

Chapter 10

Integrating the Social Dimension into New Business Models for Energy Access

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Abstract In the last decades, the issue of energy access has attracted increasing attention from both academic and practitioners and the debate has gone beyond purely technical issues, raising the interest of the public opinion and private citizens. Particular attention has been given to the question: how private and public organizations can ensure energy access to everybody? From this perspective, this Chapter aims to analyze and discuss three cases of social proactive organizations in the energy sector in order to highlight how they have succeeded in combining social values with environmental and financial sustainability. New business models aiming at reaching low-income communities with efficient and sustainable energy systems should take into account all social aspects linked to the energy supply chain from production, distribution to final use and ensure the active participation of local communities. This ensures that energy access initiatives lead to effective results in terms of industrial and manufacturing activities but also contribute to improve health, education and livelihoods.

Beyond the Technical Dimension

Within the global debate on access to energy for all it is more and more recognized that the role of technologies, though central, may not be the only focus.

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From this perspective, current business models have shown some drawbacks and limitations. On the one hand, the recent economic crisis has underlined the critical weaknesses of the current economic system in answering to the interdependency principles and social problems of global development [1]. In addition, for-profit organizations have been increasingly recognizing that, to survive and succeed, they cannot focus only on short-term profits, but they need also to consider their contribution to environmental and social sustainability. They have started to gradually acknowledge the existence of a potential synergy between “sustainability, social responsibility” and “profitability” whereby the improvement of environmental and social performances can become a potential source of competitive advantage [2–4]. On the other hand, local and foreign policies, organizations and multilateral institutions have struggled to provide concrete responses to the urgency of providing access to basic services, create systems with active participation of all stakeholders, create stable employment and enable the integration of disadvantaged people [5]. At the same time, non-profit organizations and non-governmental organizations (NGOs) are increasingly aware of the relevance to ensure the financial sustainability of their projects and initiatives in order to be able to meet unsolved social problems [6].

From this perspective, the energy sector is a very sensitive field. First of all, it is characterized by contrasting opportunities and challenges in term of environmental and social impacts. From a technological standpoint, the choice of sources that can be used for energy conversion or power generation may lead, as discussed in other chapters of the book, to different levels of impact on the environmental and social development (i.e. human development, access to services, job creation). Secondly, the sector is characterized by the presence of different types of organizations engaged in the supply chain: large multinational companies, public and private utilities, small and medium enterprises, NGOs, non-profit organizations, social enterprises and community associations.

Ensuring Social Sustainability

The origin of the concept of business model is quite recent and a unique and shared definition has not been shared at the global level yet [7, 8]. In a broad perspective, a business model describes how an organization works and creates value [9]. In particular, Osterwalder [10] defines a business model as “a conceptual tool that contains a set of elements and their relationships and allows expressing a company’s logic of earning money. In order to identify the core components of a business model, Osterwalder and Pigneur [11] propose the so-called business model canvas which is defined by four perspectives (Fig. 10.1): value proposition; financial; activity and customer.

The structure presented in Fig. 10.1 has its origin in the for-profit sector whose final objective consists in the creation of economic value. In this chapter, instead, we focus on organizations that aim to pursue sustainable development through the

