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Accelerating access to energy services: Way forward

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Abstract
As nearly a fifth of the world's population still lives without access to electricity and double that number with no access to modern cooking technologies, both public and private sector players have invested resources in developing infrastructure to address this energy gap. While there have been exceptional cases like China, Vietnam and Brazil, where the public sector led grid expansion achieved incredible gains in expanding access as to electricity, the general trend over the years in most developing countries has demonstrated that both public and private led approaches have been unsuccessful in independently yielding the desired acceleration and continuity to deliver universal energy access. Despite the inherent benefits of both public and private sector led initiatives, typical systemic inefficiencies and inadequate capacities in both approaches prevent them from fully addressing the principal objective of facilitating energy access for the poor in the long term. Also, even if required investments were adequately capitalized, with the current population growth rate continually outpacing the rate of interventions, the number of people who remained energy poor 15 years hence, would still be the same. Thus, not only is there is a need for providing energy access to the existing population mass, but an equal need to do it fast enough to truly reduce the number of energy poor across the globe. An alternative approach therefore needs to be explored that juxtaposes the social welfare objectives of public sector led initiatives with the enterprise development and growth objectives of the private sector, to support the creation of an enabling ecosystem and a viable value chain that successfully and effectively delivers energy solutions to the last mile. Such a pro-poor hybrid model will essentially address the inefficiencies and inadequacies of both public and private approaches and capitalize on their strengths through a complementary mix of social and commercial goals. The model facilitates collaborations at the corporate, institutional and individual levels to drive individual parts of a unified energy provisioning system, making it adaptable, dynamic, flexible and maneuverable within structures, relationships and entities. Policy level support and accompanying regulatory frameworks are critical for clear role definitions, proper planning and execution.

Keywords: energy access public sector driven private sector driven energy economy hybrid model public private partnership

1. Introduction

The implications of energy poverty are profound, as the lack of reliable energy access leads to decreased life expectancy, increased rates of infant mortality and environmental problems – directly linking with key global challenges of poverty alleviation, climate change, and global, environmental and food security (UNIDO, 2008, Barter, 2014) [3]. As current energy systems fail to meet the needs of the world's poor, they enormously constrain human and economic development. Despite the global upturn in the efforts towards reducing the energy access gap, nearly 20% of the world's population (1.3 billion) still lives without access to electricity, depending on kerosene as their primary source of lighting; and 40% (2.6 billion) lives without access to modern cooking technologies, relying on traditional biomass alternatives like wood, charcoal, agricultural waste and animal dung (IEA, 2013).

The primary drivers for pushing energy access in most developing countries have been public sector driven grid expansions and making available subsidised fuels, technologies and electricity to deprived communities. Huge public sector capital investment and high level of consumer subsidies have been the bedrock of energy provisioning efforts. The fossil fuel subsidy rate in South Asia, most of Latin America and large parts of northern Africa are in the range of 50%–93% (IEA, 2013). Consequently, national programmes focussing on infrastructure establishment and target oriented subsidy based dissemination of fuels and technologies have been the key vehicles for expanding access to energy.

In recent years however, there have been concerns related to the efficacy of subsidy based efforts and the need to move to commercial or market driven energy delivery systems. The need for increasing levels of investments and the imperative of pushing universal energy access through multi-stakeholder partnerships have also demanded an increase in private sector participation.

Both, the public and private sector approaches have been strongly advocated and have contributed to taking forward the energy agenda. In recent years the emphasis has tended to shift towards private sector driven energy provisioning although the bulk of basic energy provisioning for rural communities is still being driven by the public sector. We discuss here the imperatives of both the public and private sector approaches to meet universal energy access targets.

2. Shortcomings of current approaches

2.1. Subsidy-driven paradigm

Despite provisioning of subsidized energy being the dominant paradigm in public sector aided energy access programs, there is a wealth of literature that point to its failings in achieving its goals. Subsidies tend to get misdirected or misappropriated in the

