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Killing Two Birds with One Stone: Driving Green Jobs through Creating a Rural Renewable Energy Systems Industry

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Abstract

Green jobs are touted as a panacea that can reconcile the principles of economic growth and sustainable development. As our research from Bangladesh shows, the potentials of promoting green jobs and understanding employment and labour dynamics within a green rural electrification market in developing countries is still underestimated.

International institutions emphasize the importance for green jobs not only to contribute to preserving or restoring the environment but also to be decent, inclusive and gender-sensitive. When analyzing the case of Bangladesh, we notice increasing efforts to assess income-generating opportunities as an effect of electrification. However, we find a striking gap in the assessment of data and knowledge with regards to employment and labour within the nascent rural off-grid electricity market. Turning to current rural off-grid electrification programs and studies we found the same inconsistency.

The paper contributes to the debate on the social dimensions of green growth by arguing that in order to better understand the social dimensions of green jobs in nascent green sectors, rural off-grid electrification initiatives need to be complemented by research monitoring social indicators within the industry. Specifically, we propose to build awareness about employment and job conditions and develop indicators for collecting data and monitoring. To better understand the social dimensions we therefore propose a catalogue of factors and measures. Specifically, we recommended including an interdisciplinary approach when planning and evaluating rural electrification projects and to tap into the experience and networks of already existing social economic initiatives

Introduction

Green jobs are touted as a panacea that can reconcile the principles of economic growth and sustainable development. In particular since the financial crisis in 2008 some OECD countries have begun to link strategies for a low carbon economy and sustainable economic growth. Due to the climate change regime and the need to meet emission reduction targets more investment is flowing into renewable energy programs creating a large number of new jobs. Many scholars and development practitioners argue that green growth – and thus green jobs – is not confined to developed countries and some emerging economies. According to this view especially developing countries can benefit from the synergies of mitigating the effects of climate change and sustainable job creation and growth. International institutions underline the importance for green jobs not only to contribute to preserving or restoring the environment but also to be decent, inclusive and gender-sensitive.

Starting from this debate we wanted to analyze the potentials for green jobs and their social dimensions in developing countries taking rural off-grid renewable energy as a sector and the case of Bangladesh as a country example. Since the off-grid solar industry began in 1996 more than 800,000 off-grid solar home system (SHS) have been installed and 60,000 jobs have been established, including many for disadvantaged rural women with limited access to other forms of employment. As the case shows the solar industry offers diverse new business opportunities for the rural population. Yet, while studying the case we noticed a gap of data and knowledge about job creation and employment. This gap specifically refers to a range of social indicators such as the total number of jobs created, the types of jobs, payments, gender, working hours etc.

Turning to other current rural electrification programs and studies we found the same striking gap in collecting data on employment within the sector and on assessing, monitoring and analyzing the social impacts of actors within the rural off-grid energy sector. We observed that in the rural off-grid renewables industry, the projects objectives focus on improving access to electricity rather than also looking into the social dimensions of the jobs created. Indicators for achieving project goals are mostly confined to the question how much capacity of renewable energy sources has been added.

As in Bangladesh, the rural electrification programs we reviewed overlook the impacts on local job creation, entrepreneurship and labour conditions within the renewables sector. Thus the question whether green jobs also fulfil the requirement of being decent, inclusive and gender-sensitive is not touched upon.

The paper contributes to the debate on the social dimensions of green growth by arguing that so as to learn more about the social dimensions of green jobs, rural electrification projects need to be complemented by research monitoring these social indicators. Specifically, we propose to build awareness about employment and job conditions and develop indicators for collecting data and monitoring. Most importantly, we suggest that rural electrification projects do not need to start from scratch but build on and link to the experiences of development projects that foster job creation, social standards and gender equality.

Green growth, electrification and green jobs

With concerns about climate change and disillusion about established models of economic growth, green growth as a new economic paradigm has received more and more attention in recent years. So far, there is no commonly accepted definition of green growth. According to the United Nations Environmental Program (UNEP 2011:9) green growth provides "diverse opportunities for economic development and poverty alleviation without liquidating or eroding a country's natural assets". Researchers increasingly find evidence that the new economic paradigm fosters growth both in developed and developing countries[1].