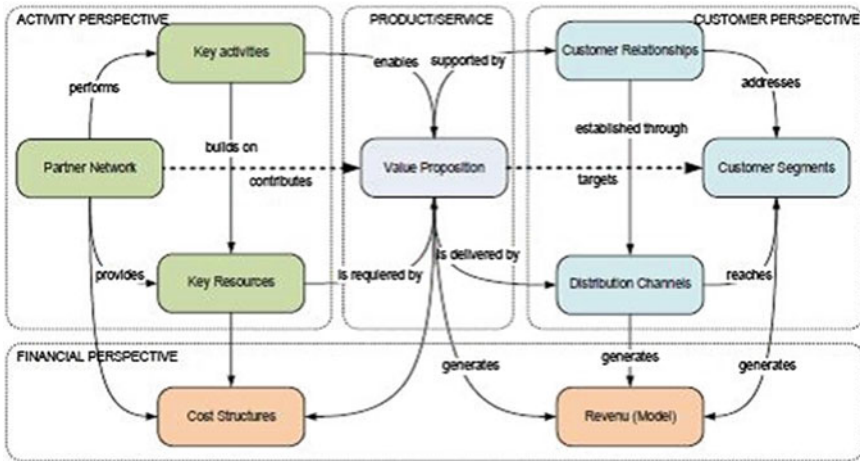


Fig. 10.1 Business model canvas grouped into perspectives. Source: [12]

involvement of social actors and communities. Hence, some key differences should be taken into account. From this point of view, a model that appears particularly interesting is the so-called ‘base of the pyramid (BoP)’ or inclusive business model, relying on the idea of enabling the poor to participate in economic activities, involving a range of actors such public organizations, policy makers, business, social entrepreneurs, development organizations, NGOs and users. These business models are based on the “4As Framework”: Availability, Affordability, Awareness and Acceptance [13] (Fig. 10.2). These principles are to be taken into account in the design and development of new business models [14].

In relation to energy access the above perspectives are described in more details. The value proposition need to describe which customer’s problems should be solved by a product or service and why the offer should be more valuable than similar products by competitors. In general terms, we can identify three main types

Fig. 10.2 The 4As Framework. Source: [13]



of energy access solutions [15]: national grid extension; distributed renewable energy systems; products and appliances.

The main dimensions to focus on are resources, activities and partner networking. When providing energy services as resources, activities and partner network can be strongly influenced by the coexistence and cooperation between for-profit and non-profit organizations [16]. For instance, multinational enterprises entering developing countries can collaborate with non-profit NGOs to adapt their business approaches to the characteristics of local markets. Large national and multinational enterprises frequently create linkages with local firms and social entrepreneurs such as suppliers, contractors and distributors. These collaborations also reinforce the ability of large companies to source inputs and to reach customers, while the local firms benefit from the improvement of their capacities [17]. Obviously, for-profit organizations still remains critical actors for addressing global energy challenges as they are efficient and capable in providing primary solutions, developing innovative products and services, deploying modern technologies and delivering efficient services. In addition, they have access to management and technical capabilities and financial resources. However, some significant existing models not only rely on the linkages and collaborations between large companies and local community associations, such as NGOs or social enterprises, but also include business directly managed by NGOs, community groups and local social enterprises (Fig. 10.3) [18].

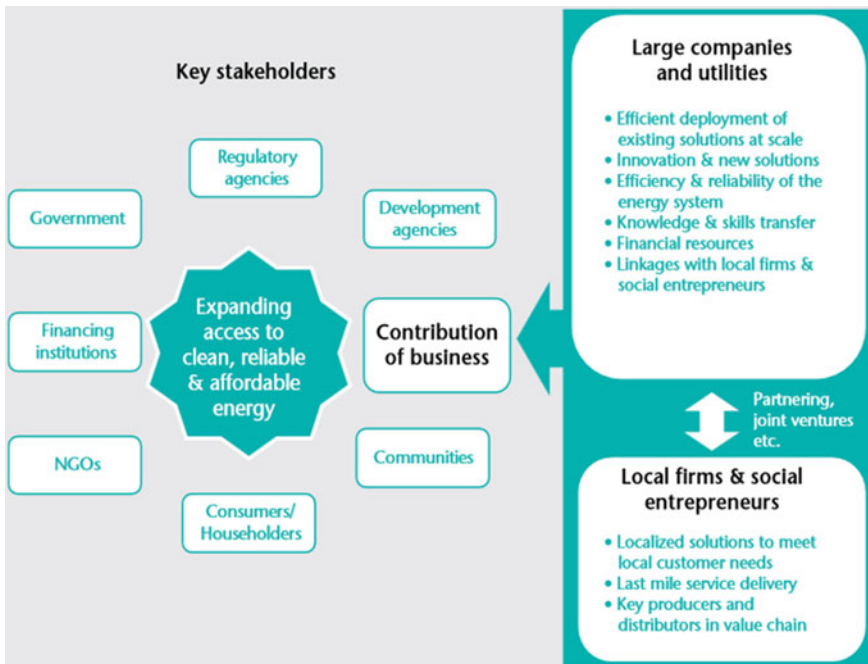


Fig. 10.3 Example of partner network in expanding energy access. Source: [19]

