1.4 billion people of the world are still deprived of any form of modern energy [8] and more people would be in the energy poverty trap in 2030 if current trends continue to persist [9].

India has been confronting this serious challenge of access to energy since long. Traditional emphasis on centralised electricity supply systems has not been able to effectively address this serious concern so far. For instance, it is argued that despite embarking on a large and ambitious programme of rural electrification like RGGVY, India continues to confront the problem of providing accessible, acceptable, affordable electricity [3]. The ambitious goal of ‘electricity by all 2012’ seems to be a far from reality given the current state of the sector. Recent statistics of MNRE indicate that about 11000 villages still do not have access to

## Joining the dots

modern form of electricity. Indian Census 2011 unfolds new evidences about the magnitude of the problem as well. The use of electricity in rural areas has been limited to only 55% rural households in rural India. More importantly, 43.2 % of rural households still rely on kerosene as their prime source of lighting. There is also a significant variation in the use of electricity across states in India. While in Lakhadeep, Daman and Diu, Chandigarh and Delhi, about 98 % of households use electricity, in states like Bihar, a meagre 10 % of households have access to electricity.

The problem gets compounded due to the lack of access to supportive infrastructure services in rural settings, existence of thin markets and poor infrastructure services in these remote rural locations. Even if off-grid solutions exist in some areas with no grid supply, lack of follow up and maintenance services complicate the situation and make these systems unsustainable over long run [10]. It is also contended that the country is yet to see off-grid renewable energy system as a viable option for electrifying remote off-grid areas, primarily due to barriers such as technical, financial, regulatory and institutional etc., operating at different scales [4, 10, 11]. Lack of proper organisational structures and institutional and regulatory arrangements has been the prime culprit behind failure of many off-grid projects despite they are financially viable [4].

Serious handicaps exist within the existing policy and legislative landscape governing the sector. There is a realisation within the policy circle that misplaced incentives like those available to mega power projects have yielded dampening effects on small scale decentralised energy projects, hence requires designing appropriate incentive mechanisms to boost the sector [12]). It is also contended that there exist several policy ambiguities and inadequacies to address the emerging challenges confronting the sector [6].

Another challenge emerges from the definitional ambiguities surrounding the concept of 'energy access'. The existing definition of energy access has been debated a lot in many quarters due to the inherent fallacy to capture true state of energy access. The moot question often asked is energy access at what level. What would be the benchmark of energy access? Pet approaches adopted to define energy access have not been adequately served the purpose. Even though, section 2 (63) of the EA 2003 spells out the definition of 'standalone system' as 'electricity systems setup to generate power and distribute electricity in the specified area without connection to the grid', it does not adequately capture the multi-dimensionality and multiplicity of approaches being practised in India.

## **IV. Appraising the need and scope of regulation in the sector**

The need for a regulatory framework for off-grid energy systems has been well appraised by several scholars in the field [1, 13, 14]. Even theoretical frameworks expounding the multi-dimensionality of small scale energy system development also favour a sort of control mechanism to regulate the wider economic and social performance of the system [13]. However, these scholarly propositions should be accepted with a caveat. While above

## Joining the dots

justifications offered by scholars emphasize on the need for regulation in developed economies of the world, developing economies confront quite a dissimilar version of the problem, therefore cannot apply the theoretical standings fitted for developed countries of the world. It merits mentioning here the definitional discrepancies of ‘what constitutes decentralised energy?’. While the definitional ambiguities related to ‘what constitutes decentralised energy?’ continue to prevail in developed economies of the world [1, 15, 16 ], it is more or less clear that decentralised generation systems are those which are connected to the distribution systems and involve all those issues related to interconnection with the local grid. However, in developing countries like India, and with reference to the specific objectives of this paper it is mostly connoted as ‘off-grid energy systems’ therefore poses different set of regulatory challenges.

