Climate Change as a Driver of Energy Efficiency in MSMEs

Compendium of Global Success Stories in SOLAR ENERGY

ISA INTERNATIONAL SOLAR ALLIANCE

YES INSTITUTE THINKING INDIA

YES BANK
During the COP21 held in Paris, 121 countries came together to launch the ‘International Solar Alliance’ (ISA) for the cause of climate justice, sustainable development and energy security for all. An idea then, ISA has now transformed into a movement with countries and global agencies endorsing this initiative of Government of India to promote solar energy in the countries that are rich in ‘solar resources’.

It is encouraging to know that United Nations Development Programme and World Bank are already exploring synergies with ISA to deepen strategic co-operation in solar energy and establishing robust knowledge management systems. We have requested World Bank for supporting ISA in mobilising USD 1,000 billion in investments that would be required to meet the ISA’s ambitious goal to massively deploy solar energy.

We envision ISA as a unique ‘implementation-focused’ alliance and the 3P Model of Partnerships, Programmes and Planning would be key in achieving this. The Indian Government is committed to promoting ISA and believes that the interested parties need to come together to share ideas, best practices, knowledge, technology and resources towards a global low carbon transition. This requires the establishment of a strong knowledge-sharing platform to locate and popularize each small and large stride already being taken in each and every unidentified corner(s) of the world.

In this spirit, the Ministry of New & Renewable Energy and YES Bank have partnered to prepare this Compendium of successful innovative stories of deployment of solar projects across the globe. These stories were chosen based on new technology, deployment scheme, compelling business model, unique financing structure or enabling policy framework.

This Compendium would provide an apt reference for learning from each other’s experience and for replicating successful models and projects in various ISA nations. I am confident that this initiative will contribute in showing the way forward to all partner countries, and be of assistance to them in promoting solar projects.
FOREWORD

The world’s energy demand is projected to experience a staggering growth of 48% from 2012 to 2040. This ever-increasing demand, coupled with dwindling fossil fuel reserves and the increasing concern for climate change have brought the world to a stage where transition to a low carbon and climate resilient economy is the only way forward.

Renewable energy sources have been embraced by the world as the fastest-growing source of energy, at an average rate of 2.6%, with investments in renewables rising to nearly USD 286 billion in 2015 alone – a six fold increase as compared to 2004 and, for the first time, more than half of all added power generation capacity, and a fourth of the world’s electricity needs being met by renewable energy today.

Given these positive developments, all stakeholders including financial institutions, investors, governments and businesses need to mobilize green capital, channelize flows away from the unsustainable practices and take de-carbonization to the next level of maturity. However, the gap of USD 70 billion in climate finance needs to be bridged by institutions such as World Bank Group, Asian Development Bank, African Development Bank and other multilateral and bilateral agencies will have to come together for developing innovative financial mechanisms including credit enhancement schemes as well as reducing high hedging costs to create a larger impact. Further, mainstreaming of low carbon development and greater adoption of clean energy would need leveraging the ‘power of the collective’ to work with momentum and make this transformation happen.

The historic launch of International Solar Alliance (ISA) in November 2015 at COP21 has created a new global landscape for galvanizing ‘collective action’ towards greater solar energy adoption. This requires global multiactor coalitions, to come together with enormous amount of will, favorable policies and ability to mobilize the USD 1,000 billion towards solar. Each member country would need to take into account its current infrastructure, natural resources and the stage of its socio-economic development to move forward towards a low carbon economy. A powerful coalition like the ISA, has presented a unique opportunity to accelerate momentum within countries, businesses and financial institutions to champion innovative pathways, reshape global action and invest in green technologies and solutions to scale up climate revolution.

Aligned to this, in its endeavor to support the mammoth renewable energy targets of the Indian Government, YES BANK, fifth largest private sector bank in India, has proactively committed to target mobilizing USD 5 billion towards climate action in India by 2020, including funding 5,000 MW of clean energy. With one of the largest renewable energy portfolio in the country, the bank has facilitated financing towards generation of 1,311 MW in FY 2015-16, out of which solar projects constituted a significant 74%.

Through our experience in the sector, we have realized that there is a need to maximize capital flows, access to new technologies and expertise and seamless exchange of knowledge amongst stakeholders.

I would like to thank the ISA Secretariat and the Union Ministry of New and Renewable Energy for providing with an opportunity to partner and provide insights on successful case studies from across the world in this Compendium titled “Global Success Stories in Solar Energy.”
I am confident that this compendium would serve as a harbinger, enabling all stakeholders to take pride, learn and adapt from the many successful stories presented. This compendium would be a valuable resource for policy makers, development finance institutions, social entrepreneurs and developers in improving their understanding of how ‘Solar’ can fuel a Renaissance in the global economy.

Thank You.
Sincerely,

Rana Kapoor
Managing Director & CEO
Chairman

[Signature]
We would like to express our profound gratitude to various stakeholders for extending their exceedingly valuable observations, comments and sharing the cases that have helped make this report holistic. Our special thanks to Ministry of New and Renewable Energy, Government of India for guiding us during the process of developing this report. We would also like to thank the following for their contributions:

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INTRODUCTION
Introduction

The year 2015 marked the convergence of the world at two important occasions – launch of the Sustainable Development Goals and the Conference of Parties, both with the underlying message of enabling, supporting and promoting sustainable development. Global leaders agree that there are no two ways of moving ahead and sustainable development is the only way forward.

Economies across the world acknowledge this challenge and are looking at new means of growth which are economically, environmentally and socially viable. Low carbon transition is bound to play a key role in this new world order. With this vision of providing access to clean energy through solar power, France and India with support from countries across the world launched the International Solar Alliance (ISA) during the Conference of Parties 21 held in Paris last year.

GATHERING STEAM

The ISA with 121 potential member countries will serve as a common platform for cooperation among ‘solar resource rich’ countries lying between the Tropic of Cancer and Tropic of Capricorn. ISA brings together countries facing similar issues mainly absence of universal energy access, energy equity and affordability, despite of being solar resource rich. All these issues would be addressed through ISAs focus on promoting solar technologies and investments in the sector, formulation of projects and programmes to promote solar applications, developing innovative financial mechanisms to reduce the cost of capital, building a common knowledge platform, facilitating capacity building and R&D among member countries and collaborating with multilateral bodies like International Renewable Energy Agency (IRENA), Renewable Energy and Energy Efficiency Partnership (REEEP), International Energy Agency (IEA), Renewable Energy Policy Network for the 21st Century (REN) and United Nations bodies.

ISA has gained a great deal of momentum by exploring synergies to deepen strategic cooperation in solar energy and bringing relevant stakeholders together to realize its stated mission and vision. ISA has partnered with United Nations Development Programme (UNDP) to leverage UNDP’s global development network for promoting solar energy and sustainable development. Both, UNDP and ISA declared their support to promote solar energy globally by developing synergies with ongoing UNDP programmes and projects on solar energy in and across ISA member countries.

During the World Bank President’s India visit, the Interim Administrative Cell of the International Solar Alliance (ISA Cell) and the World Bank came up with a joint declaration, wherein World Bank as a financial partner would support prospective ISA member countries in mobilizing USD 1,000 billion in investments. This move would leverage World Bank’s global outreach, knowledge and financial capacity to support ISA focus areas.

In the eight months since its inception, ISA has held three international steering committee meetings in Paris, Abu Dhabi and New York and the meetings of ISA tell have also been convened USA, UK and EU have also shown interest in developing a joint programme under the aegis of ISA. All these positive developments are moving the needle in the right direction and are inspiring other countries to join the ISA.

This impetus is only going to increase in the lead-up to COP 22 in Marrakech, where the World would get together to arrive at an action-oriented approach to address climate change and review the progress made so far. The achievements and milestones by countries in the field of clean energy will serve as a guiding example for greater uptake of renewable energy thus providing impetus to the ISA.

Under the visionary leadership of Honorable French President and the Indian Prime Minister, ISA is leading the way for making solar energy a valuable source of affordable and reliable green and clean energy. Foundation stone of the ISA Headquarters was jointly laid in Gurugram, Haryana, India led by France and India. French Development Agency
has allocated EUR 300 million to develop solar energy over the next five years in order to finance the initial projects. The Indian Government has committed financial support of INR 400 crore and is playing an instrumental role in forming a secretariat for the Alliance and supporting it for five years.

TRANSFORMING THE GLOBAL ENERGY SCENARIO

ISA aims to leverage the power of Government and Country level coalitions to foster strategic relations and promote meaningful dialogues. The ISA is bringing together investors and financiers in high-profile events in New Delhi, Kenya, Peru and Indonesia. The RE Invest held in February 2015 in India brought together commitments from 14 companies across seven countries to install 58,000 MW of renewable energy in India till 2020. 22 public sector undertakings (PSUs) and 257 private companies pledged 18,000 MW and 190,000 MW respectively. Banks and NBFCs also committed INR 3.94 lakh crore to finance these projects. The success of RE Invest substantiates the fact that conferences like these bring together key actors like Governments, policy-makers, multilateral agencies, bilateral organizations, solar innovators, developers and financiers, to catalyze collaboration and coordination amongst member countries.