The customer perspective includes customer segments, customer relationship and distribution channels. It is worth noticing that different energy products or service require different models to manage customer-related activities [20, 21]. Some products, such as solar lanterns and efficient stoves do not require extended interaction with the customer whilst other products, such as large scale generators, require maintenance, training, and a continuous and long lasting customer relationship management [22]. With specific reference to rural areas, we can identify three different approaches in terms of customer perspective.

- Community-based project implementation, based on participative approaches to facilitate the adoption and use of energy technologies and relying on the active presence of the enterprise within the customers' community. In many cases, enterprises using this model are non-profit and social enterprises that develop market and non-market strategies to improve socio-economic conditions and generate social value for their members [13, 23, 24]. Enterprises embracing these approaches widely interact with their customers which are recognized as part of a community. The most common mechanisms used to ensure interaction rely on training and workshops on technologies and product maintenance as well as on capacity building for local production, technology and entrepreneurship development.
- Contract sales, consisting in the sale of products or services on a contract basis to other companies or organizations. Some contract sales are made for institutions serving poor customers, whereas other types of contract sales are made by commodity-production enterprises to large consumers such as railways and industry.
- Micro franchising, characterized by a strong social nature with a focus on the well-being of the micro franchisee and residents of underserved communities [25]. Micro franchising involve limited initial investments typically not exceeding \$1,500 [26].

The financial perspective includes considerations on costs and revenues thus leading to define organizations with diversified financial structures. Some of these organizations are financed by grants and donations or start up as grant-funded, but aim to become profitable businesses. Others are for-profit organizations that rely on loans and equity [27]. Some energy enterprises have been able to finance themselves through the sale of carbon credit [19]. Whether to rely on grants and public finance or to move to a more diffused financing mechanism, involving investment grade financing sources such as debt and equity, is hence a key issue that organizations have to confront [28]. Financial performances, though relevant, is not enough to understand the broader sustainability performances, the long term impact of these projects and to evaluate the success of business models for energy access [29, 30].

Case Studies Analysis

Based on the above considerations, in this section we analyze three case studies as examples of different business models for energy access that have been developed in rural areas. The three case studies were selected based on the amount of available and accessible information and on their diversity, in order to illustrate:

- the type of organization;
- the energy products and services;
- the socio-cultural context;
- the business model.

We refer to the business model dimensions highlighted above to guide the analysis. However, we take into considerations the specific features of these dimensions in connection to business models for energy access (e.g. role of the stakeholders, partnership between business and NGOs, relevance of participative approaches, etc.). The cases analyzed [31] are also mapped against the “4As framework” in order to highlight their ability to (i) develop and bring to market more affordable and reliable products and services; (ii) increase the scalability of servicing customers living at the so-called bottom of pyramid (Table 10.1).

Table 10.1 Mapping BlueEnergy case-study against the “4As framework”

BlueEnergy		
Criteria	Level	
Availability	High	The customers are able to readily acquire and use the products and services. Indeed, Blue Energy offers small-scale hybrid wind and solar installations, based on the local manufacture, operation, and maintenance, with a strong focus on local capacity-building and community development
Affordability	High	Blue Energy produces low-Cost Products indeed the application systems are sold to local households at affordable prices
Awareness	High	Customers become aware of the product thanks to intensive training initiatives handled by the company: community workshop aimed to understand the community’s needs and expectations; choice of the village energy committee. Local technicians are trained to carry out maintenance activities
Acceptability	High	Different players of the supply chain are willing to consume, distribute or sell BlueEnergy products, due to its focus on the empowerment of local manufacturers and the development of the local community. Furthermore, the BlueEnergy model is replicated through a network of renewable energy producers at the national level in Nicaragua (Renewables), and a network of local wind turbine producers at a global level (Wind Empowerment)

