

Thinking in Ecosystems: People, Money, Technology, and Policy

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Webinar Panelists

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Hugo Lucas Porta Hello, ladies and gentlemen. I'm very happy to welcome you to today's session on off-grid solar ecosystems. Let's think about people, money, technology, and policy. I would like to thank the International Solar Alliance and the Clean Energy Solutions Center, who facilitate this webinar series. Some background for me. Before I joined Factor in 2010, I have been Director for Policy and Finance on International Renewable Energy Research Agency, IRENA. I was responsible for the design of the _____ energy work program in the agency.

Previously as Spanish civil servant, I have been involved in many national and European relation for the promotion of renewal energies and energy efficiency. In this lecture, we are looking at off-grid solar through ecosystem perspective, trying to understand the key elements that determine the viability of success of the sector. In this lecture, we will, as always, start with a brief description and definition of what solar off-grid means. And afterwards down into the main body of the presentation. Don't forget, at the end of the presentation, you will be given the chance to test your knowledge with a little quiz.

The learning objective of which this module aims to provide will consist of an introduction to the ecosystem perspective on solar off-grid, as well as more tailored insights on the individual components of solar off-grid ecosystem. As such, we will have a look at, how are policies and regulations to be designed? What are challenges around financing? What are viable business models? How does technology development innovation happen? Why do we need human resource development capacity building? Where can we find and use cross sector linkages?

The off-grid solar sector has evolved and expanded substantially since 2010. At that time, the market was characterized by low awareness and a limited geographical presence, mainly in Sub-Saharan Africa and India. In 2017, the sector by no means can be regarded as marginal anymore, with over 360 million people benefiting from off-grid solar technologies. However, the market remains highly dynamic, and it has to be understood as such. It is therefore important to take into consideration the complexity of factors and drivers that continue to shape it.

This lecture explores the core of this market, ecosystem in which the industry is rooted. The main body of this lecture is divided into two parts. We will start by looking at the off-grid solar ecosystem as a whole and then focus on the individual parts. Let's start off with understanding what we mean by ecosystem. Off-grid renewable energy solution will play a central role in countries' strategies to achieve universal electricity access in a timely and sustainable manner.

The development opportunity is immense, but it requires targeted efforts to create an environment that enables scale-up. This targeted integration are part of an integrated framework of interrelated components, an ecosystem. In order to make off-grid solar solution a viable option, all components of the ecosystem require strengthening. The foundations for _____ of renewable energy deployment comprise dedicated policies and regulations, enabling institutional frameworks, customized business and financial models, and adaptive technology solutions.

This should provide the basis for service providers to access the market, deploy off-grid technologies, and contribute to market development. Complementary efforts are also needed to build adequate capacity across the _____ chain and identify cross sector linkages to further enhance the sustainability of interrelations. As illustrated in this figure, when all these elements come together, deployment can be affiliated in a manner the mass amounts of socioeconomic benefits.

The underdevelopment or absence of functional ecosystem represents the root cause of the inability of social enterprises to scale. Loosely defined, the absence of an ecosystem includes limited ability of a secure human resource, high cost of capital for entrepreneurs, and limited access to affordable financing for other uses. Inadequate support of _____ technology innovation for free application, limited access to comprehensive, reliable information on end users and on supportive assisted policy environments that follow top-down approaches.

Consequently, what is needed to facilitate the success of such social enterprises is to develop wholistic approaches to certain ecosystems in which they hope to thrive. While there was once a focus on technology alone as the key driver in the provision of the centralized renewable energy solution, its significance has reduced. The realization of how important the other aspects are in the provision of _____ access to end use households have made it important to consider a wholistic approach, combining all aspects of the solar off-grid ecosystem. Over the following slides, we will be looking at the

different features of this enabling environment in more detail, starting with a issue of the signed and dedicated policies under who that _____ the relations for the—of this sector.