The International Energy Conference, being held currently along with the ‘Switch Global Expo’ in Vadodara, Gujarat will also serve as an opportunity to further the dialogue amongst like-minded institutions, one of the primary focus areas of the ISA.

Another important focus area under ISA includes sharing of best practices and successful case studies, which are realistic, replicable and scalable. Diffusing the key learning on new technologies, innovative financing mechanisms and business models, enabling policy frameworks would promote knowledge sharing and encourage more countries to step forward and replicate the best practices in their own countries.

To augment the knowledge sharing, YES BANK partnered with ISA and released a report ‘Financial Structures for Solar Energy’ bringing together some of the existing and innovative financing structures that can be utilized towards channelizing finance available at global and national levels towards investments in renewable energy, particularly, solar energy. Further to this, MNRE, ISA and YES BANK have partnered to prepare a compendium of solar energy success stories from across the globe.

ABOUT THE REPORT

The compendium is a collation of case studies from different geographies highlighting the challenges faced, breakthrough solutions, project outcomes and the learning from project implementation. Each case attempts to bring out the distinguishing feature of the project, which has the potential of being replicable and scalable across the geographies with comparable conditions.

The report has been prepared through a combination of primary and secondary research. The case studies included are put together in consultation with the Indian Ministry of New and Renewable Energy (MNRE) along with feedbacks and suggestions from some of the ISA member countries through surveys, personal interaction and telephonic interviews.

It is indeed a step in the right direction and will go a long way in guiding the member countries to replicate some of the best practices adopted globally, while taking into consideration their individual constraints.
Legends in the cases

Prospective ISA Countries

Other Countries

Policy Support

Business / Technology Innovation

Financial innovation
SUCCESS STORIES

Africa
SUCCESS STORY 1
Scaling the Solar Market Garden, Benin

BACKGROUND
Areas in Benin have long dry season which can last from six to nine months in a year making it unfavorable for farming. At times, the region receives scanty rainfall which further aggravates risks of poverty, illness and malnutrition. The vast majority of rural women in Benin derive their livelihood from subsistence farming and are mostly off grid with no access to electric grid. High prices of fuel make it difficult for the farmers to rely on diesel pumps. Groundwater table in the region is low and unreachable through conventional wells. Carrying water traditionally is time consuming leaving people with no time for other income generation activities.

CHALLENGE / PROBLEM STATEMENT
The major challenge is to ensure food security by finding a way to overcome the prevalent lack of water, that could grow food, which is a large contributor to the vicious cycle of poverty and poor health in the district.

SOLUTION
To solve this problem, Solar Electric Light Fund (SELF), a United States non-profit organization, developed an innovative way to use solar energy to power a well pump to draw water from an underground aquifer and filling a ferro-cement reservoir from where the water is gravity fed through a drip irrigation system into gardens. The system became popular as a Solar Market Garden (SMG).

Farmers can achieve higher yields over larger areas with less water and labor by adopting drip irrigation.

The estimated cost of each SMG is about USD 20,000, exclusive of the cost of drilling a borewell. These SMGs when used to cultivate high-value crops, provide a payback within 2-3 years.

RESULT
- 400 women work at the 11 gardens in 10 villages in northeast Benin, directly benefitting 3,352 family members
- 66,000 people have access to fresh fruits and vegetables grown throughout the year
- In 2013-14, dry season, SMGs yielded 27.7 metric tonnes of produce valued at USD 40,000

KEY LEARNING
- This model has proven to be a transformational model in helping fight against the environmental conditions of semi-arid regions
- With the right amount of institutional support (funding and capacity building), this model can help solve the most pressing problem i.e. food security
- The model can be replicated in other low income countries and can help improve the economy of a country
SUCCESS STORY 2

Blazing Tube Solar Cooker, Burkina Faso

BACKGROUND

There are over 59 million refugees around the world, internally displaced, or seeking asylum. With no access to modern cooking and fuel options, crisis-affected people have to risk their health and safety to cook their daily meals. The United Nations High Commissioner for Refugees (UNHCR)’s found that individuals spend an average of 31 hours per month on firewood collection.

CHALLENGE / PROBLEM STATEMENT

Refugee women walk for several hours a day to collect firewood in unfavorable weather conditions and the use of the same for cooking exposed them to various health risks (including respiratory infections from smoke). The challenge is to find an alternative, clean, innovative and cost effective means of cooking to address these issues.

SOLUTION

United Nations High Commissioner for Refugees (UNHCR) and its partners, Caritas Burkina Faso (OCADES) and HELP, have worked to introduce renewable energy for cooking into Saag-Nioniogo, Mentao, and Goudoubo refugee camps in Burkina Faso. The solution offered is the Blazing Tube, a solar reflector that generates heat, which is transferred to an electronic glass tube containing the oil. The vegetable oil when heated becomes more fluid and overflows into a container, into which a cooking pot is placed, creating a bain-marie. The vegetable oil at its peak can reach 200°C, enabling fry cooking.

The blazing tube has proved to be successful in tapping the immense potential of solar energy in Burkina Faso and provided as an alternative to fuel-wood as a source of energy.

RESULT

✓ 13,577 households residing in the 3 refugee camps (as on 2013) are no longer exposed to harmful emissions from burning of fuel wood and as a result have improved their health conditions

✓ The stove saves a lot of time and effort of the refugees as they no longer have to collect fuel wood

KEY LEARNING

✓ Solar cooking solutions can be scaled up to change the lives of other crisis-affected populations
SUCCESS STORY 3

Solar Bakery Project, Burundi

BACKGROUND

Burundi is an agricultural economy, a sector which employs 90% of its inhabitants. Only 36% of the land is arable and the country is densely populated with high population growth. These factors create risk for realizing the goal of food security.

Further, an additional layer of complexity is added due to the growing threat of climate change which impact the rainfall and weather patterns. It is estimated that extreme floods and drought may lead to a decrease in yield by 5-25% in the coming decades and decline of 2.4% of GDP per year on a long term basis.

CHALLENGE / PROBLEM STATEMENT

Wood, charcoal and peat account for 96% of the primary energy needs of the country. Wood is used for cooking and is a common source for energy needs in, both, rural and urban areas.

Burning of wood is not only inefficient but also adds further to the challenge of climate change, triggering a vicious circle of larger risk of climate change and declining agricultural yields and thus lower growth of the economy.

SOLUTION

An attempt to create a breakthrough and avoid use of wood for cooking was made by Regions20 and CIRID (Centre Indépendant de Recherche et d’Initiative pour le Dialogue) in 2014. The concept was to replace wood with an alternative to produce baked goods. Pilot was conducted at Gitega, by providing solar ovens to a small bakery, employing 13 women which eliminated the use of wood fired oven.

Social impact of the project was in form of reduced health risks, as the bakers were earlier exposed to large amounts of smoke.

The solar oven was also more economical, as it incurred no costs on fuel usage, whereas earlier, bakery incurred high costs on purchasing firewood. The price of wood kept rising forcing the bakery to temporarily shut down.

Once the solar ovens were deployed to the new bakery, a two-week training course was conducted for the bakers on using the ovens, business management aspects such as accounting, planning, strategy and marketing.

The oven being used is called the “Villager Sun Oven,” manufactured by Sun Oven International (a US-based company). The Villager Sun Oven is easy to use and is highly adaptable to changing weather, as it can be rotated to face the sun, and comes with a propane back-up system to be used when it rains. The oven is mounted on a trailer making it easy to transport, and has collapsible reflectors that make it secure for storage.
RESULT

✓ Villager Sun Oven is capable of baking hundreds of bread loaves each day and allows the users to save over 150 tonnes of firewood each year, thus reducing the emission of greenhouse gasses by around 277 tonnes CO₂

✓ The bread produced by the oven is 30% cheaper than regular bread sold elsewhere

✓ The bakery was much more profitable due to lower cost of production

✓ Provided sustainable employment opportunities and focused on women bakers

KEY LEARNING

✓ If thought about innovatively, solar energy based applications can find solutions to some of the gravest problems. Solar ovens, reduce impact on environment, reduce emissions, create sustainable livelihoods and support food security objectives of countries.
SUCCESS STORY 4

Facilitating Access to Solar Energy through Microfinance, Cameroon

BACKGROUND

In Cameroon, 46% of the population, which accounts for about 9 million people, lack access to electricity. In rural areas, the proportion is as high as 83%. The rural populations are not connected to the national grid and mainly depend on kerosene lamps and flashlights for lighting which are both costly and dangerous. A survey carried out in 2013, confirmed that 100% of the respondents were dissatisfied with the state of their access to electricity.

CHALLENGE / PROBLEM STATEMENT

Lack of electricity in the region has been a major obstacle for improving the living standards and local economy of the region. Few locals have generators which are used sparingly due to the high fuel costs and requirement for regular repairs.