BlueEnergy (non-profit)

BlueEnergy is a non-profit organization that installs small-scale hybrid wind and solar systems in rural villages in Nicaragua. It brings affordable, sustainable electrification, water, and sanitation systems to marginalized communities implementing a reliable clean energy model. Its activities strongly rely on the idea of supporting the development of the residents themselves by emphasizing the local manufacture and maintenance of wind and solar energy systems.

Value proposition

BlueEnergy offers small-scale hybrid wind and solar installations based on the local manufacture, operation, and maintenance with a strong focus on local capacity building and community development. By combining wind and solar technology, BlueEnergy's systems are a cheaper and more reliable source that can generate continuous power under different weather conditions.

The 'typical offer' is carried out in three phases. First, BlueEnergy installs a solar panel system connected to a set of deep-cycle batteries; generators are generally used to power community buildings such as schools. Secondly, villagers buy home electrical systems, including lights, battery and wires to power TV and radio. Finally, BlueEnergy trains local technicians to maintain the systems in order to build self-reliance.

Key activities

To offer its value proposition, BlueEnergy relies on a broad network of different partners and stakeholders, including the National Technological Institute of Nicaragua (INATEC), BlueEnergy's employees (either Nicaraguans or international volunteers) and energy operators within each local community.

BlueEnergy teaches underserved people how to construct energy systems using solar panels. To this purpose, it collaborates with the INATEC hosting workshops and providing training materials for technicians. BlueEnergy's employees manufacture the turbines in their local plant and install them in Caribbean coast communities. Following the training, local operators are thus able to operate and maintain the power stations autonomously.

Customer perspective

The model adopted by BlueEnergy is community-based, therefore its primary focus is the local community that is at the center of the customer perspective. Before installing a system in a community, BlueEnergy holds a community workshop to understand the community's needs and expectations. It then supports the community to elect a village energy committee responsible for the installation and for long term management of the system. In addition, BlueEnergy makes a broader impact by helping others replicate

its implementation methods through a network of renewable energy producers at the national level in Nicaragua and through a network of local wind turbine producers at the global level, (Wind Empowerment). BlueEnergy designs its own community power systems to meet its target users' needs, manufactures and assembles these systems locally and trains target communities on how to maintain them.

Financial perspective

The financial structure relies on different financial sources. Installation costs, including a solar power system, battery bank, and 3 years of maintenance visits, amount to \$10-15,000 and are generally paid by donors. Home systems, whose cost is \$1500 on average, are generally bought on credit from a local microfinance bank. Customers pay \$3-5 every few weeks to charge the batteries. The sale of these systems to local households at affordable prices generates revenue for reinvestment by BlueEnergy and also contributes to community development beyond mere electrification. For example, the residents of one community have begun charging their cell phone batteries at the community charging station for \$.40 a piece, and this is fueling the success of BlueEnergy's model through local demand. Thanks to BlueEnergy, entire communities are benefiting from the new economic opportunities brought by electrification.

DESI Power, (for-profit)

DESI Power is an Indian for-profit organization, operating as an independent rural power producer committed to socio-economic development of villages. DESI Power aims at reducing endemic rural poverty by income generation through the provision of electricity and other energy services.

Value proposition

DESI Power relies on a decentralized electricity-driven development process, aimed to local job creation, exploitation of agro-residues, renewable energy and other resources, to offer its value proposition.

Key activities

DESI Power offer is designed as an integrated solution where power plants, energy services, local enterprises and agriculture have to work closely together to make each other profitable. DESI Power exploits various renewable energy technologies and combines them according to the needs of the village. DESI Power provides each micro-enterprise with technical and commercial solutions for decentralized renewable energy based power generation, micro-generators and biogas plants. In order to ensure the proper transfer of knowledge, DESI Power has created a management training

program called DESI Power Mantra, providing training and capacity building to enable local communities running plants on their own.