One of the central benefits of green growth is new employment opportunities. Green growth creates new jobs mainly through two channels: First by providing new green services and technologies such as sustainable tourism and technologies increasing energy efficiency of buildings. Secondly, polluting technologies will be substituted by green ones thus shifting employment opportunities. Especially with the growth of renewable energy the potential for new employment opportunities is considered to be very high. Some jobs will simply shift from the fossil fuel industry to the renewable energy sector. As renewables are more labour-intensive – at least in the short run – a switch to low-carbon energy should yield a net gain on the job market (Fankhauser et al. 2008; Kammen et al. 2006). Studies suggest that up to 20 million jobs will be created by 2030 in the renewable sector (UNEP/ ILO/ IOE/ ITUC 2008). In addition, green growth also transforms employment opportunities as a large number of already existing jobs will simply be transformed and re-defined to the new requirements of a green economy (e.g. electricians, construction workers and engineers). The biggest potential for new green jobs is considered to be in developed countries and some emerging markets such as Brazil and China (see for example, UNEP 2008).

Many proponents of green growth argue that developing countries can equally benefit from green growth with regards to job creation. In particular, rural electrification provides an example, where green technologies play a crucial role for both poverty alleviation and the fight against climate change.

Electrification and employment opportunities in developing countries

In many developing countries the importance of rural electrification had been neglected in a number of developing countries in the 1980s and 1990s. At the time most developing countries implemented privatization and liberalization programs of public services and infrastructure. As a result of the privatization reforms, the rate of rural electrification had even declined during the 1980s and 1990s (Haanyika 2006). Since the turn of the millennium the role of rural electrification in alleviating poverty has received new attention. Its benefits on poverty alleviation are now well documented (WHO 2006; United Nations 2005; DFID 2002). Alongside health benefits and improved living standards, the use of electricity can also improve household incomes. New employment opportunities arise on the supply chain (generating and delivering energy) and on the demand side. With regards to the latter, electrification boosts business start ups and increases the productivity of already existing businesses. In

[1] To what extent green growth may be beneficial for developing countries is still debated. For most developing countries economic growth rather than green growth remains the priority. Proponents from developing point out several risks related to green growth and economic development such as the rise of new trade protection or new conditionality on developing countries for aid, loans, and debt rescheduling or debt relief (see for example, Khor 2011).

particular, it improves the lives of women as it facilitates and speeds up many domestic tasks. As a consequence, women can take paid employment (Barnes et al. 2010; Dinkelmann 2008; Barnes and Toman 2006). As to the supply chain, improved access to electricity creates jobs in the energy sector for technicians, engineers, and manual labourers.

The case of Tanzania demonstrates the opportunities for the job markets: In 2010 the government of Tanzania set the goal of connecting 500.000 households to the national grids within a five-year time-frame. The electricity will be generated mostly by gas, coal and hydro power. A study by Mwakapugi et al. (2010) estimates that over one million jobs will be created indirectly and directly within the same time span. A number of studies verify the effect of on-grid electrification (see for example, World Bank 2008; Barkat et al. 2002; Barnes 1988, Bose 1993).

For decades, improving access to electricity has been fostered by using fossil fuels and by extending the national grids. Despite the improvements for livelihoods, on-grid electrification in rural, remote areas provides many challenges. It only offers few market incentives for profit-seeking private companies. The market is characterized by geographical remoteness, dispersed consumers, limited ability to pay, high cost of distribution and maintenance as well as low consumption (Reiche et al. 2010). On-grid electrification is therefore a costly enterprise for both private companies and governments. More importantly, while large energy projects may have a positive impact on the economic development in the short run, they also contribute to the devastating effects of global warming. Developing-countries can use the opportunity to leap-frog carbon-intensive energy pathways.

Renewable energy and the social dimensions of green jobs

Off-grid electrification with renewable energy provides the triple benefit of helping to mitigate climate change effects, electrifying rural areas and driving local job markets. The technology especially constitutes an alternative solution for those rural areas which provide only few incentives for private energy companies: remote areas that are characterized by low consumption. One prominent example of off-grid electrification are solar home systems (SHS)[2], a technology to which we will come back later in the paper. There are now a few examples which suggest that off-grid electrification with renewable energy not only provides new jobs indirectly but also directly in the emerging renewables sectors. In the case of Bangladesh, for instance, 60,000 new jobs as a result of the growing SHS sector. Other examples include India where biomass gasification might create 900,000 new jobs by 2025 and the biofuels industry in Nigeria, which could create up to 200,000 new jobs (UNEP 2009).

While the potential of new job opportunities are high questions arise on the character of the new jobs. International institutions emphasize the importance of green jobs to be decent, inclusive and gender-sensitive (see UNDP 2009; UNEP 2008). The question therefore arises whether the jobs created through rural electrifications projects live up to these requirements.