Given this scenario, solar energy offers a solution but not an easy one as it brings its own set of challenges including:

- Lack of financing solutions to provide for up-front cost for solar
- Paucity of solar solution providers in rural areas
- Lack of information to select reliable solutions

SOLUTION

In Cameroon, two networks of Self-Managed Village Savings and Credit Associations (CVECA), the Association des CVECA et CECA du Centre du Cameroun (A3C) and the Union des CECA et CVECA du Grand Nord (UCCGN), launched the energy and micro finance program to overcome these barriers. The program included:

- Selecting quality solar solutions and reliable suppliers capable of providing high-quality services to clients (by partnering with Schneider Electric and its distributors)
- Developing appropriate financial products, based on a risk management approach. The financial products that were developed included:
  - ‘Lighting Loan’ to enable investment in small solar solutions for home energy needs such as lighting and mobile phone charging
  - ‘Energy Loan’ to finance larger solar solutions for equipment used by micro and small enterprises
- Strengthening the skills of microfinance institutions, to manage the technical aspects related to access to energy and solar solutions
- Dividing roles between the microfinance institutions and solar solutions distributors so that the clients could understand the responsibilities of each
- Developing the necessary tools and procedures to educate customers on correct usage of their solar solutions in order to avoid errors that could damage the equipment (local technicians were trained to install and maintain solar solutions)

RESULT

- Within a span of four months, 231 solar kits had been distributed for a total of USD 30,220
- More than 1,400 rural people were trained on the concept of solar energy
- This pilot project confirmed that access to solar energy meets a very high and solvent demand
KEY LEARNING

✓ Facilitating synergies between microfinance and energy by building strong local partnerships between microfinance institutions and solar solution distributors can pave path for reaching out till the last mile (in rural areas with relatively lower incomes) and thus facilitating greater opportunities for the communities

✓ Educating clients, distributors, microfinance institutions on proper use of the solutions, ensuring maintenance, basic technical know-how and after sales services form an important pillar of success of solar solutions at the bottom of the pyramid
SUCCESS STORY 5
Solar Desalination Systems, Cape Verde

BACKGROUND

Cape Verde is an island state in west Africa and has high renewable energy potential. The average solar radiation is estimated to be 5.71 kWh/m²/day. The country has taken up a target of achieving 100% electricity access by 2017 and switching to 100% renewable electricity by 2020. There have various policy measures that have been taken up by the Government in this regard such as mandating use of solar water heaters in new buildings, developing renewable energy clusters and tax benefits.

It is an island nation, clean and safe drinking water remains a challenge for the inhabitants.

CHALLENGE / PROBLEM STATEMENT

Cape Verde’s access to sustainable water resources is the second lowest of any country in Sub-Saharan Africa. Certain areas of the country do not have piped connections and rely on water supplied through trucks, which pose risks of contamination and limited supplies. The groundwater available in the area is brackish and non-potable.

SOLUTION

To solve this problem, the island municipality signed an Memorandum of Understanding (MoU) with, Netherlands based, Elemental Water Makers, (in January 2016) to set up a project to provide 50,000 liters of drinking water per day to a village of 1,300 people.

This water would be provided to the village by the help of a desalination plant that converts brackish sea water to affordable fresh water. The continuous desalination process happens while using only fluctuating renewable power sources like solar energy.

Following the MoU, the company would sign a definite Water Purchase Agreement with the municipality. Through this long term agreement, the investment would be refunded over time through sale of water. This also means that the company would be involved in both construction and service phase of the project reducing post commissioning risks.

RESULT

✓ Provided clean and safe water to the local community
✓ Eliminated dependence on electricity and trucks for water supply

KEY LEARNING

✓ Solar based desalination reflect a scope for providing water through a decentralized set up for islands which lack access to clean and safe drinking water
✓ Solar based desalination reduces the electricity costs in long term and impact on the environment
SUCCESS STORY 6
Solar Drinking Water Supply, Chad

BACKGROUND
Am Nabak, a refugee camp located in Chad, a landlocked country suffers from water scarcity. It is situated at 1000 meters above sea level on a solid granite plateau with limited access to groundwater due to the geography. The camp houses 13,000 displaced people and was supported by trucking 140,000 liters of water per day. The trucks had to carry the water for distances of about 50 km which proved to be expensive and were prone to risks of contamination and breakdown.

CHALLENGE / PROBLEM STATEMENT
Building a sufficient water supply system in Am Nabak while addressing the following issues:
- Dry riverbeds at low depths of about 15 meters with continuously dropping water level until refilled during rainy season
- Wells being blocked by sand if too much water is pumped out

Borewells and open wells were not able to surmount these issues. Therefore, a revolutionary reliable method of providing water to camp was needed.

SOLUTION
To overcome this problem, three options were analyzed:
- Transport of water instead of installation
- Install a diesel based water supply system
- Install a solar water supply system

Transport of water instead of installation
Transporting water through trucks would have saved in the installation costs however, incurred costs for transporting water over long distances as no water sources were available in the vicinity. This makes the transport system extremely inefficient. It was observed that the cost for acquiring and installing the solar water pump system was only 20% of the regular water transport cost per year.

Installing a water supply system
Given the complexity of the scenario, original pumps at site were replaced with Lorentz helical rotor pumps which are designed for low volumes of water, delivering constant flow rates and reduce turbulence inside the well, thus preventing blockage.

The pumps have an output of approximately 20,000 liters of water per day. A combination of these pumps was installed at the site, each of which being connected to a 70,000 liter water storage tank.

As the volume pumped out of the storage tanks is set a little less than the conventional pumps used earlier owing to which, there is always a minimum flow of water.

This system can either be powered through diesel generators or through solar based system.

Diesel based supply system
A comparative analysis showed that even though installation costs for diesel based system would have been slightly lower, savings in lower costs for AC pumps and diesel generators are outweighed by higher maintenance cost after just two years in operation. Maintenance of the diesel generators would also require skilled labor and intensive servicing and parts replacement and regular intervals.

Diesel generators would require regular supply of fuel and installing a fuel well at the site would mean guarding and extra costs.

Solar based supply system
Even though local people were trained by HELP to maintain the system, regular maintenance for the solar system only means cleaning the panels. On a five year scale, cost savings amount to more than USD 3,000,000 which may be used for other projects.
Cost saving over time, for daily water requirement of 160,000 liters, assuming an annual general cost increase of 3% and an annual 10% increase on fuel, are presented in the below table.

<table>
<thead>
<tr>
<th>Energy source</th>
<th>Water transport (USD)</th>
<th>PV (USD)</th>
<th>Diesel (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well building</td>
<td>0</td>
<td>49,000</td>
<td>49,000</td>
</tr>
<tr>
<td>Pumps and installation</td>
<td>0</td>
<td>27,500</td>
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<td>Yearly Operational cost</td>
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<td><strong>1 year cost</strong></td>
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<td><strong>5 year cost (no cost increase)</strong></td>
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<td><strong>5 year cost (cost increase)</strong></td>
<td><strong>3,311,769</strong></td>
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<td><strong>182,939</strong></td>
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</table>

Source: Case study - Solar drinking water supply, Am Nabak, Chad, Lorentz, July 2015

**RESULT**

- The camp has a stable water supply and supports the local population. Each of the eight pumps, deliver the designed 20 m³ of water per day, providing 160,000 liters of water for the camp and the local population. The overflow system in the transit tanks provides drinking water for cattle on site.

- The delivered output exceeding 10 million liters of water is equivalent to more than 250 tank truck transfers. Hence an enormous amount of fuel is saved by using solar powered water supply.

**KEY LEARNING**

- Solar water pumps provide for a lucrative model for solving issues of water scarcity even in areas with a low water table.

- This model can be easily replicated in ISA countries having scarce water resources.
BACKGROUND

Egypt represents Africa’s most populated energy market and is the largest oil and gas consumer in the continent. About 94% of total primary energy consumption in Egypt is from fossil fuels. In a bid to diversify the energy mix the Government has set a target to achieve 20% of generated electricity from renewable energy by 2020.

The country is blessed with adequate solar radiation with about 300 days of sunshine. Two-third of the country has solar energy intensity of more than 6.4 kWh / m² day (an annual global solar radiations of 2300 kWh / m² year)

CHALLENGE / PROBLEM STATEMENT

Egypt is facing rapidly growing energy demand due to population growth, economic expansion and increased industrial output, among many factors. It suffers from frequent power outages due to ageing infrastructure, and the lack of adequate generation and transmission capacity. Shortfalls of both fuel and transmission capacity have led to regular blackouts. The country’s production of oil and gas is declining and the country has begun importing gas for the first time.

Also, provision of large subsidies bestowed a cost advantage to fossil-fuel sources in comparison to renewable energy sources, thus acting as a barrier to renewable energy sources. High costs of solar PV and lacked Government incentives posed a major challenge towards widespread uptake of renewable energy in Egypt.

SOLUTION

In 2014 the Government introduced a series schemes to tap the country’s renewable energy potential.

- Feed-in tariff (FiT) scheme: Launched for both solar and wind renewable energy projects, FiT would support grid connected renewable energy projects. Egypt plans 2,300 MW of solar (including 2,000 MW of larger solar PV projects ranging from 500 kW up to 50 MW, 300 MW of solar PV projects below 500 kW) and up to 2,000 MW of wind generation in the first regulatory period

Households will receive USD 0.12 per kWh, whereas large scale commercial projects between 500 kW and 20 MW will receive USD 0.14 per kWh and those producing 20 MW to 50 MW will be entitled to USD 0.14 per kWh. The feed-in rates will vary depending on usage.