Customer perspective

DESI Power customers include both individual villagers and business activities. Villagers generally buy power for lightning and fuel for cooking. Enterprises buy power for a wide range of activities including services for mobile phones, irrigation and agro-processing. To handle customer relationships, DESI Power appoints a full time manager assisted by an experienced team with the task of coordinating all activities in the village. All installations are managed locally by a village cooperative that is trained by the company itself and is responsible for maintenance activities.

Lighting is delivered to villagers either through home wiring systems connected to the plant or lanterns recharged at a central station, both sold by DESI Power. While villagers can easily pay the monthly costs of charging a lantern or powering their home (as it is generally cheaper than the kerosene they are replacing), buying a lantern or connecting their home to the plant is often too expensive. In these cases, DESI Power seeks subsidies from donors or provides these products and services through a financing scheme. Such model is coherent with the so-called community-based implementation.

Financial perspective

DESI Power's investment structure is made up for 50 % of equity, 10 % of funds from the Indian government for delivering renewable energy, and 40 % of a loan which is paid back over 7 years. DESI Power sells the power to villagers paying for lighting, to enterprise power, to agribusinesses and mobile phone companies. DESI Power seeks equity investment of US\$100,000 for each installation, offering investors a 5 % return for the first 7 years and then a dividend return of 12–15 % in the following years. Installations typically cost \$200,000 of which 60 % is required for the plant, 30 % for the enterprise development, and 10 % for capacity building and training.

D.light, (social enterprise)

D.light is a social enterprise whose purpose is to design, manufacture and distribute solar light and power products in rural areas. In particular, D.light serves 44 countries, including Haiti, Nigeria, Mozambique, Vanuatu, Pakistan, Colombia, and China, through over 10,000 retail outlets, 10 field offices, and four regional hubs. The company employs over 100 people directly and hundreds more indirectly worldwide.

Value proposition

D.light sells low-cost durable solar light, including the world's cheapest solar lantern, the S1, and other power products such as mobile phone

charging products. D.light strongly leverages on innovative design and cutting-edge solar and LED technology to ensure quality, reliability and affordability of its lanterns. The range of their products includes lights that work for four hours (costing US\$8–\$10) as well as more expensive and longer-running devices that may offer additional services such as charging phones (costing approximately US\$45).

Key activities

Since it is not cost-effective to manufacture the products locally, they are usually mass-produced in China. D.light develops all its own products and begins the development process with field-based research on consumer needs so that the products result attractive, versatile, of high quality, durable and extremely affordable.

Customer perspective

The customer segment is composed by three target markets: rural households, off-grid businesses and off-grid schools. For the distribution D.light established partnerships with organizations that already operate locally, including microfinance networks, urban gasoline and rural liquid propane distributors, and NGOs. In order to ensure the transfer of competencies about the products, the distribution partners are trained in consumer education and product demonstration. D.light offers a one year warranty on all products.

Financial perspective

D.light is primarily financed through equity, by both traditional venture capital and social impact investors, but it has also received loan and grant financing. D.light puts particular emphasis on making its products extremely low-cost; the cheapest light, the S1, is sold at approximately US\$8. For this reason, the company has developed the Give Light program in order to connect NGOs with individual donors that donate D.light products to customers who cannot afford them. It is worth noticing the broad impact that D.light products have on the customers, since the possibility of exploiting energy allows customers to extend their workday and reduce kerosene usage, resulting in a monthly income increase of 30–50 %

The following tables summarize the results of the analysis based on a three levels scale.

- High, indicates that the organization is totally able to ensure these characteristics to the products or services.
- Medium, indicates that the organization is partly able to ensure these characteristics to the products or services.
- Low, indicates that the products or services need to be rethought in order to be consistent with the characteristics.