[2] The SHS technology has been particularly successful in Asian countries such as Bangladesh, India, Sri Lanka, Nepal, Thailand and China (Wang et al. 2011)

The solar home systems supply chain

While the indirect or enabling effects on income generation and business opportunities through improved access to electricity are being studied, there is a need to understand the job dynamics within the off-grid solar PV industries using the example of Solar Home Systems (SHS). First we need to understand the technology and the supply chain of SHS. Typically a SHS is composed of a photovoltaic module, a battery, a charge controller, wiring and switches, lights (often fluorescent), and outlets for other small-scale appliances. The SHS can be used for lighting or cell-phone-charging, as well as for small radios, televisions and fans, depending on the system's size (Mondal 2010; Reiche et al. 2000). SHS can replace or reduce a household's demand for kerosene (used for lamps), battery charging (for cell-phones, for example), propane and candles.

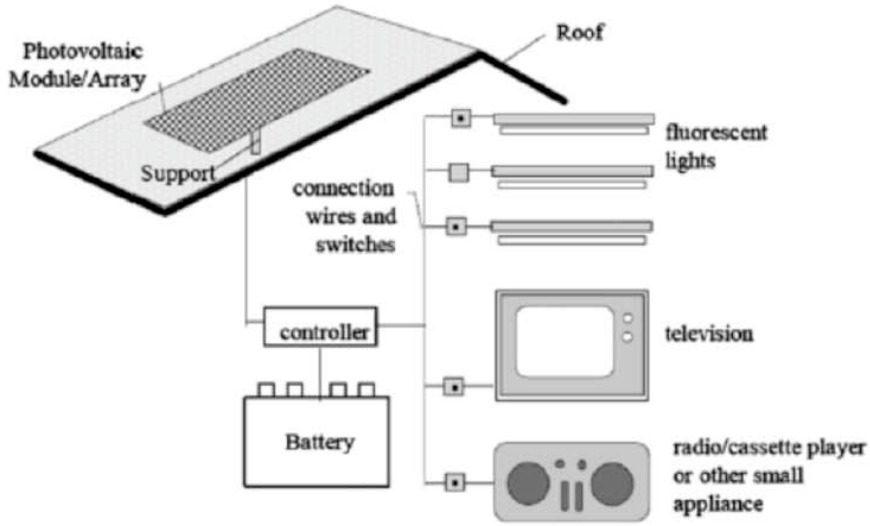

Figure 1: A typical solar home system (Mondal 2010)

The SHS are distributed in various business and distribution models. One model is the commercially led delivery system, which follows a basic cash-sale model. Typically the whole system is imported through a trader who sells to local retailer. The latter are commonly micro-enterprises, which add the system to their sales basket. This model is found in areas with an existing demand base and buying power. Models more commonly applied in poor rural settings are multistakholder models, e.g. a public private partnership or in cooperation between rural energy service companies and microfinance institutions, retailer or concession models. In order to understand the employment opportunities and types of jobs involved in the sector, five production and service streams on the supply and demand side need to be taken into account: a) PV module production, parts and assembly b) Service provision (Rural energy service companies, retail with sales or leasing systems, cooperatives etc.), c) Maintenance and Service, d) Training and Capacity building and e) Financial services. Most jobs created in the supply chain in developing countries are those in the category b)-e). PV-modules are still mostly produced in developed and emerging markets, China being a lead supplier. Prices have decreased dramatically in the last decade, spurring a new enthusiasm for PV systems. A whole set of research is needed to identify jobs and qualification requirements for the promotion of an own component industry and involved business potentials. Under the category service provision and maintenance and services, a wide range of jobs and qualifications requirements can be found. We can classify the types into 1) high-skilled engineers; 2) skilled or newly skilled service

technicians; 3) sales staff and fee collectors; 3) managerial staff and entrepreneurs; 4) support services.

As noted in Wang et al (2011), in many countries there is a lack of trained staff for delivering and maintaining SHS, which has been a factor for slowing down the dissemination of SHS. Hence by extending rural electrification programs along with capacity building, they can also foster the creation of green jobs. Moreover, as Ian Crosby has pointed out in a workshop on the rural energy service companies: "many issues facing the private sector are not energy specific, but applicable to all entrepreneurs in all industries" (Rural Electrification Board of Bangladesh 2010). ESMAP has started to react to this demand for targeted training and promotion of small and medium sized companies with its Energy Small and Medium Enterprise Program supported by the Department of International Development (ESMAP 2010). The India-based Barefoot College is an excellent example of a local training institution. The college tracks not only the number of installations and electrification efforts, but the number of graduates from the college who receive specified training to primarily unskilled workers to gain expertise with small scale PV systems (Barefoot College 2011).