The notion of regulation itself is contentious and possesses varied interpretations and meaning [17]. Regulation is often reckoned as participation by the government either directly or indirectly through government agencies or through independent bodies to influence decision making processes of individuals or business groups. This intervention may be purely due to economic reasons or may be owing to environmental or social concerns. Importantly, apart from conventional rationales of regulation i.e. market failure owing to presence of externalities and presence of monopolistic elements in a market, regulation often acts as a catalyst in enhancing broader societal welfare by reallocating and redistributing resources to the desired sections of the society [18]. There are two major strands defining regulation; while the narrow or technical conception of regulation emphasizes on the economic explanation of regulation with a focus on relationship between economic agents and economic outcomes in a principal agent framework, in a broader connotation, regulation is viewed in a larger setting where multiple actors and institutions are embedded in a wider social and political arena [19]. In the current context of the paper, our definition of regulation is more inclusive keeping in consideration of the inherent attributes of the sector and their features with specific reference to the Indian rural setting. Key regulatory requirements for the sector emerge from multiple sources and in multiple forms.

The need for regulation or some form of regulatory control also emerges from several recent developments being experienced in the sector. One of the interesting developments is related to gradual increase in the participation of private players in the field, *albeit* in varying forms i.e. pure privatisation, and public private partnership (PPP) forms etc. This has been spurred by accommodative provisions introduced through changes in legal and legislative spheres governing the sector. The change in the policy focus can be evident, when one critically examines the key goals of various policy pronouncements made from time to time. For instance, while the REST mission had a focus on rural co-operatives and non-governmental organisations for rural electrification through decentralised modes, recent off-grid electrification programmes like JNNSM has implicit mention of business communities as important players in the field. However, it has not been adequately appraised in policy circles about the regulatory consequences of such developments. Evidences suggest that PPP style of social enterprising models are gradually built into variety of decentralised renewable technical options ranging from solar home systems (SHS) to mini-grid centric off-grid energy

facilities in varying forms with differing intensities. These new developments throw multiple challenges including regulatory ones. Challenges confronted by the sector are in the form of creating appropriate mechanisms to monitor the sector, introducing incentive schemes for controlling the possible high rent extraction, ensuring minimum quality of supply etc. Without any regulatory control over private players, it is possible that the stated goals of the sector may be subverted. It is also suspected that gradual involvement of private actors in the field might dilute ethical and environmental considerations associated with project operation and management [20]. There are also studies carried out in Indian context justifying the need for effective regulatory mechanism in order to make the entrepreneurial spirit to flourish in the desired direction [11].

The need for some form of regulation is felt in terms of specifying standards and codes. The need for standards and specifications has also been reiterated by scholars in India. It is argued that since the thrust of off-grid system development in India is limited to techno-economic aspect there is a need to have clear specification of standards for different technologies [21, 10]. Contentions also run that absence of certification and monitoring of gasifier performances on the basis of specified standards and performance benchmarks pose serious threats to the sustainable development of off-grid energy system development [22].

Emphasis on creating an effective regulatory regime also emerges in the current scenario of grid-expansion in the country. It is estimated that on an average, about 250 km of distribution lines are being extended per day under the current RGGVY programme of Ministry of Power (MoP), Government of India. Therefore, in a long-run scenario, it would be obvious to believe that situations would emerge where the existing and future off-grid plants would be connected to the local distribution networks. It is logical therefore to conduct some ground work to address the future regulatory challenges that might emerge in the above context. Since, there are policy and regulatory uncertainties about such a futuristic scenario, it merits identifying possible regulatory threats and proposing the necessary solution. However, given the thrust of the paper, we are not touching this aspect in this paper.

### **V. Existing piecemeal regulatory dispensation: a stock taking exercise**

Given the key characteristics of the off-grid energy sector, and limited understanding of the sectoral operation and management, regulatory experience has also been in its nascent stage of development. Even though explicit regulatory control over off-grid energy systems has been limited in Indian context, however, it is also not true that off-grid energy sector is altogether free from any kind of regulatory purview. There are several instances where discreet and patchy forms of regulatory requirements impact the operation and management of off-grid energy systems in some way or the other. This section highlights the existing piecemeal approaches to regulate the sector.