Table 10.2 Mapping Desi Power case-study against the “4As framework”

DesiPower		
Criteria	Level	
Availability	High	The customers have directly access and are able to use the products and services through the active presence of the enterprise in customer communities. Lighting is delivered to villagers either through home wiring systems connected to the plant or lanterns recharged at a central station, both sold by DesiPower
Affordability	Medium	Villagers can easily pay the monthly costs of charging a lantern or powering their home (as it is generally cheaper than the kerosene they are replacing). By contrast, buying a lantern or connecting their home to the plant is often too expensive for them. For this reason, DesiPower seeks donor subsidies for these products or offers them through a financing scheme
Awareness	Medium	Customers become aware of the products and service by the activities of a DesiPower unit, dedicated to coordinate and supervise all village activities. To ensure the proper transfer of knowledge, DesiPower has created a management training program that provides training and capacity building to enable local communities run their plants on their own. In particular, training activities are performed towards a village cooperative that is responsible for maintenance activities
Acceptability	High	Different players of the supply chain are willing to consume, distribute or sell DesiPower products, because DesiPower creates a local infrastructure and promotes its businesses at a local level, so that a large part of the value generated by its installations remains to villages themselves, thanks to the creation of new jobs

Lesson Learnt and Final Remarks

This chapter has addressed the problem of ensuring energy access from a business model perspective, hence considering the set of managerial and organizational arrangements whereby an organization creates value from economic, environmental and social perspectives. In particular, we analyzed three case studies of social organizations in the energy sector in order to highlight how these organizations have proactively succeeded in combining social values with environmental and financial sustainability, creating new business models. To this purpose, we relied on the framework developed by Osterwalder and Pigneur [11] to guide the analysis of the different components of a business model, assessing the contribution of these organizations to sustainable development through the 4A’s framework [13] (Table 10.2).

A number of success factors can be identified as key elements to ensure the business model provide energy access to the poor:

1. A partnership approach with local institutions, organizations, companies and communities.
2. An appropriate mix of finance models, which include investment assistance, microfinance systems, public and private donors to mobilize capital costs and financial contributions to ensure the customer ability to pay.

Table 10.3 Mapping D.Light case-study against the “4As framework”

D.light		
Criteria	Level	
Availability	Medium	The customers have access to the products only in the purchase phase. The company sells through distribution partnerships with organizations that already operate locally, including microfinance networks, urban gasoline and rural liquid propane distributors, and NGOs
Affordability	High	D.light produces the world’s cheapest solar lantern, the S1. Products design based on consumer needs: attractive, versatile, high quality, durable and extremely affordable
Awareness	Medium	Customers <i>become</i> aware of the products mainly in the distribution phase. Distribution is performed in partnerships with existing organizations, in order to ensure the transfer of competencies about the products, D.light also trains its distribution partners in consumer education and product demonstration and provides a one year warranty on all products
Acceptability	Medium	D.light products are mass-produced in China, hence the value from production is not captured locally. This limits the acceptability of the products in certain parts of the value chain, and makes their price the main leverage for attracting customers

3. The establishment, whenever possible, of local companies, cooperatives or organizations to provide, manage and maintain the service with targeted training and capacity building for local staff.
4. The use of multiple energy sources and products to actually meet local energy demands (households, collective, commercial and productive uses).
5. The identification and implementation of local appropriate technologies, process and management methods through the direct involvement of the local community.

The empirical analysis provides a few lessons that are discussed below (Table 10.3).

Private sector interventions alone can hardly reach poor customers. Traditional for-profit models are unlikely to ensure energy access in rural areas because profit margins and timeframes are less attractive [32]. In these cases, the involvement of ‘non-traditional’ business partners, such as government, non-government organizations, enterprise associations, social enterprises and communities themselves, is required. From this perspective, a key challenge is targeting government and donor support to stimulate and enhance private sector involvement. One of models of interest is represented by social enterprises, defined as businesses with “primarily social objectives whose surpluses are principally reinvested for that purpose in the business or in the community, rather than being driven by the need to maximize profit for shareholders and owners” [33].