Off-grid solar electrification and job creation in Bangladesh

A prominent example for off-grid solar electrification is the case of Bangladesh. Its off-grid solar PV sector is fast approaching a significant milestone: the installation of the millionth solar home system (SHS)[3]. Reaching this milestone seemed inconceivable when the first system was sold in 1996, or when the 10,000th was sold eight years later in 2003 (Rahman 2009).

The need for SHS in Bangladesh is acute. Bangladesh is one of the poorest and most densely populated countries. As its per capita electricity generation capacity is one of the lowest of the world approximately 85 million Bangladeshis lack access to grid-based electricity (Wang et al. 2011; Government of Bangladesh 2010)[4]. In June 2010 the government of Bangladesh issued a road map on extending the electrification to all Bangladeshis. The majority of rural Bangladeshis live in remote areas with no access to the national grid (Wang et al. 2011). Due to its topography 100 percent on-grid electrification is difficult and expensive to realize. SHS constitutes an opportunity for the country to extend electrification in rural areas at lower costs. SHS are well suited to providing this population with energy services because Bangladesh has a very high average daily solar irradiance of 3 to 6.5 kWh/m^2 (Sarkar 2003). A second advantage of SHS is that they are easy to transport to rural villages and install as they are comprised of a solar panel, change controller, wiring, and a battery. SHS provide an odourless and smoke free light source that is 100 times more powerful than the kerosene lamps they typically replace (Asaduzzaman 2009). The increased light output increases the amount of time that children study and facilitates the growth of home businesses (IDA 2010). Finally, the battery-component of the SHS allows it to power additional appliances such as mobile phone chargers, radios and televisions.

[3] As of May 31, 2011, a total of 977,109 SHS had been installed. See www.idcol.org/prjshsm2004.php

[4] The Government's *Towards Revamping Power and Energy Sector: A Road Map* stated that as of April 2010, 47 percent of Bangladeshis had access to grid-based electricity. The World Bank listed the population of Bangladesh as 162 million in 2009, which combined with the electrification rate yields a total of more than 85 million people without grid-based electricity.

One driving factor for the SHS sector has been Grameen Shakti (meaning "village energy or power" in Bengali, Siegel 2011) a subsidiary of the Grameen Bank. The company offers microcredit programs to make SHS available and affordable to rural population (UNEP 2009)[5]. The private sector has been important as the microcredit scheme improving access to SHS of the rural population. Yet, public support was critical to the success of SHS dissemination at the initial stages (Wang et al. 2011). After a slow start between 1996 and 2002 the program was supported by the International Finance Corporation and the Government of Bangladesh. By 2002 a formalized program was set up was financed by the World Bank's Rural Electrification and Renewable Energy Development Program (RERED). This program extends grants and soft loans to the government-sponsored Infrastructure Development Company Limited (IDCOL). IDCOL uses these funds to: 1) provide the NGOs selling SHS with soft loans and institutional development grants; and 2) buy down the cost of a SHS for consumers (IDCOL 2010). As Siegel 2011 notes, sales of SHS increased rapidly from 2003 onwards[6].

The growth of the SHS sector has created business opportunities both indirectly and directly for entrepreneurs across the entire value chain. As a way of highlighting the diversity of green jobs created by this industry, the following section will draw upon interview data collected during the summer of 2010.

SHS owner income generation

There are three large groups of SHS owners that use their systems for income generation: residences, businesses and hybrids that straddle both categories.

One important job opportunity arises in the context of mobile phone usage. Mobile phones are so prevalent in rural Bangladesh that SHS are sold with a mobile phone charger. In fact, there are over 75 million mobile phone subscriptions in Bangladesh, although this underestimates the number of people with access to a mobile as many rural households share a single phone (BTRC 2011). The penetration of mobile phones creates a business opportunity in areas where phone ownership is more widespread than electricity.

Both households and businesses have taken advantage of this opportunity. Several of the households interviewed stated that they charged their neighbours 10tk[7] to charge their mobile phones. This provided households with a steady, albeit modest, additional stream of income. Many of the shops in bazaars throughout the Kurigram region charged customers 5-10tk to charge their mobile phones. One of the shops JRS visited had three solar panels on its roof and was charging customers' 2tk per charge—well below the market rate. When JRS asked why the shop charged so little, the shop owner with his brothers, responded that they

> …could charge 20 mobiles at a time, and generally charged 40-50 a day. We also charge flashlights for 3tk. Although we don't make much money off of the charges, most of the customers buy a snack or something small while they wait for their phones to charge. The customers attracted by the low cost of charging their mobile phones help us sell 5,000 – 6,000tk of goods each day.