The main body of this lecture is divided into two parts. We will start out—we have started by looking at the off-grid solar ecosystem as a whole. And then now we are focusing in the individual parts. National _____ Certification stated you need to be backed by dedicated and stable policy and regulatory frameworks. Traditionally, these sector frameworks have to be adapted to support the deployment of the solution. Policies, including incentive structures, need to be signed for _____ sustainable market development. The participation of the private sector will be key to complement the rectification efforts by governments and the _____ agencies and to sustain—and sustain and scale up deployment.

To enable these, a robust policy and regulatory environment is needed to reduce investment risks, improve viability, and increase the overall effectiveness of the sector. Critically, the stability in policy is highlighted to be particularly important, for a simple change in intersection policy when in a schedule changes, and can dramatically alter the economics of a technology and can lead to low _____ in uptake. Additionally, eloquated (sp?) standards and quality control measures are important to avoid proliferation of low-quality system and market disporation (sp?).

Renewal energy based mini-grids are especially dependent on policy and regulations. Thereby _____ and sustainability of mini-grids largely depend on _____ regulations. One approach to setting the targets for private sector mini-grid, it is to import a national uniform _____, which will—however is often too low _____ operation and provides sufficient viability up front. Another approach is to allow limited ties high enough to cover costs, but it still will benefit _____ customers depending on commercial energy in off-grid _____.

The private sector prefers minimal touchpoints with governments to improve efficiency and reduce _____ costs. By bringing greater regulatory _____, clearly defining institutional roles and responsibility, _____ risks for mini-grids can be reduced. The untimely arrival of the national grid may introduce major _____ for the long-term viability of mini-grids. If they find it ahead of time, interconnection and all conversation mechanisms _____ risks _____ may _____.

Even one interconnection provision assist status for the interconnected mini-grids need to be set at levels that are low for sustainable operations. If you are interested in learning more about mini-grid policy design, please see our respective webinars on the topic. Finally, what we need to take away—the policy and regulatory landscape for off-grid is highly dynamic as government introduce dedicated measures. _____ spreading and signing _____ _____ dedication of a more effective framework for market development. This is essential to allow to local conditions and address the specific deployment barriers.

Tanzania constitutes an interesting example of how a positive and advancing regulatory framework for off-grid solar could look like. Tanzania has taken measures for greater private sector involvement in the many sectors _____. Standardized power purchase agreements to cut down negotiation time between regulators and developers. Annual tariff adjustments to address microeconomic changes in the country that are imposed through variation in the changed rate or inflation.

Segmented licenses such that projects below one megawatt do not require license, only registration of site. Projects under 100 kilowatt are exempted from tariff regulation. As well as technology-specific tariffs as offered under the second generation of Tanzania's mobile _____. This is an example of how diligently the signed regulations can stimulate private market engagement.

The core aspects of building the financial link in the ecosystem involves an interest from financiers and investors to provide access to credit, which in turn requires focused capacity building. Factors usually identified as concerns are represented in this figure. This include concerns of grassroots entrepreneurs with no formal business training, as well as those with better education and qualifications and a tailored business plan. As postulated by the ecosystem approach, these issues need to be overcome quarterly; otherwise the sector is unlikely to develop.

Let's look into the details. Low-cost, left, financing primarily for working capital is a key need for entrepreneurs. However, this is often hard to access from banks for _____ and upcoming entrepreneurs with no established credit history. Interest rates with other financial institutions are high. And even with bank loans, moratorium periods are short. All of which make it economically infeasible for a newly established energy enterprise.

Another critical concern is the difficulty in availing patient investment capital on account of high expectation of growth and internal rates of return for the impact investment community, without considering the challenges of creating an ecosystem on the ground. In the case of end user financing, on the other hand, the cost of finance—for example, from banks, microfinance institution, or local financial institutions—and collateral requirements may become prohibitive factors. Lack of willingness of financial institutions to finance for productive _____ and application _____ centralized renewable energy makes this difficult for households to move to application beyond basic lighting.