#### **a. Direct regulatory requirements under different legislations**

## Joining the dots

One such area is related to the safety and security standards as specified in the Electricity Act 2003. Specific mention must be made about section 53 of the Act where provisions relating to safety and electricity supply are spelt out. It speaks of the role of authorities and respective state governments to take suitable measures to ensure that safety concerns relating to generation and distribution are taken care of.

In addition, Rural Electrification Policy in its clause 8.6 specifies that the benefits of financial assistance /subsidies by the government agencies or others must be fully passed on to the consumers. The role of appropriate commission here is to lay down guidelines for various projects (for different fuels, technology and sizes) receiving subsidy as opposed to tariff determination on case to case basis. Appropriate Commission has the right to scrutinize tariffs if such guidelines are contravened.

### **b. Indirect regulatory measures**

It must be mentioned here that some form regulatory control is imposed through various fiscal measures like taxes, duties imposed or waived by federal as well as provincial governments on renewable energy products and equipments from time to time. Taxes are used as feasible ways of inducing behavioural changes, thereby, often fulfilling the desired goals [23]. Specific mention must be made about the variety of subsidies offered to generate power through off-grid renewable energy sources. There are also incentives in the form of concessions on custom duties on renewable energy products and equipments, tax holidays, sales tax and electricity duty exemptions by provincial governments. The aim here is not to detail out the specific incentive structures and schemes, rather to highlight that these are also part of the broader regulatory domain surrounding the development of the sector.

### **c. Standard setting as a form of regulatory measure**

Standards are considered as vital elements in any regulatory regime. Standards in its most general form are reckoned with norms, goals, objectives, or rules around which regulatory regimes are constructed and designed. Standards in a regulatory regime can be set not only by state actors but also through non-state actors [24]. Standard setting is characterised by responsibility sharing at different scales and among different actors [25]. The approach to set standards through state and non-state actors is transforming the conventional regulatory governance regimes which are primarily centred on state actors [26]. Often regulatory standards are defined in very restrictive ways confining it to technical standards set at different scales i.e. international, national, regional and local agencies. However, broader conception of standard setting looks for an achievement of values, goals and outcomes. Design standards about particular technologies usages or performance standards are often conceived as command and control form of regulatory instruments in the literature. These standards are often widely used in contrast to the 'market based' instruments [27].

Technology specific standards and designs have been specified by different actors associated with the development of off-grid energy systems in the country. MNRE being the highest custodian in the promotion and development of off-grid renewable energy also has developed

## Joining the dots

technical standards and specifications for off-grid energy systems. For instance, technical specifications for CFL based solar lighting systems, solar street lighting systems, solar lantern systems are instances where MNRE has played critical role in setting standards. Broad technical specifications of water pumping wind mills and aero-generators have also been drawn up by MNRE. Further, to have control of manufacturers of small wind generators, type testing of aero-generators has been made mandatory as per international standards by MNRE.

Apart from an array of specifications by MNRE, there have been specifications imposed by state nodal agencies for renewable energy. For instance, Chhattisgarh Renewable Energy Development Authority (CREDA) has devised its own standards and specifications for projects funded by Chhattisgarh state government. Most of the specifications are spelt out by state nodal agencies while float the tendering documents for specific activities relating to project operation and management.

### **d. Emerging self-regulatory and co-regulatory processes**

While all pervading dominant form of regulation in the 20th century is one of the shift away from the 'self-regulation' to 'statutory regulation', there have been certain niche areas where self-regulation still forms the key apparatus for regulatory governance. The shift away from 'laissez faire' state to 'welfare state' and further to 'regulatory state' has redefined and reconfigured the role of state in managing the public resources of the country. Often 'self-regulation' is positioned in a continuum between 'no-regulation and classical 'statutory regulation'. In a self-regulation regime, the regulatory mechanisms are specified, administered, and enforced by regulated organisations. The process of self-regulation is a suitable alternative to the traditional mode of command and control regime of regulation. In a pure self-regulatory arrangement, industry retains discretion both over the shape and content of its internal systems. Self-regulation is often advocated where there exist weak institutional structures characterised by weak regulatory capacity and inadequate resources to craft sound regulatory regimes for complex and heterogeneous industries [28]. Judging self-regulatory arrangement is crucial in order to ensure that the process of self-regulation is producing desirable outcomes. It is important to gauge how regulatory arrangements are used to meet their public interest obligations and duties. Mechanisms of monitoring and performance arrangement of self-regulatory entities also hold important. Moving beyond self-regulation and close to statutory regulation is called 'co-regulation' which is often perceived as a combination of self-regulation and classical statutory regulation.