[5] In addition to SHS Gremeen Shakti also installs biogas plants to convert biomass such as animal dung into biogas (UNEP 2009)
[6] For a detailed account of the driver fuelling the post-2003 explosion in sales, see Siegel 2011.
[7] A standard conversion rate is 70 taka = 1 USD.

Solar home systems allow both households and shop owners to increase their income by using the electricity from their systems to charge neighbours' and customers' mobile phones.

SHS can be used for myriad income generating activities beyond mobile phone charging. For example, a man who sells sweets his wife made at a village market near Kurigram in the north of the country uses his system to sell electricity. Every day, he charges his SHS battery at home and bikes the battery along with his sweets up to the village market each night. The stall owner uses a DC-AC converter to plug the light at his market stall into his battery. In addition, he charges three or four other stall owners 10tk a night to connect the light bulbs above their stalls to his battery. All of the stall owners benefit from this arrangement; the increase in light from a SHS-run light bulb over a kerosene lamp draws additional business to these stalls that more than offset the cost of the electricity. At the end of the night, the owner bikes the battery home and uses the remaining power, if any, to light the house as his family prepares for bed.

The novelty of moving the battery from his home to the market as needed underscores the diversity of income generating activities that SHS can facilitate. The SHS provides a mechanism through which people are able to create new and unique green jobs and income generation opportunities.

The SHS industry

The SHS sector in Bangladesh employs upwards of 60,000 people (Barua 2011). The vast majority of these workers are field assistants who market, sell, install and provide maintenance services related to SHS. Because SHS are sold using microfinance, the field assistants also collect monthly payments during the three years that the average customer takes to pay back the initial loan. During the summer of 2010, JRS spent several days following field assistants on their rounds in the Tangail and Kurigram regions.

All of the field assistants interviewed were men in their early twenties from rural areas who had completed a Diploma in Engineering[8]. They earned an average of 6,000tk a month—just below the average rural household income of 6,095tk (BBS 2009)—and lived in shared rooms attached the branch offices. The field assistants were united by their mission-driven focus. In interview after interview, that said that they loved the job because it allowed them to extend electrification to marginal areas of the country and, in doing so, improve the lives of the local villagers. This underscores a key point—namely, that the corps of young people looking to engage in "green" and mission-driven work exists from the least developed to most developed countries.

Two of the largest organizations in the sector, Grameen Shakti and the Bright Green Energy Foundation, employ rural women who assemble and repair component parts of the SHS in Grameen and Green Technology Centres, respectively. Grameen Shakti operates 45 GTC, while the Bright Green Energy Foundation runs four more GTC[9]. GTCs are managed by women with Diplomas in Engineering who recruit, train and employ women from disadvantages backgrounds as technicians. The technicians are paid for each item they build or repair.

[8] Diploma in engineering programs proliferated throughout the country in the 1960s and provide graduates with basic technical and vocational skills (Bangladesh Technical Education Board 2011).
[9] The data in this section is derived from interviews JRS conducted at 3 GTCs during the summer of 2010.

Item	Fee (Tk)
Charge Controller Circuit	7
Entire Charge Controller	14
Light shed Inverter	2.5
Light shed	7
Mobile Charger Circuit	1.5
Mobile Charger	10
DC-DC Converter Circuit	1.5
DC-DC Converter	10

Figure 2: Payment Received by Technicians per unit at a GTC, summer 2010

Because of the flexibility of the work, many technicians take parts home to repair at night, while others do not work five days a week. All of the women interviewed stressed that they enjoyed working at the GTC because of the sense of community it engenders, and all of the technicians stated that this was their first job outside the home. The new technicians interviewed made approximately 3,000tk in their first month of work, while the more experienced ones made from 7,000 – 8,000tk. This places starting technicians in the second quintile for rural households and experienced technicians above the median income. The jobs at the GTC provide rural women who had no access to employment with well-paying jobs that improve livelihoods.

Ancillary services

The SHS sector has also facilitated the proliferation of green jobs engaged in ancillary services. In fact, almost the entire SHS is manufactured in Bangladesh. One of the few components that continue to be imported, the solar panels, will be manufacturing in Bangladesh in the near future. Rahimafrooz Renewable Energy recently agreed to buy a solar module manufacturing line capable of assembling 20MW per year from US-based Spire Corporation (Spire 2011). Once installed, this plant and others like it will create green jobs ranging from unskilled labour to advanced engineering. Given that the industry has grown from nothing to one million systems sold in 15 years, it is possible that solar panels will follow textiles as a major Bangladesh export in the next decade.