Understanding the socio-cultural context is important to effectively design business models that reach BOP customers. This chapter highlights the importance of understanding the socio-cultural context, to identify new entry points for

capturing the needs of BOP customers and how their needs evolve over time. This is crucial to properly interpret local expectations and ensure the long term viability of the business model.

A key element is the integration of training activities into the delivery model. This is a key element emerging in all the three case studies which represents a specific feature in the delivery of the value proposition in rural areas. BOP customers may need to become aware of energy products and services because these products are not yet well distributed and available in the market as they are in developed countries. Hence, training customers, local cooperatives or, more in general, local communities become a channel to establish and manage the customer relationship, but represent also a key leverage to disseminate energy and improve life conditions over a broader swath of customer or potential customers that otherwise would remain excluded. Moreover, the lack of knowledge and understanding of delivery models is a key obstacle to investment, thus working on training and capacity building can contribute to overcome this additional barrier.

References

1. Ocampo JA (2005) Globalization, development and democracy. *Items Issues* 5:11–20
2. Azzone, G. and Bertele, U (1995) Exploiting green strategies for competitive advantage. *Long Range Plan* 27(6):69–81 (December 1994). *Long Range Plan* 28(2):152. doi:[http://dx.doi.org/10.1016/0024-6301\(95\)91039-5](http://dx.doi.org/10.1016/0024-6301(95)91039-5)
3. Adams C, Zutshi A (2004) Corporate social responsibility: why business should act responsibly and be accountable. *Aust Account Rev* 14(34):31–39. doi:[10.1111/j.1835-2561.2004.tb00238.x](http://dx.doi.org/10.1111/j.1835-2561.2004.tb00238.x)
4. Murillo-Luna JL, Garcés-Ayerbe C, Rivera-Torres P (2011) Barriers to the adoption of proactive environmental strategies. *J Cleaner Prod* 19(13):1417–1425. doi:<http://dx.doi.org/10.1016/j.jclepro.2011.05.005>
5. O'Brien R (2000) *Contesting global governance: multilateral economic institutions and global social movements*. Cambridge University Press, Cambridge. <http://books.google.it/books?id=2VD2PSvEdYsC>
6. Alter SA (2006) Social Enterprise models and their mission and money relationships'. In: Nicholls A (ed) *Social entrepreneurship: new paradigms of sustainable social change*. Oxford University Press, USA
7. Shafer SM, Smith HJ, Linder JC (2005) The power of business models. *Bus Horiz* 48(3):199–207
8. Teece DJ (2010) Business models, business strategy and innovation. *Long Range Plan* 43(2):172–194
9. Magretta J (2002) Why business models matter. *Harvard Bus Rev*
10. Osterwalder A (2004) The business model ontology: a proposition in a design science approach. Institut d'Informatique et Organisation Lausanne, Switzerland, University of Lausanne, Ecole des Hautes Etudes Commerciales HEC 173
11. Osterwalder A, Pigneur Y (2010) *Business model generation: a handbook for visionaries, game changers, and challengers*. Wiley, Hoboken