Elements of self-regulation and co-regulation could be traced in the operation and management of off-grid energy systems in India on the face of growing enthusiasm among private players in the field. While these entities operate within the broader mandate provided by central and provincial authorities, over time there have been lot of self-regulatory practices, codes evolved to regulate certain aspects of their business activity. For instance, mandatory training programmes for operators, routine maintenances, sharing knowledge about energy efficiency and energy conservation, safety protocols are areas where evolving practices are emerged as self-regulatory practices in the absence of formalised regulatory schemes.

## **VI. Regulatory vacuum and suggested mechanisms**

Having elaborated the existing regulatory control over the off-grid electricity system, it merits discussing the areas where further regulatory control could produce desirable outputs in the above line of discussion. There are several areas where further regulatory control is required to produce optimum societal benefits.

### **a. Regulating varied forms of ownership structures**

Ownership structures of off-grid energy systems vary substantially across projects. Broad categorisation could be, projects owned by state nodal agencies, projects owned by private enterprisers, projects owned by NGOs, and projects owned by communities. While varied ownership structures are premised on certain logic and dependent on programme objectives, there should be a set of informal guidelines for each of the varieties taking into consideration the key characteristics of the ownership structures. State nodal agencies or state regulatory agencies should come up with such guidelines and should devise ways of monitoring them from time to time.

### **b. Regulating tariffs**

In most of the cases, tariffs charged by off-grid project developers are based on flat rates. A simple calculation can tell you that tariffs charged by the suppliers are many times higher than their grid counterparts [29]. While private initiative is definitely a welcome movement in the sector, there should be some form of control on the tariffs charged by private business enterprisers. Private players sans any regulatory control could lead to high rent extraction and could create additional financial hardships for the people who are burdened with high tariffs.

There should be an upper bound placed on maximum unit prices for different technologies to have at least a minimum control over the prices. Even though, there are indirect ceilings on prices in terms of electricity supplied through grid based systems by the nearby discoms, this may not be adequate to impose the necessary control.

### **c. Regulating quality of supply**

Similarly, ceilings should be placed on the identified parameters of service quality in order to ensure that a minimum level of service is provided to the beneficiaries. At least, an informal guideline should be provided to the project developers which would specify the minimum quality required. Since quality monitoring is difficult, given the nature of the problem, there is a need to specify codes, standards and certifications relating to service quality to address the quality issue. Though, quality issues are some extent addressed through technical standard specification, appropriate monitoring should be made to ensure that the specifications and standards are met by the project developers.

Table 1 spells out the areas requiring additional regulatory control and necessary actions.

<b>Areas requiring additional regulatory control</b>	<b>Required regulatory actions</b>
Diversified ownership structures	Informal guidelines for each of the key varieties.
Tariff structure	Setting floor and forbearance price for specific technology/size.
Pollution monitoring	Should be assigned to state pollution control authority
Technical approaches like electricity network designs and codes	Specific standards should be set by state nodal agencies/MNRE.
Quality regulation	Appropriate codes, standards and certifications should be set by nodal agencies/regulatory agencies/MNRE

**Table 1: Regulatory vacuum and required actions**

## **VII. Conclusion**

Bringing off-grid electricity sector into the existing regulatory domain is often challenging. It is argued that it has been a deliberate and conscious decision by the existing regulatory community not to touch the off-grid energy sector[30]. Given the institutional capability of the electricity regulators in the country; additional regulatory burden will further compound the problem. Instead of creating a whole new set of regulatory structure, at best, a set of informal guidelines with adequate amount of flexibility could better serve the purpose. However, the key is to institutionalise a proper monitoring mechanism to act as watchdog for the sector. In addition, if necessity arises then a regulatory regime with light-handed and simplified regulatory scheme could be introduced.