International rural electrification initiatives do little to assess data and impacts on job creation and the labour market

After noticing the diverse opportunities for job creation and employment in Bangladesh and touching upon the social dynamics of these employment conditions, we now turn to a review of pertinent rural electrification projects in other countries to learn more about their activities and assessment of green jobs in the rural off-grid PV sector. In most developing countries, two of the most pressing needs in rural areas are improving livelihoods and extending the benefits of electrification. Although these goals are intricately related, most projects focus on either improving or evaluating livelihood effects caused by the new or improved access to electricity.

Shift from publicly driven electrification to an increasing number of private solutions and a nascent rural green energy industry

Rural electrification has for decades been the responsibility of public programs and state-owned utilities. The current achievements in Vietnam show that traditional grid-

based electrification with access rates of more than 90% can be achieved by concentrated government efforts and support of international technical and financial assistance (World Bank 2011). In many other countries with more dispersed population living in isolated areas, decentralized small scale renewable energy technologies and business models have created a vast array of new opportunities to promote off-grid rural electrification. Promoters of this approach are besides international institutions such as UNEP, UNDP, the Global Environmental Fund, various development banks and technical assistance agencies and increasing number of private sector initiatives, microfinance institutions and NGOs. This makes the rural green energy sector increasingly diverse and dispersed and data on the industry development tedious.

Rural electrification programs measure economic and employment impacts of electricity, not of the off-grid industry itself

Amongst the increasing number of rural electrification programs that include off-grid components, the government of Kenya is one of the leading off-grid energy drivers. It has demonstrated clear achievements in the deployment of solar PV systems with an estimate of 150,000 installed solar PV systems that reached approximately 300,000 households (Kenya Bureau of Statistics 2005). Those systems are typically used to power lighting, household electronics and communication technologies such as mobile phones. SHS enable the users to replace kerosene and automotive batteries. A number of cases have been reported, where especially women have benefited from the new business opportunities. The Indian Barefoot College has started collaboration with local NGOs in Kenya to provide training for installation and repair services (Gathanju 2010). The program "Lighting for Africa" was set out by the World Bank and IFC to accelerate the development of commercial off-grid lighting markets in Sub-Saharan Africa (IFC 2011). In its 2011 Synthesis Report the program has filled a vital gap in providing market information through conducting a large scale consumers study. However, the program offers little information on job creation and labour in the concerned areas. We observe an opportunity for Lighting Africa to use its massive network of stakeholders to develop a framework to collect and assess industry and employment data of the rural off-grid industry itself to evaluate labour market impacts.

Sri Lanka's Renewable Energy for Rural Economic Development (RERED) project has deployed about 130,000 solar home systems by 2010. The strength of the program lies in its sector-wide and multistakeholder approach involving complementary actors such as solar companies, local dealers and microfinance institutions (WHO/UNDO 2009). The projects sets its goal to improve "the quality of life in rural areas through the use of electricity as a means to further income generation and social service delivery"[10]. In consequence, the outcome of the program is measured according to the impacts of electricity as a means with indicators such as: a) 160,000 rural homes electrified through solar home systems and off-grid electricity connections to households through independent mini grids powered by village hydro, wind or bio mass, b) 1,500 off-grid electricity connections to small and medium enterprises and public institutions, c) measurable increases in socio-economic activity in project areas and incomes of households gaining access to electricity (RERED 2011). While the project aims at increasing the number of energy service companies in operation, it does not measure the impacts of jobs created within the sector or the labour conditions or requirements.

[10] See www.energyservices.lk/theproject/objectives.htm

Lao PDR has been reporting great efforts in rural electrification programs, especially on SHS concessions and through private initiatives like the successful Sunlabob Company. Since 2000, Sunlabob has been developing a local off-grid energy industry in Lao PDR, training villagers and spurring entrepreneurship (Bergsten 2009). It's a pioneer in building a locally skilled workforce in the off-grid sector. In a investigations carried out by ESMAP (2010) in Lao PDR on business dynamics in for Solar Lantern Systems, it was found that the new technology was mostly sold by micro-enterprise retailers run by women. These entrepreneurs run into the risk of lacking knowledge about the technology and its usage and maintenance needs. Little is know about the background of these entrepreneurs. The study furthermore reinforces that without appropriate training, manuals and capacity building, the sales of the new technology itself will not guarantee business profits. Also in the case of micro-hydropower systems, ESMAP found out that efficiency, effectiveness and safety are strongly compromised with the absence of the provision of accessible manuals, technical, managerial and safety training for workers in the sector. There is a lack of awareness and resources to include training and capacity building mechanisms and moreover, the establishment of local training centres and qualified trainers into the roll out of off-grid electrification programs.