Consequently, the challenge around financing in the off-grid solar ecosystem have to be met with measures which strengthen financial capacities and foster the development of innovative financing schemes. With respect to capacity building, experience in parts of India have shown that undertaking workshop and meetings with financial _____ about the technology and engagement of former bankers who have actively financed the sector before to discuss the means of reducing of mitigation of risk, innovation in finance, in promoting financial _____. Productive business technology is critical in convincing new financial channels and institutions.

For regulators where the banking channel is not active, efforts are required towards either revitalizing these or capitalizing on alternative financial institutions. Similar rigor is capacity building and _____ is critical. When it comes to investment in this enterprise, this is a need to convince investors on the importance of patient capital and push back on the nature of due diligence process and investment conditions when they do not take note of realities on the ground.

Regarding new innovative financial schemes, the use and adoption of innovative financing mechanisms that reduce the risk of banks, increasing access to loans and improved credit conditions for entrepreneurs _____ the financial link. When a basic financial model is unavailable due to the high risk settings, increased international institution confidence can be achieved by facilitating innovations like loan guarantees and interest subsidies using _____. This can be common where customers have low ability to pay or communities are migrant or illegal or lack land titles and collaterals.

Similarly, in the case of entrepreneurs, there is a need for more work on instituting working capital debt, allowing for lower rates of interest and a reasonable moratory on payment. While there are a number of governments and bank scheming countries to provide this sort of credit, very little is known about the _____ for energy sector.

In emerging markets, microfinance institutions have successfully partnered with solar home service companies to bind their home solar system with micro finance loans. While these did not initially result in increased energy access across most countries, the introduction of pay as you go arranged _____ payment plans and improved _____ payments technology has drastically reduced barriers. This is an example of innovative consumer finance solution, which will _____ so in the future continue to _____ the sector.

Microfinance institution the other—on the other hand are already quite established finance instruments, but one that exemplifies how financing can be approached more holistically. And interesting example is provided by The Netherlands deployment of organizations work in Cambodia. SMB is a not-for-profit international development organization from The Netherlands. In Cambodia, they took up the challenge of fostering the adoption of solar solution. Main barriers included a lack of customer _____ in solar, low consumer awareness of the benefits of solar, limited _____ solution by solar frames, a local financing scheme, limited business management and technical skill among solar staff, and poor sector coordination and policy framework.

SMB implements technical system programs in Cambodia that aims to capitalize the development of sustainable, local, off-grid solar energy industry to improve energy access for _____ household. Among other things, to tackle the market barrier of affordability, the program collaborates with four lending microfinance institution with _____ in _____ and credit high in networks in rural Cambodia, to allow customers to buy solar _____ in installments. Also, the program operated on private sector _____ based incentive found that other

solar companies _____ for each solar _____ installed that complies with the program's quality standard and is financed with a loan from an MFI partner. In this way, both the energy entrepreneur needs, the end user needs are integrated in the design of a supporting scheme.

We now jump to a related component of the off-grid solar business model, the business models through which the service of product is sold profitably. A strong business case can be made for off-grid renewable energy solution, whether for an electric fiber or household industry or a system for _____ based installations. A sustainable operational model should be in place so that customers continue to receive reliable services. In identifying the right business models, a consumer-driven, bottom-up approach is preferred for rapid deployment of off-grid renewable energy solutions, as it allows greater interaction and a learning opportunity for both private sector and the community.

This gives the private sector the visibility and the ability to adapt its technical and business model as required. For mini-grids, off-take risk and revenue generation remain _____ for off-grid renewable energy breakers. In the case of a standalone system, this risk has been addressed in part through innovation in business models and _____ technology for simple to pay as you go systems. In some cases, the energy service itself mitigates the off-take risk as it creates an environment for increased productive activities.

For mini-grids, one way to mitigate the off-take risk is to enter into a PPA with _____ clients, such as telecommunication _____, warehouse centers, and _____ supply, or by diversifying revenue generation and by participating in shared value partners, where excess energy from commercial sites could be supplied to surrounding communities. Public-private partnerships can play a crucial role in enabling the participation of the private sector.