The results suggest that contrast to the widely prevailing perception, the sector operates under different forms of regulatory controls. There are several direct and indirect control mechanisms in terms of taxes, duties, standards, certifications and self-regulatory codes and practices impacting the operation and maintenance of projects. However, the existing piecemeal dispensation to regulation needs to be supplemented through additional regulatory doses particularly in the areas of tariffs, quality control and ownership structures.

## **Reference**

[1]Woodman, Bridget and Baker, Philip (2008) ‘Regulatory Frameworks for Decentralized Energy’, *Energy Policy*, 36, 4527-4531.

## Joining the dots

- [2] Hiremath, R.B., Kumar, B., Balachandra, P., Ravindranath, N.H., and Raghunandan, B.N. (2009) 'Decentralised Renewable Energy: Scope, Relevance and Applications in the Indian Context', *Energy for Sustainable Development*, 13, 3-9.
- [3] Greenpeace India (2011) "Failed Aspirations: an Inside View of RGGVY", *Greenpeace India Society*, 2011.
- [4] Cust, James, Singh, A., and Neuhoffm K., (2007) 'Rural Electrification in India: Economic and Institutional Aspects of Renewables', *EPRG 0730 and CWPE 0763*.
- [5] Bhattacharyya, S. (2006) "Energy Access Problem of the Poor in India: Is Rural Electrification a Remedy? *Energy Policy*, 34, 3387-3397.
- [6] Mishra, A & Sarangi, G.K. (2011) "Off-grid Energy Development in India: An Approach towards Sustainability", *OASYS Working Paper*, No 13.
- [7] MNRE (2012) "Annual Report 2011-12", Ministry of New and Renewable Energy, Government of India.
- [8] IEA (2010) "World Energy Outlook 2010", International Energy Agency: Paris.
- [9] IEA (2009) "Energy poverty? How to Make Modern Energy Access Universal", OECD/IEA.
- [10] Chaurey, A., Ranganathan, M., and Mohanty, P., (2004) 'Electricity Access for Geographically Disadvantaged Rural Communities – Technology and Policy Insights, *Energy Policy*, 32, 1693-1705.
- [11] Radulovic, V., (2005) 'Are New Institutional Economics Enough? Promoting Photovoltaics in India's Agricultural Sector', *Energy Policy*, 33, 1883-1899.
- [12] Planning Commission (2006) "Integrated Energy Policy 2006", Planning Commission, Government of India.
- [13] Sauter, Raphael and Watson, Jim (2007) 'Micro-Generation: A Disruptive Innovation for the UK Energy System? In Joseph Murphy (Ed.) 'Governing Technology for Sustainability', Earth-scan Publication, UK.
- [14] Cossent, R., Gomez, T., Frias, P. (2009) "Towards a Future with Large Penetration of Distributed Generation: Is the Current Regulation of Electricity Distribution Ready? Regulatory Recommendations under a European Perspective", *Energy Policy*, 37 (3), 1145-1155.
- [15] Ackerman, T., Andersson, G., Soder, L., (2001) "Distributed Generation: a Definition" *Electric Power Systems Research*, 57 (3), 195-204.
- [16] Pepermans, G., Driesen, J. Haeseldonckx, D., Belmans, R., D'Haeseleer, W., (2005) "Distributed Generation: Definition, Benefits and Issues, *Energy Policy*, 33 (6), 787 – 798.