In Peru, the International Bank for Reconstruction and Development (IBRD) and Global Environmental Facility (GEF) funded Rural Electrification Project "Light and Hope" has reached 105,165 people by December 2009 with new electricity service through the extension of the grid and sub-projects and aimed at providing electricity to an additional 39,300 people living in isolated rural areas via off-grid solar systems by the end of 2010. The model of promotion is to support distribution companies to provide tariff plans for its customers. The companies are responsible for the functioning of the systems and maintenance. The project focuses on the cooperation with local providers. It is seen as a sustainability factor that the "electricity distribution companies prepare, execute and operate rural electrification subprojects as part of their regular commercial operations" (World Bank, 2010). Cooperation with local SME is promoted with support of ESMAP. The "Light and Hope" Program targets a low-carbon economy and puts electrification at the heart of its operations. With a vast network of involved private companies including local SME, the program could provide a rich basis for assessing the quantities and quality of job creation in the off-grid sector. Thus far, employment and entrepreneurship data through the project's efforts have not been assessed.

In the Republic of the Fiji Islands the Rural Electrification Project aims at improving opportunities for livelihood and poverty reduction, environmental protections along electrification. In isolated areas, the project promotes the "installation of 3,200 solar home systems in Viti Levu (1,725 systems) and Vanua Levu (1,475 systems) to support a 'Proof of Concept' demonstration project of solar implementation institutional arrangements with private sector participation for sustainable remote-area rural electrification" (ADB 2005). The approach involves that the Department of Energy purchases and owns the SHS while renewable energy service companies lease the technology to provide the installation and maintenance services. Little research exists on the economic dynamics of the introduction of the SHS in to the local market and on the history and development of jobs in local companies and their supportive services.

The Alliance for Rural Electrification (ARE), an international business association, promotes the development of private rural off-grid solutions worldwide. In recent studies and assessments, the ARE draws on the evaluation of a great number of positive development impacts due to the roll out of off-grid business solutions. ARE members follow a market-based approach and understand the need to develop sustainable supply

chains and the need to provide training and capacity building. In a best practice study, the ARE showcases 18 private ventures in the sector (ARE 2010). While different in use of technology and model, the cases draw on certain indicators to show their development impact: number of people now having access to service, improvement of living conditions or human development and existence of training and capacity building measures. While all projects demonstrate close collaboration with local stakeholders and understanding of local demand and conditions, it is striking that the cases do not provide assessments on local job creation, quality of jobs with the local supply chain and impacts on the labour market. An example of an approach to assessing employment and training is Renac, a Germany-based provider for training in the field of renewable energy. Renac has conducted a first evaluation of their TREE project in 2008/2009 to track the career paths of their alumni in developing countries.

Killing two birds with one stone - assessing and monitoring impacts on job creation and the labour market in line with electrification efforts

The field research in Bangladesh reveals an explosion of entrepreneurial activity. Yet, while institutions such as Grameen Shakti and the IDCOL emphasize the potential for creating green jobs, these institutions do not monitor the changes in the labour market and its social dimensions. Thus, a number of questions remain unanswered such as 1) what is the total number of the jobs created; 2) what is the quality of the new green jobs; 3) what types of jobs are created (full/part-time, homework, field work etc.); 4) do green jobs provide new opportunities for the unemployed; 5) what are the effects on gender; and 6) what are potential unintended negative side effects (such as how are entrepreneurs selling kerosene affected)?

We also saw that current approaches to electrification projects do little to integrate activities and initiatives for assessing and monitoring the effects on entrepreneurship, local industry development and labour. We find that current approaches to electrification projects do not account for the impacts on job creation, employability and entrepreneurship within the industry and focus too narrowly on increasing access to electricity. Often the impacts of the service provision of electrification and the social dimension of job creation and job quality within the industry and the impacts on income generation, poverty alleviation through the industry itself are not aligned. In the cases we reviewed, rural electrification programs measure project objectives by 1) number of systems installed, 2) newly installed capacity and 3) training of new staff. Thus an opportunity is missed within current projects to assess, monitor and understand the effects on the social dimension of the emerging green industry sector.

In November 2008, the World Bank published a handbook “Designing Sustainable Off-Grid Rural Electrification Projects: Principles and Practices” (World Bank 2008). The manual is based on experiences and practices from various projects and underlines the need for tailored solutions to local conditions. One of the principles includes the aspect of social safeguards and environmental considerations. However, it focuses mainly on environmental protection, on hazardous waste and the need for recycling facilities. Based on our previous assessment of a vast gap in understanding of labour and employment factors within the off-grid rural electrification sector, we suggest including a principle targeting inclusive business practice and labour.