absence of strict monitoring. For instance, a study in rural Zimbabwe observed that subsidies were inefficient, failing to make energy affordable for the poor (Dube, 2003) [14]. On the other hand, in some cases, the benefits of subsidies are significantly higher for the non-poor households than the poor households (Kebede, 2006). Gangopadhyay *et al*. (2005) [16] noted that removing subsidies will affect affluent households the most, and poor households the least. In essence the subsidies may worsen the deprivation of poor for whom they are intended, particularly if they are misdirected, misused and misappropriated as is the case in subsidisation of kerosene and LPG in India. It has been observed that subsidies economically devalue products for both the sellers and the buyers, sending wrong price signals to the market (Rotenberg, 2006). Energy subsidies can lead to market distortions resulting from infrastructural and institutional deficiencies (Bazilian and Onyeji, 2012) [5], and may have negative impacts on markets when reduced or removed. If subsidies benefit only a selected group of suppliers, the market tends to be monopolistic, disfavouring suppliers who cannot avail of the subsidy (Corden, 1967) [12]. Consequently, some private players are inhibited from entering the market due to lack of willingness to pay for the actual cost of the service (Vine, 2005). Attending to recurring maintenance requirements and having the managerial and technical skills to operate energy delivery systems is essential for their long-term sustainability. However, development assistance to the energy sector has been mainly directed towards fixed capital assets, with comparatively small amounts earmarked for maintenance and capacity building (Kozloff and Shobowale, 1994).

Once started, the volume of subsidies grows year after year, unless unchecked by robust governance mechanisms. Problems like electricity leakage due to unmetered supply, theft of power and rise in consumer size contribute to a progressive increase in subsidies year after year (Bhattacharyya, 2012). Top-down subsidies to grid-connected electricity has also imposed severe restrictions on popularization of rural off-grid electrification, which are mainly operated at the level of the village community by local institutions (Palit and Chaurey, 2011) [11].

2.2. Market-led paradigm

The intended benefits of bringing in efficiencies and promoting sustainability through private participation for energy access often gets defeated due to efforts to increase profit margins through tariff enhancement and focusing on areas that provide quick and high returns. Consequently, governments have had to suppress arbitrary increases by strict regulation to keep electricity affordable on the principle that supply of electricity was an essential social service (Haanyika, 2006), limiting further investments by private entities. As commercial or privatized utilities focus on profits, they tend to be less interested in supply of electricity to non-profitable rural areas (Kessides, 2004). Provision of electricity in rural areas would be most beneficial when there is adequate physical and social infrastructure to make best use of the available power (WEC, 1999). However, in most cases, private players are compelled by governments to engage in rural electrification on political or equity considerations without focusing on basic infrastructure for power generation and distribution, rendering the projects unsustainable in the long run (Haanyika, 2006). Some of the other barriers to rural electrification in developing countries by private companies include limited financing, high cost of distribution, poor demand and over-dependence on public funds for meeting the cost of capital (Ramasedi and Ranganathan, 1992). Decentralized and renewable energy projects have long gestation periods with low returns on investments, making investments in such technology viable only for large corporations (Bhattacharya and Kojima, 2012) [7]. Large initial investments in infrastructure, manpower and technology limit the role of small and medium private enterprises, unless there is provision of low-risk finance or financial support.

Private entrepreneurship in rural areas has also emerged as a bottom-up approach to commercialization of energy service provisioning. However, the track record of such enterprises to manage business viably and provide efficient after-sales service has been dismal due to a variety of resource and capacity limitations. Examples from Zimbabwe (Mulugetta *et al*., 2000), South Africa (Karottki and Banks, 2000), Bangladesh (Barua, 2000) [3] and Sri Lanka (Gunaratne, 1994) of such enterprises demonstrate how such enterprises collapse due to lack of external support, low profit margins, poor technical skills, lack of finance and poor infrastructure.

3. Transitioning to hybrid models

As seen from the discussion above, both subsidy-driven and commercial paradigms of improving rural energy access have systemic inefficiencies, capacity inadequacies and divergence in results from the overarching goals of facilitating energy access for the poor. At the same time, each paradigm has inherent benefits which may be lacking in the other. The inadequacy of either paradigm to address energy access challenges demands alternative strategies and approaches. Ideally, such strategies should capitalize on the benefits of both subsidy-driven and commercial approaches, through a provident mix of social welfare and commercial viability goals.