- Subsidy Cuts: In early July 2014 the Egyptian Government announced energy subsidy cuts leading to increase energy prices of diesel, gasoline and natural gas paid by residential and commercial customers. The most significant step was the 64% hike in diesel prices. Removing this cost advantage through subsidy reform has fostered development of the renewable energy sector in Egypt

Also, using renewable energy resources to meet domestic demand can free domestic fossil-fuel resources for export, with associated revenue benefits for the country.

- Reduced Customs Duty: Renewable investors will only pay 2% import duty on any imported materials or equipment used in FiT eligible projects (a significant decrease on the usual duties)
Customs duty on solar water heater parts and LED bulbs is removed encouraging the increased use of energy-efficient technologies.

RESULT

✓ A total of 187 local and international applications have been received for the first period:
  o 13 have already qualified for PV installations under 20 MW
  o 69 have been approved for PV projects above 20 MW
  o 28 have been prequalified for the wind scheme.

✓ It is expected that contracts for all 4,300MW of installed capacity will be awarded by the end of 2016.

✓ The fiscal deficit has gone down considerably on account of slashed subsidies that were granted to the fossil fuel / petroleum industry

KEY LEARNING

✓ Satisfactory Government support can help the development of the nascent renewable industry and help lead to the path of sustainable development
SUCCESS STORY 8

Solar Micro-grid, Equatorial Guinea

BACKGROUND

Annobon Province is an isolated island of Equatorial Guinea with a population of about 5,000 residents. The residents only have reliable electricity for up to five hours per day and spend an average of 15-20% of their income on supplemental power. Diesel generators are used to provide power in this area.

CHALLENGE / PROBLEM STATEMENT

Diesel generators cannot be counted on for reliable electricity as they are prone to breakdowns especially in warm temperatures. Furthermore, these generators are loud, polluting, leading to environmental degradation and prove to be expensive in the long run.

The challenge is to look for an alternative environment friendly, reliable source that would withstand high temperatures while providing electricity throughout the day and reduce the expense of generation in order to become a better functioning island.

SOLUTION

As a part of accomplishing the target of making the country an emerging economy by 2020, the Government sought for outside help to overcome their power dilemma. The Government contracted US company MAECI Solar, in collaboration with GE Power & Water and Princeton Power Systems, to install a 5 MW solar micro-grid system on Annobon Island. MAECI Solar provided the solar modules and system integration while Princeton Power was responsible for the energy management system and controls.

Princeton Power Systems built the 5 MW self-sufficient solar micro-grid, consisting of 20,000 solar panels split into three geographically-separated arrays, three large-scale advanced battery banks and redundant generators on Annobon Island. The micro-grid was enabled by Princeton Power Systems 250 kW battery integrated inverters, used to condition the power from the solar arrays to manage power flow between the different sources and loads. The inverter through advanced smart-grid functions saved customers time & money. It operates both on-grid and off-grid and offers built-in smart functions, such as peak demand shaving, PV ramp rate control and area frequency regulation.

RESULT

- The island wide micro-grid can handle 100% of the island’s current energy demand
- The micro-grid will enable the development of multiple industries on the island, therefore, providing residents with more jobs and significantly raise the standard of living

KEY LEARNING

- Solar power with advanced storage solutions can be used as a reliable source of electricity to power similar isolated islands and remote areas
- Forward looking Government agencies and technology providers can collaborate to help light remote areas by implementing smart energy strategies
SUCCESS STORY 9

Village Electrification, Gabon

BACKGROUND

Gabon is a sparsely populated central African country, rich in natural resources, with forests covering 85% of the territory. The electricity access rate in Gabon is roughly 60%, with power reaching 80% of the urban areas and only 35% of the rural areas.

CHALLENGE / PROBLEM STATEMENT

There is a huge economic disparity between the rural and urban areas due to no access of electricity in the former setting. Consequently, the villagers have to end their day early and are deprived of reliable means of livelihood. The key challenge is providing the rural areas with electricity while overcoming challenges like lack of skilled manpower, inhospitable terrains & weather.

SOLUTION

Su-Kam Power Systems, an Indian power solutions company, came up with a renewable solution to this problem by installing 2,000 solar street lights in the remote villages of Kango, Mouila and Bitam in Gabon. The project was completed in 2013.

The solar PCUs developed and installed in these areas work on the “Dusk to Dawn” technology which automatically regulates lighting of street lights after sundown.

Local people were trained for the installation and maintenance of the solar street lighting system and many instruments were engineered in-house due to the unavailability of the same in remote villages.

RESULT

- By 2013, Su-Kam has installed 2,000 solar street lights in the remote villages of Kango (350 kms from Libreville), Mouila (1200 kms from Libreville) and Bitam (900 kms from Libreville) in Gabon which provided electricity and employment
- Post completion of the project, the company started installing 400 solar street lights in a Special Economic Zone 50 kms away from Libreville from July 2013 onwards

KEY LEARNING

- This model provides an easily replicable model for providing community lighting solutions to villages across the globe
SUCCESS STORY 10

Pay-As-You-Go (PAY-G) Model, Kenya

BACKGROUND

According to IEA, 1.2 billion people lack access to electricity, making energy poverty a key global concern. The situation is worst in rural Sub-Saharan Africa with a rural electrification rate of only 17%.

Even though Kenya is one of the best-performing economies in sub-Saharan Africa, half of the country’s population is below the poverty line and only 23% of its population has access to electricity.

CHALLENGE / PROBLEM STATEMENT

 ✓ Solar PV technology involves high up-front costs (even though they are cheaper over a longer time frame) which acts as a prohibiting factor for scaling up solar in low income regions

 ✓ Developing self-sustainable working models, which do not depend on grants or aids, remains a challenge

SOLUTION

Companies (such as M-Kopa Solar and Azuri) in Kenya have been working on a new approach of Pay-As-You-Go (PAY-G) Model with the objective of providing affordable solar solutions to the rural market. Under this model, the companies initially own the solar systems with the option of transferring the ownership to the clients / beneficiaries at a point in future. The companies charge for the solar system based on the usage in a manner similar to pre-paid telecom operators.

M-Kopa Solar estimates that 80% of its customers live on less than USD 2 per day and seeks the clients to pay USD 35 upfront followed by a daily payment of USD 0.45 for a year, after which the system ownership is transferred to the clients.

The kits come with a control box containing the battery and a SIM card that is used to communicate with M-Kopa headquarters in Nairobi. When a customer makes payment via mobile phone, the SIM card sends a signal to activate the battery, which is powered by the panels.

The company has brought about a big turnaround from using fuel-wood as a source of energy to solar technology by providing information, facts and figures to the local people of the cost effectiveness of using solar energy.

A similar model has been adopted by Azuri, a UK based start-up, which provides solar energy as a service, combining mobile phone and solar technology.

 ✓ The company provides a basic starter kit (Indigo unit) consisting of a PV module, a long-life battery, a pay-as-you-go controller along with two 60-lumen LED lights and a USB socket for phone charging. This kit can be bought at an initial fee of USD 10

 ✓ Users pay for the usage of the solar system through the purchasing of weekly scratch cards, similar to mobile prepaid cards. Users can access the services of light and a charging point by entering a valid code on the keypad provided on the controller.

The power systems include a solar panel, two LED bulbs, an LED flashlight, a rechargeable radio, and adaptors for charging a phone.
Top-ups are either physical cards bought for cash, or codes bought by mobile phone, using a mobile money system.

They can be purchased for one-week or four-week activation. Average weekly top ups of around USD 1.50-2.00, After around 80 weeks users can own the system permanently by paying about USD 10.

The company funds the business through a variety of routes including equity, working capital loans and loans from donors. However, the financing of such large amounts of credit sales is the main challenge for Azuri, and this challenge is increasing with growing sales.

**RESULT**

- M-Kopa Solar claims that 600 new customers are plugging in their solar panels on a daily basis and the company estimates to sell over a million units by the end of 2017.
- Company’s profits have been increasing manyfolds and plans to become a billion dollar company by selling solar panels to rural residents.
- Estimates suggest that, in Africa, customers can save up to 50% of the money previously spent to operate kerosene lamps and can save many hours of walking to the market for mobile phone charging.

- From August 2012 to March 2014, Azuri has around sold 30,000 units in the distribution channel, with around 15,000 units installed and operational in customers’ houses.
- Azuri is scaling up quickly and plans to distribute thousands of starter kits in the near future.

**KEY LEARNING**

- An innovative financing models such as PAY-G need to be explored for providing clean energy access to people leading to a win-win situation for the financing company as well as the people.
- Doing business with low income people, understanding their needs and providing them with requisite services can be more rewarding for both the parties.
- This innovative model can help in making modern solar-powered appliances affordable to a huge new market (currently there are 1.3 million people off grid).
SUCCESS STORY 11
Solar Kiosks, Madagascar

BACKGROUND

Madagascar is an overwhelmingly agricultural economy with a low Human Development index of 0.51 (ranked 154 out of 188 countries). Only 20% of the total population has access to electricity whereas in rural areas the situation is worse with only 5% of the population having access to electricity.

CHALLENGE / PROBLEM STATEMENT

Madagascar is geographically isolated and there is no source of energy for off-grid rural communities. Also, the purchasing power of the rural population is very less. Providing electricity to rural customers at affordable rates is a key concern.