In order to spur private sector investments into the sector, it is widely recognized that there is a need for more market information and data at the base of the pyramid. While initiatives have started to collect consumer data and test business models, little has been

done to assess the dynamics within the supply chain and sector. This is difficult as the major driver of rural electrification has shifted from public programs to an increasing number of individual initiatives and private ventures. The recent REN21 report noted that "statistics on renewable energy use in rural areas of developing countries are not being collected systematically" (REN21 2011). Even more so, we observe that statistics on job creation and labour within this sector are not collected at all and little is understood about the labour market and conditions within the sector. It is only since August 2010 that a new program set up by the ILO and the Australian Government on green jobs in Asia intends to look at these questions in-depth[11]. One of the project's aims is to deepen the understanding and commitment for the "promotion of gender sensitive green jobs opportunities" [12]. Amongst others, the project will 1) generate information and data on green jobs, 2) prepare an inventory on green jobs in the country and 3) develop training courses for ILO constituents and national partners to further promote green jobs. As the project will not be completed until June 2012, we will need to wait to draw any general conclusions on the potentials of renewable energy electrification and its social dimensions. There is no doubt that the increasing diversity and number of public and private sector initiatives will further complicate the process of monitoring, documenting, and learning. None the more is it time to address this gap through the development of assessment schemes and indicators.

Key concerns regarding job creation within the sector

Based on our observations we suggest that the assessment could be aligned with the goals of existing rural electrification programs and initiatives. Therefore it will be important to build awareness and capacity to understand employment dynamics and labour issues and to develop a catalogue of indicators and measures. Those should include tools for:

- The promotion and assess job creation within the sector
- The assessment of business performance indicators of SME in the off grid energy sector
- The assessment of workforce dynamics and the quality of jobs created in the sector and the demand in training, standards, regulations and monitoring
- The assessment the social effects of these jobs such as gender to understand local labour dynamics ensure that, for example, certain groups will not be marginalized and discriminated against due to new activities.

It will be advisable that technical assistance:

- continues to invest in business incubators and business plan development for SME in the off- grid energy sector, the promotion of inclusive business and support to vocational and managerial training. It is key to "characterize the alternative/ renewable energy sector as entrepreneurial at its core. People in this sector are not just focused on technology; they are developing innovative business models" (ESMAP 2010).
- fosters the potentials for new job creation by adjoint capacity building programs for unskilled rural workers to quickly adapt to needs in the markets (jobs in the supply chain).
- follows an integrated approach to electrification and local SME promotion and business development in the energy sector.

[11] Countries covered in this project are Bangladesh, Indonesia, Nepal, Philippines and Sri Lanka.
[12] For more information on the project see www.ilo.org/dhaka/Whatwedo/Projects/lang--en/WCMS_157871/index.htm.

So as to include these assessments rural electrification projects can build on the experiences of development projects that foster job creation, social standards and gender equality. Rural electrification projects are very technically oriented. Hence we recommend an interdisciplinary approach by building on the experience of and fostering links to existing social development programs and networks in the specific countries or regions.

Conclusion

Promoting renewable energy improves the livelihoods by mitigating the effects of climate change and creating new job opportunities. Many OECD countries and some emerging economies have already begun to seize this chance – some of them already noticing the positive effects on their labour markets. Growing evidence suggests that the shift to low carbon energy generates the same synergies in developing countries.

As we can see from the case of Bangladesh, the rural off-grid energy sector gives rise to a wide range of new business and employment opportunities. Yet the social dimensions of these new job opportunities are still not fully understood. There is a lack of data on a range of social indicators such as the total number of jobs created, the types of jobs, payments, gender, working hours, motivation to work in the sector etc. As we turned to other pertinent rural electrification programs we found the same striking gap in collecting data on employment. Rural electrification projects focus on increasing access to electricity. Thus their success is evaluated by measuring indicators such as newly installed capacity. In the projects we reviewed, questions of the social dimensions of rural electrification were largely overlooked.

We argue that there is a need to accurately understand the economic and social impacts of the development of a rural green energy economy, especially entrepreneurial activities and gender dynamics. This understanding will contribute to reducing possible negative side effects such as poor labour conditions, economic dependencies, and gender discrimination.

To better understand the social dimensions we therefore proposed a catalogue of indicators and measures. Specifically, we recommended including an interdisciplinary approach when evaluating rural electrification projects and to tap into the experience on and networks of already existing social economic programs.

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