A model for a scalable approach could be partnership with a rural _____ agency like _____ wherein the agency provides infrastructure, and the private sector is responsible for forward innovation plan. But the business model ecosystem component is also closely linked to the finance component. High-risk innovation capital is required to _____ deployment of business models and technologies. Allow learning by doing, and encourage _____ sector development. It is important to foster innovation partnerships, including incubators, to stimulate local innovation and to strength capacity to access finance.

So, what is the pay as you go model about? Business operators and especially business profitability of off-grid renewable energy businesses are limited by the bankability of their potential customer base. Rural households often lack the collateral and the financial power to obtain _____. The traditionally required upfront investment is _____ affordable. A prominent business model adaptation meant to overcome this issue is pay as you go financing.

A pay as you go company essentially rents consumers a solar home system that comes with a battery, a charge controller, a solar panel, LED bulbs, and a _____ charger. Basic systems have enough power to transform sunlight, and

larger ones could power a small appliance like radios or TV. The first approaches of this business model were tested already in 2010 in Eastern Africa. And since then, the concept has developed into a continuously growing, worldwide industry.

Put very simple, in the pay as you go approach, customers pay only for the electricity they use. _____ small installments pay on the _____, most often through mobile money infrastructure. The hardware in the solar device regulates usage, disabling the energy services when the customer prepaid use is used up or expires. Under some pay as you go models, the device permanently locks at the end of the lease period, and _____ to the end customer. Difference along the financial model spectrum will be discussed in a minute.

Today there are issues with technology innovation on many different fronts. While research continues into improving panel technology and reducing costs significantly, improvements in battery technology which have a clear bearing on the _____ life, renewable energy systems have still not made enough progress to warrant a study local supply in underserved regions at affordable cost. Similarly, improving efficiency and innovating on _____ such as televisions, motors, _____ has been limited, ultimately effecting the end user ability to access additional productive use in household appliances, certainly in some parts of the world.

In cases where innovation is occurring, there are hardly any standards for comparison of products to determine the working under _____ conditions. Often quality assurance is lacking on these newer efficient technologies, and manufacturers make claims based purely on in-house testing of products. This, however, is insufficient in a sector where end use happens in a completely different set of circumstances that are often difficult to predict. Hence, there is no way around field testing.

Such testing is often _____ and time intensive for individual enterprises and can easily eat into the revenue streams of enterprises. In order to address these issues, a great trust is required to field testing of off-grid appliance, in addition to assisting lighting solutions for faster implementation in rural and _____ and poor communities to facilitate movement of household up to the energy level. There must be a great _____ on bringing these solutions to high energy access tier levels, with supportive financing for small entrepreneurs. Centralized _____ development and quality assurance significantly for this sector will be a move in the right direction.

As we can see, there are _____ links both to the ecosystem components of finance and regulation required in order to facilitate these developments. Especially finances once more important. Flexible financial resources and self-funding should be allocated, developing research facility that can further build sustainable models. For example, through field based testing and pilot programs in a specific context for the centralized renewals energy as well as on inefficiency. This can also be made possible through unique entities of _____ and _____ agencies.

Capacity building and vocational training is key to increase sustainability of projects and programs and generate greater socioeconomic impact. These need to be integrated into off-grid renewable energy _____ from the signed for different stakeholders in the sector, including end users, enterprises, financial institutions, and policy makers. The need for skilled human resources in the sector is large and so far has not been fully addressed.

While the sector is _____, it is critical to address the development of human resources at all organizational levels for renewable energy enterprises—operations, sales and marketing, finance, servicing, research and development, and community involvement. The centralized energy programs often lack rural _____ implementors with low _____. Further, there seems to be little availability of appropriate skilled human resources at the local level. Building up this capacity is difficult.

This time and resource intensive need is currently being made _____ by the entrepreneurs who are already stretched for resources. Individual organizations are _____ to invest in the most basic skill training. To reduce the cost of training and skill development incurred by individual entrepreneurs, there must be a _____ on creating curriculum and teaching models for training of renewable energy technicians, operators, or micro entrepreneurs.