## Joining the dots

- [17] Minogue, Martin (2010) “Regulatory Governance: Principles, Practice and Applications to Off-grid Electricity Services”, *OASYS Working Paper*, No. 6.
- [18] Posner, R.A. (1971) “Taxation by Regulation”, *Bell Journal of Economics*, The Rand Corporation, Vol. 2 (1), Pages 22-50. Spring.
- [19] Ogus, A. “Comparing Regulatory Systems : Institutions, Processes and Legal Forms in Industrialised Countries” In *Leading Issues in Competition, Regulation and Development*, ed. Cook, P., Kirkpatrick, C. Minogue, M., Parker, D., 146-164. Edward Elgar, 2004.
- [20] Ilskog, Elisabeth & Kjellstrom, Bjorn (2008) “And then they live Sustainably Even After? – Assessment of Rural Electrification Cases by Means of Indicators”, *Energy Policy* 36 92008) 26-74 – 2684.
- [21] Kumar, A., Mohanty, P., Palit, D., and Chaurey, A., (2009) “Approach for Standardisation of Off-grid Electrification Projects”, *Renewable and Sustainable Energy Reviews*, 13, 1546-1556.
- [22] Ghosh, D, Sagar, A.D., and Kishore, V.V.N. (2006) “Scaling up Biomass Gasifier use: An Application-Specific Approach”, *Energy Policy*, 34, 1566-1582.
- [23] Ogus, A. (1998) “Corrective Taxes and Financial Impositions as Regulatory Instruments”, *Modern Law Review*, Vol.61, No.6.
- [24] Scott, C. (2010) “Standard Setting in Regulatory Regimes”, In *Oxford Handbook of Regulation*, ed. Baldwin, R., Cave, M., Lodge, M., Oxford University Publication, 2010.
- [25] Haufler, V. (2001) “A Public Role for the Private Sector: Industry Self-Regulation in a Global Economy”, Washington, DC: Carnegie Endowment for International Peace.
- [26] Kerwer, D. (2005) “Rules that Many Use: Standards and Global Regulation”, *Governance*, 18: 611-32.
- [27] Keohane, N. O., Revesz, R.L., Stavins, R.N., (1998) “Choice of Regulatory Instruments in Environmental Policy”, *Harvard Law Review*, Vol. 22, pp.313-367.
- [28] Coglianese, C. and Mendelson, E., (2010) “Meta- Regulation and Self-regulation”, In *Oxford Handbook of Regulation*, ed. Baldwin, R., Cave, M., Lodge, M., Oxford University Publication, 2010.
- [29] Palit, D., Malahotra, R., Kumar, A., (2011) “Sustainable Model for Financial Viability of Decentralised Biomass Gasifier Based Power Projects”, *Energy Policy*, 39, 4893-1901.
- [30] OASYS (2012) “Workshop on Off-grid Access System in South Asia”, *OASYS Workshop Proceedings*, January 2012.

## Joining the dots



## OASYS South Asia project

The Off-grid Access Systems for South Asia (or OASYS South Asia) is a research project funded by the Engineering and Physical Sciences Research Council of UK and the Department for International Development, UK. This research is investigating off-grid electrification in South Asia from a multi-dimensional perspective, considering techno-economic, governance, socio-political and environmental dimensions. A consortium of universities and research institutes led by De Montfort University (originally by University of Dundee until end of August 2012) is carrying out this research. The partner teams include Edinburgh Napier University, University of Manchester, the Energy and Resources Institute (TERI) and TERI University (India).

The project has carried out a detailed review of status of off-grid electrification in the region and around the world. It has also considered the financial challenges, participatory models and governance issues. Based on these, an edited book titled “Rural Electrification through Decentralised Off-grid Systems in Developing Countries” was published in 2013 (Springer-Verlag, UK). As opposed to individual systems for off-grid electrification, such as solar home systems, the research under this project is focusing on enabling income generating activities through electrification and accordingly, investing decentralised mini-grids as a solution. Various local level solutions for the region have been looked into, including husk-based power, micro-hydro, solar PV-based mini-grids and hybrid systems. The project is also carrying out demonstration projects using alternative business models (community-based, private led and local government led) and technologies to develop a better understanding of the challenges. It is also looking at replication and scale-up challenges and options and will provide policy recommendations based on the research.

More details about the project and its outputs can be obtained from [www.oasyssouthasia.dmu.ac.uk](http://www.oasyssouthasia.dmu.ac.uk) or by contacting the principal investigator Prof. Subhes Bhattacharyya ([subhesb@dmu.ac.uk](mailto:subhesb@dmu.ac.uk)).

OASYS South Asia Project  
Institute of Energy and Sustainable Development,  
De Montfort University,  
The Gateway, Leicester LE1 9BH, UK

Tel: 44(0) 116 257 7975