12. Fritscher B, Pigneur Y (2011) Business IT alignment from business model to enterprise architecture. In: Salinesi C, Pastor O (eds) *Advanced information systems engineering workshops. Lecture notes in business information processing*, vol 83. Springer, Berlin, pp. 4–15. doi:[10.1007/978-3-642-22056-2_2](https://doi.org/10.1007/978-3-642-22056-2_2)
13. Anderson J, Billou N (2007) Serving the world's poor: innovation at the base of the economic pyramid. *J Bus Strategy* 28(2):14–21
14. Prahalad CK, Hart SL (2002) The Fortune at the bottom of the Pyramid. *Strat Bus* 26(First Quarter):2–14
15. Business Solutions to Enable Energy Access for All (2012). WBCSD/ANDE Meeting, 21 Feb 2012
16. Dahan NM, Doh JP, Oetzel J, Yaziji M (2010) Corporate-NGO collaboration: co-creating new business models for developing markets. *Long Range Plann* 43(2–3):326–342. doi:<http://dx.doi.org/10.1016/j.lrp.2009.11.003>
17. Pansera M (2012) Renewable energy for rural areas of Bolivia. *Renew Sustain Energy Rev* 16(9):6694–6704. doi:<http://dx.doi.org/10.1016/j.rser.2012.08.015>
18. Balachandra P (2011) Modern energy access to all in rural India: an integrated implementation strategy. *Energy Policy* 39(12):7803–7814. doi:<http://dx.doi.org/10.1016/j.enpol.2011.09.026>
19. Business solutions to enable energy access for all (2012) The world business council for sustainable development. <http://www.wbcsd.org/pages/edocument/edocumentdetails.aspx?id=14165&nosearchcontextkey=true>. Accessed 3 July 2013
20. Friebe CA, Flotow Pv, Täube FA (2013) Exploring the link between products and services in low-income markets—Evidence from solar home systems. *Energy Policy* 52(0):760–769. doi:<http://dx.doi.org/10.1016/j.enpol.2012.10.038>
21. Mont OK (2002) Clarifying the concept of product–service system. *J Cleaner Prod* 10(3):237–245. doi:[http://dx.doi.org/10.1016/S0959-6526\(01\)00039-7](http://dx.doi.org/10.1016/S0959-6526(01)00039-7)
22. Pon B (2012) Designing affordable solar lighting: energy-efficient LED design reduces payback to 5 months for Zambian customers. University of California, Davis
23. Antinori C, Bray DB (2005) Community forest enterprises as entrepreneurial firms: economic and institutional perspectives from Mexico. *World Dev* 33(9):1529–1543
24. Peredo AM, Chrisman JJ (2006) Toward a theory of community-based enterprise. *Acad Manag Rev* 31(2):309–328
25. Fairbourne JS, Gibson SW, Dyer WG, Hatch J (2007) *MicroFranchising: Creating Wealth at the Bottom of the Pyramid*. Edward Elgar Publishing, Northampton
26. Lehr D (2008) *Microfranchising at the base of the pyramid*. Acumen Fund New York, USA. http://www.acumenfund.net/uploads/assets/documents/Microfranchising_Working%20Paper_XoYB6sZ5.pdf. Accessed 3 July 2013
27. Glemarec Y (2012) Financing off-grid sustainable energy access for the poor. *Energy Policy* 47, Suppl 1 (0):87–93. doi:<http://dx.doi.org/10.1016/j.enpol.2012.03.032>
28. Bose A, Ramji A, Singh J, Dholakia D (2012) A case study for sustainable development action using financial gradients. *Energy Policy* 47, Suppl 1 (0):79–86. doi:<http://dx.doi.org/10.1016/j.enpol.2012.03.038>
29. Agbembiese L, Nkomo J, Sokona Y (2012) Enabling innovations in energy access: an African perspective. *Energy Policy* 47, Suppl 1 (0):38–47. doi:<http://dx.doi.org/10.1016/j.enpol.2012.03.051>
30. Rehman IH, Kar A, Banerjee M, Kumar P, Shardul M, Mohanty J, Hossain I (2012) Understanding the political economy and key drivers of energy access in addressing national energy access priorities and policies. *Energy Policy* 47, Suppl 1 (0):27–37. doi:<http://dx.doi.org/10.1016/j.enpol.2012.03.043>
31. Koch JL (2013) Energy map, an initiative of the Center for Science, Technology, and Society. Supported by applied materials. <http://energymap-scu.org/profiles/>. Accessed on 3 July 2013

32. Wilson E, Wood RG, Garside B (2012) Sustainable energy for all? linking poor communities to modern energy services. IIED, London
33. Department of Trade and Industry (DTI) (2003) A progress report on social enterprise: a strategy for success. UK