For example, in a country like India, the _____ training institutes and rural development and self-employment training institutes in rural areas and some urban areas can then be utilized to disseminate these _____ at the local level and build more power on the ground. The capacity development ecosystem goes beyond the training of the _____ salesmen or the raising of awareness in community.

What has been touched on before is the critical need to also make finance personal reach and understanding an appraisal of what the off-grid solar sector is and how it works. There is a _____ link between the ecosystem component and finance and capacity.

The off-grid _____ sector features various aspects like health, _____, education, and job creation. _____ the employing of off-grid renewables have achieved the SDG _____ while also contributing to several other SDG's, including those related to polity elevation, _____. Policymakers at growth sectors should integrate off-grid renewables as a pillar for development, thereby facilitating achievement of these SDGs.

The decentralized model _____ renewables allows them to cater to local energy demands in areas not served by the main electrical grid, supporting rural communities as they move up the energy ladder. Off-grid renewables can also be tailored to different applications and settings, such as health _____. The left side of this table presents off-grid _____ in the rural _____. Agricultural and _____ food related activities are the share of rural economy.

Therefore, growth in that economic sector is among the most effective ways for poverty elevation. Introducing off-grid renewable energy technologies along different status of the agri-food chain, to deliver a fuller, more secure, environmentally sustainable energy can boost productivity, reduce losses, and increase resilience to climate _____.

The right side of the table introduces the role of off-grid renewables for healthcare. Many health facilities in rural settings continue to operate without electricity. Furthermore, facilities with access often have an unreliable supply. These generators were used struggle with both high fuel costs and unreliable fuel delivery. This lack of access to reliable energy contributes to the healthcare challenges developing countries face, including high material death rates largely due to limited access to _____ and emergency _____ and ruining of vaccines due to poor _____ training services.

Access to electricity plays a critical role in the functionality of healthcare facilities and the quality, accessibility, and safety of health services delivered to rural communities. Electricity is necessary to operate critically needed medical devices such as emergency _____ cart and diagnostic equipment, as well as to refrigerate vaccines, blood, and medicines. Electricity is also needed for the operation of basic amenities such as lighting, refrigeration, ventilation, and communication within the healthcare context. Without energy, many lifesaving interventions simply cannot be undertaken.

The effect of off-grid renewable energy _____ effects cross sectors. When rural household receives solar consistent or access to mini-grids, their quality of life is improved, and the extra hours of light, and the time saved through the use of _____ device as well as the access to information technology devices may on their own be factored that also improve the saving and earning potential of household members. Also larger systems that are used in community setting may have a wide range of positive effects on the members of the community. For example, as discussed before, for the _____ of access to improved healthcare services.

The productive use of energy can further more readily provide economic opportunities. Customers may be able to improve their current economic activity or even start a new one after receiving access to electricity. Especially solar _____ can often be obtained as bundle kits with so-called productive use appliance. A recent study by _____ found that almost 60 per cent of the solar house system customers undertake more economic activity due to their purchase of such systems.

Of these, for 24 per cent of solar _____ component in their income-generating activity. And for seven per cent the solar _____ enable household members to get a new job. With a growing offer of productive use appliance, this development is likely to gain momentum. In the presenting _____ pathway through which access to electrification can literally improve economic opportunities, livelihoods, and inclusive growth from within a community. Clearly, however, these will only work if the full off-grid solar ecosystem is intact.

Concluding remarks. The off-grid solar ecosystem is a concept or framework, but one that aids in understanding the finances of the sector and in the context. The components of the ecosystem are all important, and intervention can leverage synergies between them. Fully promoting all components of the ecosystem can drastically improve not only _____ but also contribute to poverty elevation, health improvements, and economic development.

And with this, we arrive at the end of this lecture on ecosystem. I would like to thank you for participating. Please remember to take the opportunity to test your knowledge through our little quiz.

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