SOLUTION

To overcome this problem, HERi Madagascar (financed by the European Union) came up with power kiosks which act as one-stop-shop to access electrical products and services, otherwise unavailable in the rural off-grid locations of the country. These power kiosks are stand-alone buildings designed to house a range of appliances, which are charged via rooftop solar panels. The kiosks were designed for simplicity, so local labor can assemble and maintain them. They can be constructed by the local labour in as less as 3 days.

These kiosks power a range of appliances including lamps, refrigerators that individuals can purchase, pay per use or rent for varying lengths of time. Flexible payment options are offered as the kiosks are situated in villages where individuals have inconsistent income streams.

To set up the kiosks, an area to build the kiosk is identified followed by identification of a local entrepreneur within the community to operate the kiosk. Entrepreneurs open ‘franchises’, paying a monthly fee for the use of the building, equipment and product portfolio, but keeping all profits generated by the kiosk. They go through a short management course (learning marketing, sales, business administration) before they launch their business. All the HERi entrepreneurs till date are women, which helps in empowering women in the developing world.

RESULT

- HERi has 51 operational kiosks serving 459 villages and touching about 42,000 people by providing access to electricity and employment opportunities
- Impact of the project is not limited to social parameters but has also avoided the use of kerosene as about 60% of the customers of HERi are said to have switched to solar appliances from kerosene lamps

KEY LEARNING

- One-stop-shops can be an effective way of reaching out to rural population through a hub and a spoke model. Such models are already available in African and Asian countries and require higher scales to reach out to more people
- Engaging the local community and working with them can lead to more fruitful results and also lead to uplifting of local community
SUCCESS STORY 12
Solar-Powered Lamp-Post, Mali

BACKGROUND

Mali is a landlocked country characterized by long dry seasons with electrification rates as low as 15% in rural towns and villages. Rural households satisfy their energy needs by using kerosene and batteries, which are expensive and unreliable. In one such village, Sangola, many villagers would sleep for several hours during the day to beat the heat and would get up to work in the middle of the night, relying on dangerous petroleum lanterns and cheap battery-operated flashlights for illumination.

CHALLENGE / PROBLEM STATEMENT

The challenge was to light up the Sangola village using environment friendly and affordable technology while innovating something that could be shared within the community as possessions/land were not owned by individuals but shared between the social structures in the village.

SOLUTION

Matteo Ferroni, an Italian architect, designed a portable, locally manufactured transportable light post. The women of the village named it ‘Foroba Yelen’, which means ‘collective light’ in Bambara.

The lamps were designed after consulting local welders and other labor workers so that it could be easily replicated and fabricated by the local people. Locally sourced materials like old bike parts and piping were used. The only imported material used was the solar-powered, rechargeable light bulb. The lamps are built with bike wheels on the bottom so they could be easily moved around homes and the community.

Each lamp costs roughly USD 330, with the majority of the cost going towards the imported lightbulb. The unit takes as little as a couple of days to construct.

The architect set up a foundation, eLand, where young people learned to construct the lamp, take care of the solar charging panel and spare part. Women on the other hand are entrusted with the lamps’ ownership.

A common fund is created to buy the lights at a subsidized price and a group of eight custodians is nominated who maintain, recharge and hire the lights out to other villages and collectives.

RESULT

✓ 56 lamps across 12 villages in Mali (as on 2014) were being used for activities like work, education and rituals like weddings, baptism and funeral.

✓ Solar lamppost is used for income-generating activity in the area and has helped reduce economic burdens faced by people as more work can now be conducted in the early mornings and at night.

✓ Many of the lamps are rented out to other communities for a small fee, resulting in additional income for the communities.

✓ They have helped in enhancing the lives of the village people economically, socially and educationally.

KEY LEARNING

✓ Solutions can be developed locally with limited effort but need to be replicated and scaled by NGO’s and developmental organizations where collective communities are commonplace.
SUCCESS STORY 13

Off-Grid Village Electrification, Nigeria

BACKGROUND

Nigeria is one of the most populated countries (with a population of about 162 million people) in Africa but only 40% of the people are connected to the grid. Poverty is widespread in Nigeria, about 70% of people are living below the poverty line of USD 1 per day.

CHALLENGE / PROBLEM STATEMENT

In Africa, grid extension is limited due to substantial distances across the continent and the inherent huge associated costs / losses related to this. At dusk, those households who are not connected to the grid are only left with kerosene, which is not only hazardous but also expensive. The objective is to provide affordable and sustainable energy that reaches off-grid communities helping them come out of poverty.

SOLUTION

GVE Projects Limited (earlier Green Village Electricity project) incorporated with an objective of providing energy access to off-grid villages came up with a scalable solution to increase energy access. In its first pilot green village electrification project, it started by providing two 6-kilowatt off-grid solar electricity systems, each with two sets of portable battery kits.

Each system supplied electricity to an estimated 80 homes and several businesses in Egbeke, a remote off-grid settlement in Nigeria. With an average household size of 15, the estimated direct impact of the project is on about 2,400.

The company has a policy that requires them to hire local people for 80-90% of project implementation. Local people are trained in technical and electrical work that provides employment even once the project has been implemented.

RESULT

- GVE has an installed capacity of 242.6 Kwp
- 410.25 MWh of energy generated
- Energy related cost savings USD 98,560
- Wealth creation USD 52,500
- Impacted 1,320 households and businesses
- 489 jobs created
- 260 capacity building and skill transfer

KEY LEARNING

- Mini-grids have distinctive opportunities and can help to scale up economic activities while also providing lighting for homes and communities.
SUCCESS STORY 14

Low Interest Loan & Rebate on PV installation, Seychelles

BACKGROUND

Seychelles is a small island developing country that relies significantly on imported oil and other fossil fuels for transport and electricity generation. It spends a large part of its GDP on energy imports that creates budgetary pressure, increases economic volatility, and enhances greenhouse gas emissions. The Government aims to generate 20% of its energy requirements from renewable sources by 2020.

CHALLENGE / PROBLEM STATEMENT

The cost of importing fuel to the remote small island state is high and the rising energy costs for businesses have impacted inflation and the growth of the private sector as a whole. The country should switch over to viable renewable energy sources but very high upfront costs for the PV systems act as a major barrier for a widespread uptake of solar energy.

The challenge is to adopt policies / framework to make PV systems affordable for domestic as well as commercial users.

SOLUTION

In May 2014, the Seychelles Government launched the Financial Rebate Scheme for grid connected rooftop photovoltaic systems in collaboration with United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) along with other local stakeholders.

The scheme will provide a financial rebate of 35% on solar PV systems upto 3KWP to domestic and commercial entities which would be subsidized varying amounts depending on sector and system size, when purchasing and installing solar PV systems.

In 2015, this value was reduced to 25% as the average cost of a PV installation dropped.

RESULT

✓ Will enable uptake of about 1.3 MW of solar rooftop capacity in the island
✓ Would reduce diesel consumption by the Public Utilities Corporation (PUC), the state utility, by 390 tonnes

KEY LEARNING

✓ Proper institutional Framework and Government support can boost the sustainable energy development of a nation
✓ If such initiatives are adopted on a larger scale, that is by other countries as well (making PV affordable), it would foster a wave of clean sustainable growth in the region
SUCCESS STORY 15

Solar home systems, Tanzania

BACKGROUND

Only about 15% people in Tanzania have access to electricity. The spread of mobile phones has far surpassed the spread of grid electricity. A significant range of services can be provided with the help of mobile phones, which now provide access to internet and mobile money apart from conventional calling and text messaging services.

CHALLENGE / PROBLEM STATEMENT

Electricity access can be provided through modern solar home system, but the initial cost and availability of after sales service prevent widespread adoption of the solar home systems.

SOLUTION

Off Grid Electric designed small solar home systems in partnership with Fosera, a German solar company. It provides an agreed level of electricity service through a 5 or 10 Wp solar home system installed at the home of the consumer.

Off Grid Electric works on a leasing model whereby the consumers pay a deposit of USD 6 and daily fee between USD 0.18 to 0.63, depending on the level of service that they have chose. Entry level service provides for two bright lights and a phone charge.

The use of smart-phone apps linked to a complex database allows customer to pay for the service using mobile money. Tailored services for individual user needs, with flexible payments make the services affordable for the local population.

Off Grid Electric starts work in an area with a publicity campaign and installation of some demonstration systems. A network of local agents is used to find customers, install systems and provide ongoing customer support. Locals who are interested to become agents are trained for the same and carry out functions of recruiting customers and installing systems.

Off Grid retains ownership of the system, and replace or repair it at no cost, provided that the customer is paying for the service.

Off Grid Electric has a customer care department that runs an helpline which functions 18 hours a day providing undeterred service to the customers.

The Tanzanian Government has also aggressively promoted the reliability, usefulness and safety of solar PV systems. This has also contributed to the growing demand for solar products in rural areas.