Recent literature has pointed to public-private partnerships for expanding energy access in developing nations (Sovacool, Expanding renewable energy access with pro-poor public private partnerships in the developing world 2013) (Mukherjee, 2005, Tumiwa and Rambitan, 2009). Loosely defined, public-private partnership (PPP) is a "cooperative institutional arrangement between public and private sector actors" to achieve a common goal, without compromising on personal goals (Hodge and Greve, 2007). In PPP related to infrastructure projects, the public role is generally limited to sponsorship of finance while the private sector is responsible for building and operating the infrastructure (Dewatripont and Legros, 2005) [13]. Examples of such partnerships are evidenced by 'build–operate–transfer' and 'build–own–operate–transfer' models of PPP commonly seen in energy and infrastructure projects (ADB, 2007) [1]. Hart (2003) states that inefficiencies in PPP projects get exacerbated by conflicts between "quality improvement" motives of the public sponsor and the "cost saving" motives of the private partner, leading to information asymmetry, adverse selection and moral hazards. The success of PPP projects largely depends on the private partner's capacity to internalize life-cycle costs and generate returns from investment (Bennett and Iossa, 2006) [6]. Even while quality considerations are of paramount importance in delivery of energy services, public-private partnerships may constrain dynamism between social-welfare mandate of public partners and profitability considerations of private actors due to

enforcement of strict contracts. Delivering quality energy services to the poor may require trade-offs between public and private actor goals, without distorting the relationship equilibrium, and building transparency across partnerships can significantly minimize transaction costs associated with different public private partnership activities.

This necessitates rethinking of the relationships between diverse public and private, and market and non-market actors in energy access programs. Such relationships should try to synchronize and synergize performance-driven operations of private sector players with the funding support and social-welfare mandates of donor agencies and NGOs. The approaches for 'hybridizing' commercial and social objectives have service quality as its core strength, but with a fair amount of flexibility to innovate in terms of the product, service or business relationships. Hybrid business models have to align themselves to the specific circumstances (social, economic, geographical and cultural) of the markets in which they operate.

4. Designing pro-poor hybrid models

The hybrid business model essentially seeks to combine different aspects of the social and commercial approaches in order to maximise effectiveness and efficiency through the involvement of several entities owning and operating different parts of the system, while at the same time providing flexibility and maneuverability within structures, relationships and entities.

4.1. Economic dynamism

Even though underlying objectives of commercial and non-commercial players may remain constant, there is no barrier or restriction on the economic distribution between the two. What this translates to is, that based on the nature and size of players in the commercial-social mix, the investment contributions remain flexible and change in response to the dynamics of the market and value chain. For instance Lighting a Billion Lives programme of The Energy and Resources Institute that focuses on bringing solar photo voltaic based lighting solutions to energy deprived households was initiated mainly as a grant led initiative wherein 90% capital subsidy was provided to village entrepreneurs to provide fee for service based lighting solutions. Over the years the programme brought in multi stakeholder participation for both the grants portion and the equity component. The programme leveraged government subsidy, corporate social responsibility, citizen contributions to mobilise financial resources to meet part of the capital cost that the entrepreneurs were not in a position to share. The participation of large scale manufacturers, local level entrepreneurs, and financial institutions ensured development of a market value chain to deliver technologies and services to the rural households. Over the years the general trend in the programme shifted from 90:10 grant: equity model to a 60:30:10 grant: equity: debt model. However, the uniqueness of the model was that several grant: equity: debt ratios, depending upon the social economic and geographical context, co-exist with varying levels of participation of multiple stakeholders including government, corporations, civil society organisations on the social side and manufacturer, local entrepreneurs, financial institutions representing the commercial side (Chaurey and Kandpal, 2009, Chaurey *et al*., 2012) [10, 11].

4.2. Information dissemination

Lack of information is a significant non-financial barrier for acceptance of rural energy technologies. For instance, many rural households using traditional stoves may not be aware of the benefits of adopting an improved cookstove. Consequently, this limits their interest in purchasing an improved cookstove (Lewis and Pattanayak, 2012). Access to information and to training is therefore fundamental to ensure long-term program success. Many stakeholders involved in the off-grid rural electrification project chains do not know how to deal with renewable energies, or may not be used to obtaining and paying for electricity. Hence, education, trainings and information about the benefits of access to energy and of renewables are necessary prior to any project. Civil society organisations have a critical role to play in generating awareness among members of the community which are normally marginalized or ignored by conventional communication channels. In the case of pure market actors, the costs of effectively communicating a message about the benefits can be a difficult barrier to overcome.