RESULT

- Over 35,000 households are using electricity Off (as on March 2015) and plans of expanding its reach to 1 million homes in Tanzania by end of 2017
- The company claims to be lighting over 50,000 homes per month
- Addition of every new household means an additional 140 kg of carbon dioxide and 1.45 kg of black carbon in avoided emissions per year
- According to estimates, there has been an increase of 149% in study time after the households have received power
- The company has been creating 40 new jobs every month through our in-house recruitment and training Off Grid Academy
- In August 2016, Off Grid launched its first retail shop making it even easier for customers to access affordable and reliable solar energy in their homes and businesses
KEY LEARNING

Success of Off Grid Electric reconfirms the fact that social enterprises and private players can play a vital role in scaling solutions and remaining profitable. Off Grid Electric is estimated to have received a total of USD 118 mn through funding from investors like Helios Investment Partners, responsAbility Investments, DBL, Omidyar and SolarCity.
SUCCESS STORY 16
Scaling Solar, Zambia

BACKGROUND

In Zambia, there is an ever increasing demand for energy due to robust GDP growth (greater than 6% per year) for the past decade, predominantly in the mining, manufacturing and agriculture. Currently, only 25% of the urban population and 3% of the rural population have access to power.

Unending power cuts stifle economic activity even in Zambia’s high-value mining sector.

CHALLENGE / PROBLEM STATEMENT

Zambia is highly dependent on hydro-power for its energy requirements which is a major risk factor in power generation as the country is heavily dependent on rain and any fluctuations in the rainfall pattern deepens the power crisis. Also, declining water levels in Kariba Dam, Zambia’s biggest power source is a matter of concern.

Alternative sources of energy such as solar energy (as Zambia is a solar rich country) need to be scaled to diversify energy related risks. However, solar energy in Zambia presents risks similar to other countries. These include

- Institutional capacity: Many Governments have limited capacity to manage, structure and negotiate private power concessions
- Lack of scale: Navigating small and distinct power markets can deter investors and small grids can only absorb small projects
- Lack of competition: Many power projects are not competitively tendered
- High transaction costs: Individually negotiated contracts have high transaction cost
- High perceived risk: Poor credit utility off-takers and political risks increase the cost of capital, driving up tariffs

SOLUTION

In July 2015, Zambia’s Industrial Development Corporation (IDC) signed an agreement with IFC through the ‘Scaling Solar’ initiative.

The program functions as a ‘one stop shop’ with the aim of unlocking private funding for grid-connected solar projects operational within two years and at competitive tariffs. Currently operational in Zambia, Senegal and Madagascar, the program aspires to create a new solar energy regional market.

Salient offerings of the program include:

- Advice to assess the right size and location for solar PV power plants in a country’s grid
- Simple and rapid tendering to ensure strong participation and competition from committed industry players
- Fully developed templates of bankable project documents that can eliminate negotiation and speed up financing
- Competitive financing and insurance attached to the tender, delivering competitive bidding and ensuring rapid financial close
- Risk management and credit enhancement products to lower financing costs and deliver power at lower tariffs
RESULT

✔ The competitive auction organized through the program attracted 48 solar power developers, the bids yielded the lowest solar power tariffs in Africa to date. 73 MW of solar power has been added from Scaling Solar initiative

✔ The program has been successful in facilitating cheaper solar power in Zambia at a cost of USD 0.06/Kwh

✔ Faster solar projects have been enabled through the program with first solar project in Zambia expected to be completed just within one year of from the time of procurement

✔ Benefits to Government and utilities result in faster speed through standardized procedures, greater certainty through balanced, bankable documents offered on non-negotiable terms and lower costs through improved competition

✔ Benefits to project developers and investors include greater market creation, reduced development time and costs and creating a level playing field for all players

✔ International donors and development partners benefit through larger reach, leveraging private capital and low cost - high impact

KEY LEARNING

✔ Right institutional skills and experience can enable a successful model for rapid delivery of low-cost, sustainable electricity to help countries to meet their energy needs

✔ When implemented across multiple countries, the program will create a new regional market for solar investment
SUCCESS STORY 17
Rural Sustainable Energy Development Project, Zimbabwe

BACKGROUND

Energy in Zimbabwe is a serious problem as only 19% of the population in rural areas has access to electricity. As a result, living standards and livelihood opportunities are restricted. Energy requirements are sufficed majorly through fuel wood which is expensive and a major cause of pollution in the area.

CHALLENGE / PROBLEM STATEMENT

Connecting rural areas to the grid has technical, manpower and geographical challenges. Providing off-grid solar solutions face similar challenges of cost and technical capabilities.

SOLUTION

To overcome these issues Rural Sustainable Energy Development Project (RuSED) (running from August 2011 to January 2016) was conceived in isolated parts of Gutu district in southern Zimbabwe. The project was led and implemented by Oxfam in partnership with Practical Action and in association with the Ministry of Energy and Power Development and the Rural Electrification Authority of Zimbabwe. It received EUR 2 million in funding from the European Union and Oxfam.

Oxfam had helped set up a community-owned, self-financing solar energy scheme. It provided the community with solar equipment for irrigation and an initial batch of solar lanterns, which were sold to members through energy kiosks. The proceeds were pooled in a savings and lending scheme, allowing others to join and buy solar products for home and business use.

The cheapest solar lanterns, costing about USD 15, were sold outright at the energy kiosks. The more expensive lanterns costing USD 60 have a rent-to-buy scheme whereby each buyer pays USD 5 per month, or alternatively USD 24 up front and USD 2 per month thereafter, and at the end of 12 months the buyer obtains the lantern and also receives the solar panel to go with it. A customer can recharge her or his lantern or phone for a typical fee of only 20 cents at the kiosks.

Through the proceeds from the energy kiosks, Oxfam assisted communities to create Community Energy Funds (CEF) and devise ‘community-based energy plans’. These funds were dedicated to reinvestment in growing the solar energy business.

RuSED also provided training to technicians at each energy kiosk to give them better understanding of the products which are water pumps, solar lanterns or solar home systems so that they could demonstrate usage of the product and provide maintenance services locally at a reasonable price.

With the help of the CEF, the rural communities could collectively buy solar water pumps, solar panels etc. which can foster development for the community as a whole.

RESULT

- Improved health outcomes
- Widened access to education
- Increased production and boosted business and enterprise

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KEY LEARNING

✓ Initial requisite support (grants) by the governments / NGO’s can help make a sector self sustainable if the funds are used optimally by the community as a whole

✓ Strengthened livelihoods
✓ Enhanced quality of life
✓ Helped chicken farms, fisheries, tailors and shopkeepers acquire hire-purchase solar panels, so they can work round the clock
✓ Some Entrepreneurs use the solar panels to sell mobile phone charging services for USD 0.20 a time
SUCCESS STORY 18

Solar Home Systems in Sub-Saharan Africa

BACKGROUND

Sub-Saharan Africa region is home to 13% of the world’s population and registers the lowest Human Development Index of any region. This region also accounts for 48% of the share of the global population (about 600 million people) without access to electricity.

CHALLENGE / PROBLEM STATEMENT

The local population has access to limited and conventional technologies and inadequate know-how of solar energy technology.

High upfront costs incurred for Photo-Voltaic (PV) technology is a major barrier for a widespread uptake of solar systems on a large scale for the low income countries in the region.

The challenge and the solution both lie in educating the local communities for adoption of solar technology, training the retailers and distributors and subsequently providing customers with financing options to make solar technology affordable.

SOLUTION

To further realize these solutions on ground, Rural Energy Foundation (REF), a not-for-profit organization, initiated the SolarNow programme for providing access to affordable solar energy to households and small businesses in 2007. The programme works across 9 countries in Sub Saharan Africa region (including Burkina Faso, Ethiopia, Ghana, Mali, Tanzania, Uganda, Senegal, Mozambique and Zambia).

The programme focuses on training retailers and distributors on solar energy technology along with other business development skills like marketing, sales and helps them start up and expand businesses to create a local market of solar energy products, primarily solar home systems and solar lanterns.

The project success was also ensured through the supply chain that was created consisting of upstream linkages consisting of a mix of domestic and imported products. Imported PV modules with a rating of 11 to 50 Wp are used for the solar home systems. The programme also supports the local economy as the batteries used in the home systems are manufactured domestically. These systems were assembled locally and installed by technicians who received training.

Systems are intended to be modular in nature to support easy scale up in capacities, to suit the increasing demand and electricity needs with increasing affordability. Modular nature also support varying needs of the households can carry the load of mobile phone chargers, radios, fans or television sets based on different size of the solar home system.

To make SHS affordable for the customers, REF has setup Micro Finance institutions (MFIs) to make finance available for customers to buy solar products. It also has a guarantee fund to stimulate loans to potential customers and entrepreneurs. REF guarantees 50% of the repayment of the customer and retailer loans. The customers repay the loans in 12 to 24 monthly installments.

In 2011, SolarNow was established as a for profit social business with the aim of providing high quality solar energy and financing solutions in East Africa. The company has 36 branches in Uganda and plans further expansion in East Africa and is focused on providing ‘high-quality solar home systems, electrical appliances and power solutions that are designed to fit the needs of both rural and urban households, entrepreneurs and institutions’.

RESULT

✓ Within a span of four years (from 2007 to 2011), the retailers, entailed under the SolarNow project, have sold over 57,000 solar home systems (cost: USD 250-630 each) and 36,000 solar lanterns.
(cost: USD 25-90) resulting in access of electricity to over 110,000 households and 492,000 people

✓ Over the same timeframe, the project has provided employment to 200 technicians and worked with 200 retailers across the nine countries

✓ The project also avoided 12,000 tonnes of CO₂ per year and saved about one liter of kerosene per week and 4.9 million liters annually

✓ During the project, it was observed that the cost of electricity decreased significantly and the solar home system had a pay back of one to three years and average saving per household of about 30% on its energy expenses

✓ SolarNow is projected to impact over 3.8 million lives cumulatively in East Africa by 2018

✓ SolarNow has been receiving encouraging response from investors such as Acumen and Invested Development

KEY LEARNING

✓ Local capacity building can transform a region’s development by providing livelihoods, clean energy and access to electricity which creates ripple effects on standard of living result in a win-win situation for all the relevant stakeholders of the community

✓ Providing adequate finance at every leg of the value chain is a major step leading towards the adoption of solar energy on a major platform

✓ Highly Replicable plan, it can be used for the electrification as well as the development of similar energy deprived regions

✓ Development Aids and Corporate Social Responsibility funds, if utilized effectively can create self sustainable models which can transform local scenarios

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SUCCESS STORY 19

Women Barefoot Solar Engineers of Africa

BACKGROUND

It is often said that the threats of climate change are not gender neutral. According to UN, women are more vulnerable to the effects of climate change, furthermore those in rural areas. Women are often conferred with the responsibility of securing water, food and fuel for cooking and heating facing the greatest challenges. It is therefore important to equip the women in combating climate change.

CHALLENGE / PROBLEM STATEMENT

Women are often unable to realize their full potential within families and communities and play a significant part in the decision making. Most conventional development programs fail as they miss out on this important half of the community.

Apart from this, the tools and technologies are sometimes are complicated or require high maintenance making the communities dependent on external help.

SOLUTION

To address the challenge of climate change through inclusivity and local capacity building, Barefoot College trains women from local communities as solar engineers, water managers, artisans, health workers, teachers, and advocates. The college trains middle aged women from Africa (mostly illiterate) through a six month course, on fabricating, installing and maintaining solar-powered household lighting systems. These Barefoot Solar Engineers of Africa aim to improve the lives of rural poor living on USD 1 per day in remote inaccessible off-grid villages. The college makes an investment of up to USD 50,000 in solar equipment for 120 households in the participant’s village. Once the course is finished, the women go back to their villages where they help in installing solar lamp kits.

The communities pay every month for the use of the solar units (thus even reaching those who cannot afford to buy these systems even in installments), hence guaranteeing the financial commitment for purchase of replacement components and payment of monthly salary of the woman solar engineer. Each household agrees to pay a fee ranging from USD 5 to USD 10 a month for the solar lighting (similar to what they used to spend on kerosene, candles and flashlight batteries).

Barefoot works with six countries in Africa (Burkina Faso, Liberia, Senegal, South Sudan, Tanzania, and the semi-autonomous region of Zanzibar) which were selected basis the governments’ interest in piloting and scaling solutions, and the presence of promising non-governmental organization (NGO) partners. 560 more women solar engineers will be provided training in these six countries. It has an aim of bringing solar electricity to more than 24,000 households and 125,000 people across six locations in Sub-Saharan Africa.

RESULT

- Since 1989, Barefoot’s flagship solar electrification program has trained 664 illiterate and semi-literate women as solar engineers.
- Electrified 40,000 rural households in 1,265 villages in 64 countries across Latin and South America, Africa, the Middle East, and Asia to serve 500,000 people, installing and maintaining equipment, and receiving a salary for their services.
KEY LEARNING

✓ Solar energy can not only fight climate change but also help in creating inclusive societies

✓ The program effectively demonstrates how a combination of traditional knowledge (barefoot) and demystified modern skills can bring lasting impact and fundamental change when the tools are in the control and ownership of the rural poor
SUCCESS STORY 20

‘Noor’ Solar Power Complex, Morocco

BACKGROUND

Morocco, the host of COP 22, faces pressures of increasing energy demand due to increasing population, growing prosperity and expanding grid connection to remote areas. Morocco primarily generates electricity from fossil fuels which it imports at high prices from abroad.

However, the Moroccan Government aims at strongly expanding renewable energy capacities in solar, wind and hydro by 2030, thereby increasing the security of the country’s energy supply and contributing to global climate change mitigation.

CHALLENGE / PROBLEM STATEMENT

To meet its target of sourcing 52% of electricity from renewable capacities, rapid implementation of large scale RE-generation capacity is required.

SOLUTION

The area of Ouarzazate has an extraordinarily high solar radiation intensity of more than 2,500 kWh / m² per year which makes it a very advantageous location for North Africa’s first big solar power complex – ‘Noor’ meaning light.

The complex named ‘Noor’ will consist of four power plants (Noor I-IV) with a whole capacity of 580 MW. The first plant, Noor I, with 160 MW installed capacity, was made operational this year 2016, Noor II and III are under construction and are expected to be completed by 2017 / 18 and Noor IV has been successfully tendered. The solar power complex combines three different technologies: parabolic trough (Noor I and II), solar power tower (Noor III) and photovoltaics (Noor IV). The projects will be implemented through a Public Private Partnership Structure. The public partner for this project is the Moroccan Agency for Sustainable Energy (MASEN). Total investment costs amount to about EUR 2.2 billion. On behalf of the German Government KFW Development Bank is financing EUR 864 mn. The remaining project costs are funded by the private sponsors and several other bilateral and multilateral agencies such as EIB, AfD and CTF.

RESULT

✓ The Noor solar power complex will significantly contribute to achieving Morocco’s renewable energy targets
✓ The complex will generate clean electricity from renewable sources for at least 1.3 million people
✓ The complex will save a minimum of 800,000 tonnes of CO₂ emissions per year when compared to fossil fuel based power generation, thereby mitigating global climate change
✓ Noor decreases Morocco’s dependency on costly fossil fuel imports, thereby increasing its energy security
✓ The complex is currently set to be the world’s biggest solar power complex and will therefore serve as a precious reference for future large scale solar power projects in the whole region
KEY LEARNING

✓ The project has pioneering character and has potential for replicability in the North-African region.

✓ National public partners (MASEN), private sector and a several bilateral and multilateral funding agencies have successfully collaborate to jointly implement large-scale power projects through PPP structures because of the following framework conditions: political stability, rule of law, economic stability, efficient administration, appropriate risk sharing between the public and the private parties, availability of relevant infrastructure and services, willingness of banks to adapt lending conditions to local requirements, good project planning and clear division of tasks and responsibilities among the involved actors.
SUCCESS STORIES

Asia
SUCCESS STORY 1

Enabling Solar Home Systems through Micro-Credits, Bangladesh

BACKGROUND

Bangladesh has a vision of ensuring ‘Access to Electricity for All’ by 2021 while in 2012 only 59.6% of the population was connected to grid electricity. A research conducted by IFC states that most of the off grid households are concentrated in rural Bangladesh where electricity access through solar PV could be the most feasible option as expanding the national grid would not prove to be cost effective.

CHALLENGE / PROBLEM STATEMENT

- Initial cost of solar installations is high which needs to be tackled with provision of financial mechanisms such as payment in installments, fee for services and other suitable modes, to increase the affordability of such systems
- Every household needs a customized system basis the household needs and financial capacities which is difficult to provide in the initial phase

SOLUTION

Several agencies (NGOs, private enterprises) came together to provide Solar Home Systems (SHS) in these households under the umbrella of Rural Electrification and Renewable Energy Development Project (REREDP).

- This project not only reduces their dependence on kerosene lamps but also provide a continuous power supply for their businesses or ‘haats’ leading to an increase in their working hours and eventually their daily income
- A national program to provide dealer credit to households to purchase solar home systems was set up by the Government
- A competent implementation agency - Infrastructure Development Company Limited (IDCOL) was selected to manage and implement this scheme across Bangladesh
- The program provided a platform to devise tools for financial assistance such as loans, build capacity on SHSs through training and support to 47 partner organizations (POs) such as Grameen Shakti that provide micro-credit loans to individual poor households
- IDCOL and the POs worked extensively towards ensuring quality using the following measures:
  - Free monthly checkup of the system of the solar home system components
  - Providing requisite technical training to these households

One of the most successful examples of this scheme is Grameen Shakti model which follows an ownership-based financial mechanism.

- On credit-based purchases of a Solar Home System, the user has to pay 15% of the total price as a down payment. The remaining 85% of the total cost is to be paid within 12/24/36 months with 12% (flat rate) service charges
- A 6% discount is available on the price in case of cash purchase
- A buy-back system is available under which a buyer may return his/her solar system to Grameen Shakti when his/her area gets connected to the grid
RESULT

- Increase in rural income: Improved productivity / more business hours
- Environmental impact: Each household saves around 108 litres of kerosene that produces 0.232 tonnes of CO₂ annually. Installing 1.5 million Solar Home Systems save 164 million litres kerosene and thus saving 350,000 tonnes CO₂

KEY LEARNING

- Grass-roots organizations play a critical role to fuel the clean energy revolution through alternatives such as SHS which are effective alternative way to provide electricity
- Suitable financing schemes and on-going support for maintenance are critical factors that determine the acceptance of such alternatives
SUCCESS STORY 2
Solar powered tuk tuk; Solar Mobility, Cambodia

BACKGROUND
According to a 2015 Asian Development Bank (ADB) report, Cambodia is optimal for development of solar

✓ Huge solar energy potential
✓ Power grid’s limited reach (covering only around 35% of the households)
✓ High electricity tariffs

The abundant solar energy resource available in Cambodia could be harnessed appropriately to help the country become completely self-sufficient, thus boosting the available livelihood opportunities as well. Solar energy solutions coupled with a livelihood opportunity could prove to be a boon for a developing country like Cambodia

CHALLENGE / PROBLEM STATEMENT
✓ Lack of awareness on solar energy
✓ Lack of technical know-how on leveraging available solar energy for mobility
✓ High cost of solar installations

SOLUTION
✓ An innovative solution was developed by an Australian solar company, ‘Star 8’, by providing a 100% solar powered vehicle – ‘SolarTuk’ using new highly efficient, lightweight solar technology
✓ The vehicle could reach a top speed of 50 km per hour, and can run up to 120 km before requiring a recharge. The vehicle can be recharged through the solar panels or the grid.
✓ The continual charging process enables the SolarTuk to find multiple usages like public transport and earn livelihoods. The charged batteries can be used by the families which are not connected to grid during night hours.