4.3. Supporting research and development

Research and development (R&D) is the driving force behind innovation and monitoring of new technological and commercial solutions to energy challenges, which are a crucial and inherent part of hybrid model. This includes specific programs focusing on developing and tailoring products and services for low-income markets, reassessing priorities enabling rapid dissemination of research outcomes, as well as development of new technologies that have applicability in energy access (WBCSD, 2012). This may also include the development of a mechanism for linking and financing basic R&D to applied R&D, both public and private (UNIDO, 2009). This will not only juxtapose social and commercial objectives but will also keep a steady view on the scientific side of solution and technology developments. Further, it will enable interventions to widen their impact by considering environmental, social and development objectives as well.

Innovation can be a driver to help overcome a number of the barriers and challenges in providing affordable energy services to poor consumers profitably and at scale. The variety of innovations for energy access may rely on a range of collaborations and partnerships to develop, produce, distribute and maintain products and services (WBCSD, 2012). Delivery of technology to the 'bottom of the pyramid' population requires imagination in designing institutional models that ensure inclusion of even the socially and economically marginalized sections of the society. Similarly, energy access programs can be strategized in a manner that facilitates business development and social inclusion simultaneously.

Undercutting the end-to-end design of any hybrid model, an accountability framework is crucial and must be built in to enable appropriate governance and check.

5. Conclusions and policy recommendations

Well-designed and stable policies are critical to facilitate multi stakeholder participation in the energy sector and the expansion of access to energy. Policymakers need to focus on prioritizing energy access in national development planning, improving the investment climate and implementing enabling measures to promote the primary energy access solutions (Brew-Hammond, 2010, Pachauri *et al*., 2012) [9].

Governments need to formulate clear and stable policy and regulatory frameworks that elucidate their political priorities in relation to main grid extension vs. mini-grid electrification (Jamasb, 2002). Given the long-term investment perspective needed to develop mini grid projects, private investors' involvement may be deterred if they are not assured that schemes will not be superseded by connection to the national grid—therefore, policymakers need to focus on improving the investment climate and implementing enabling measures to promote primary energy access solutions. They also must define tariff structures that balance the financial sustainability of the sector on the one hand and the consumers' well-being and willingness to pay on the other hand. Tariffs should cover the entire running costs and generate revenues to ensure the operation of the system through its lifetime (SE4All Energy Access Committee, 2014).

5.1. Facilitating demand creation through viability gap funding/subsidies/loans

Energy enterprises will sustain in a market that not only has demand but also the capacity to pay. While the target population may have a need and therefore an associated demand for clean lighting and cooking solutions, there is an affordability gap that inhibits the market to fully develop and operate in a continued manner (Riley, 2014, Fankhauser and Tepic, 2007) [15]. Bringing in financial support in the form of viability gap funding, subsidies and loans by tapping into socially driven government programmes and corporate social responsibility initiatives, it is possible to reach out to the poor consumer and shift the cost burden to a third party. This will support the overall existence of a market by making the solution affordable to the end user and creating opportunities for profit making (Sovacool and Saunders, 2014, Ailawadi and Bhattacharyya, 2006) [2].

5.2. Facilitating the development of cross sectoral synergies to promote clean energy solutions

Energy is a pivotal input for overall social and economic development, having observed linkages with sectors of human development such as health, livelihood, education and gender. Emphasising on the role of energy in each of these sectors will help in bringing together a multitude of institutions and agencies working on different sectors of human development together. While multiple institutions and agencies can draw benefits from energy access initiatives, their individual mandates may also be met at the same time.

5.3. Creating market value chains involving local enterprise

Involving enterprise at the village and local level will support the development of a robust energy access value chain by strengthening business relationships, improving market structures. A local enterprise is the best positioned entity to understand the exact nature of end user demand that is crucial for the development and adaptation of the other elements contributing to the value chain (Porter and Kramer, 2011). Assisting the development of local micro and small enterprises also helps overcome constraints of poor market access and low bargaining power. Hence, privatization of the energy value chain should not disregard local micro-enterprises, who are critical for long-term stability of the market ecosystem (Jolly *et al*., 2012). The principle of 'shared value', which involves creating economic value in a way that also creates value for society by addressing its needs and challenges is one of the most important considerations that need to be taken into account in the entrepreneurial energy delivery model.

5.4. Technology development and customization

Technology customization to suit market needs is essential for developing viable business models. For example, in the area of clean cooking, due to geographic and cultural disparities, it is not possible to have a universal improved cookstove solution that equally addresses and satisfies the need of all end user categories (Lewis and Pattanayak, 2012). Hence, customization of technology that takes into consideration local user behaviour, affordability and user preferences is important for designing successful programs for dissemination of energy products.

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