RESULT
SolarTuks being clean and affordable means of transport allows it to find multiple usage

✓ It is an excellent local taxi and tourist like it
✓ Coca Cola, Dutch Mills and Nestle are using the tuk-tuks for deliveries
✓ A non-governmental organization called Aziza’s Place started using tuk-tuk for its mobile coffee cart
✓ The idea of solar powered buses is also conceived
✓ Various NGOs are looking to adopt similar innovations and develop micro-financing models for increasing the affordability of ‘SolarTuk’

KEY LEARNING
✓ A small technology innovation can lead to improvement of creation of new businesses and empowerment of many lives
✓ ‘Feed-in tariff’, where the Government can give special rate for solar power systems to feed back excess power into the grid, can also support SolarTuks to extend
SUCCESS STORY 3
Green Economic Development, China

BACKGROUND
Cities in China have been given the opportunity by the Government to support the establishment of renewable energy industries for stimulating sustainable economic development. It can play the role of any of the following five development roles: Incubators, Reformers, Multipliers, Executors or Visionaries. A case in point is City of Dezhou (popularly known as China’s solar city), a tier three city which espoused the role of an incubator to develop viable renewable energy industry clusters and a multiplier by creating momentum and associating additional economic value with the sector.

CHALLENGE / PROBLEM STATEMENT
- The area had immense potential for solar energy, however the size of the local solar energy industry is small
- Lack of well developed financing mechanism and sector specific skilled workforce

SOLUTION
An elaborate development plan for the Dezhou Economic Development Zone was developed in line with the national policy to centralize solar technology research and development, manufacturing, education and capacity building.

- The municipality facilitated supportive policies on land-usage, tax return and financing to promote investment in solar energy in the Dezhou region
- The new policies allowed land prices to be negotiated on a case by case basis and promoted favorable prices depending upon industry sector and business size
- Investments were invited from foreign companies and high-tech companies received tax waivers and tax reduction options

RESULT
- The local Government lowered barriers for entrance of new solar ventures and companies with patented technologies by providing access to finance through low-interest loans and options of installments
- Both the private sector and the local Government undertook numerous initiatives to boost R&D in the solar energy industry including conducting 20 National High-tech R&D programmes on solar energy

- Over 120 solar energy enterprises established operations contributing to GDP and employment generation for local community
- The region now has a mature technology innovation system and excellent capacities in engineering, research and commercialization
- Solar energy companies are benefitting from regional tax rebates and preferential land use policies which also improved the ease of doing business

KEY LEARNING
- Integrated approach is required to promote investment and policy initiatives in renewable energy industries
✓ Socio-economic and geographical characteristics of an area plays an important role in linking renewable energy development and economic growth.

✓ Similar city/state level integrated action plans can be developed to cater to specific needs complementing ambitious plans like local manufacturing, Solar / Smart Cities and skilling programmes.
SUCCESS STORY 4
Canal top Solar Power Project, India

BACKGROUND
Technology in the solar space has been progressing at a rapid pace. This development in technology has also been solving some of the critical challenges associated with solar projects – some of which being higher costs and large land requirements. Floating solar panels on water bodies and covering areas which require lesser clearances verses ground mounted solar has been taken up by India at policy and implementation levels.

CHALLENGE / PROBLEM STATEMENT
✓ Large conventional solar power plants require huge amount of land area
✓ It not only increases the cost of land acquisition but also presents challenges like deforestation and blocking of land for other activities

SOLUTION
✓ The river canal networks, reservoirs and other water bodies can be utilized for installing solar photovoltaic panels with minimal land hassles
✓ The Indian state of Gujarat has made stride in this environment friendly concept by erecting 1 MW canal top solar power project on Narmada Branch canal
✓ Gujarat State Electricity Corporation Limited (GSECL), a Government Company spearheaded this project with Sun Edison as EPC contractor
✓ The plant, set up over a 750 meter-long stretch of the canal, generates clean electricity and prevents evaporation of water from the canal
✓ Being a ground breaking first-of-its-kind concept, a prototype structure was designed and installed at a separate site, which served as an essential and significant learning experience for the implementation team

RESULT
✓ Saving land use to the tune of 5 acres/MW
✓ Saved CO₂ emissions through clean and green power generation
✓ Save canal water from evaporation by an estimated 9 million litres/MW/year
✓ Higher efficiency power generation compared to terrestrial solar power plants due to cooling effect on solar panels by evaporating canal water
✓ Employment opportunity for local community
✓ Encouraged development of new implementation mechanisms like floating solar

KEY LEARNING
✓ The project has the potential of replicability and scalability amongst other states and ISA member countries
✓ Governments play a key role in implementing innovative projects, demonstrating the merit thereby encouraging private sector to take part in similar activities
SUCCESS STORY 5
Rural Electrification through Renewable Energy, Indonesia

BACKGROUND

Indonesia is an archipelago of distributed islands. Fuel shipments or grid extension to these islands are intermittent and costly making renewable energy more affordable and reliable than the diesel or grid electricity. High fuel costs, low electrification rates, abundant renewable resources, and strong government support make Indonesia the ideal venue for widespread installation of mini-grid systems.

The Indonesian Government created the Rural Electrification Project to provide electricity by means of solar energy to villages throughout Indonesia. The objective of the Rural Electrification Project is to promote the economy of rural communities and improve the quality of life.

CHALLENGE / PROBLEM STATEMENT

- With 13,466 islands, providing access to electricity to all parts of Indonesia remains a big challenge to policy makers
- Diesel generators have high operating costs, which are compounded by the costs of shipping and storage of fuel
- Initially, rural electrification initiatives lacked adequate financing to be sustained or scaled up
- The small size and high transaction cost of a mini-grid leads to very high investments

SOLUTION

- The project - REwiRE was launched to develop renewable energy-based mini-grid projects across several remote villages lacking electricity using an innovative capital structure
- The primary goal of this government-funded project was to provide access to electricity through 100% renewables without a dependency on diesel

RESULT

- The pilot project implemented in Sumba Island in Nusa Tenggara Timur (NTT) province, providing electricity access to about 80% of those who did not have access
✓ The innovative project finance method which bundled multiple village-scale mini-grid projects into a package was large enough to attract institutional investors.

✓ By bringing access to power, it increased local productivity, accelerated access to electronics and other media, and improved security on the islands.

KEY LEARNING

✓ Innovative financial structures customized to local conditions can help solve complex problems.

✓ Local ownership and strong Governmental support helps in scaling renewable energy.

✓ Credit enhancement from a multilateral agency helps the success of such project.
SUCCESS STORY 6

Creating Solar PV Market, Japan

BACKGROUND

In December 2008, the Ministry of Economy, Trade and Industry, Government of Japan announced a goal of 70% of new homes having solar power installed, and would be spending $145 million in the first quarter of 2009 to encourage home solar power.

In November 2009 Japan’s Government enacted a feed-in-tariff for residential and business users, requiring electricity utilities to purchase excess solar power from these users.

The Fukushima nuclear disaster in 2011 helped Japan to refocus its energy strategy towards promotion of renewable energy to make its energy green and safe.

CHALLENGE / PROBLEM STATEMENT

The prohibitively high costs and lack of appropriate incentives was becoming a deterrent for achieving the envisaged scale of solar energy

SOLUTION

In July 2012, the government introduced a series of policy interventions which facilitated the large scale solar technology uptake in Japan:

- The Feed in Tariff (FiT) Scheme: The FiT apart from setting the price also obligated 10 regional electricity utilities to purchase electricity from renewable energy producers. The current FiT scheme includes solar photovoltaic (PV), wind, biomass, geothermal and hydro energy

- Rebates and direct support: rebates (distributed after project completion), direct support (distributed before project completion) are capital incentives given to the developers by the Government

RESULT

- Enduring market support by the Government (i.e. pre-FiT) created a price competitive industry and created market space and opportunities for other competitive and innovative players bringing new appliances and services

- Due to this new promotional policy scheme, in particular, the Japanese PV market has been able to gain strength

- Within a period of 2 years a total of 10.5 GW of new PV capacity was installed and by 2013 Japan emerged as the second fastest growing PV market in the world (after China and ahead of the US)

- By the end of 2015, Japan became the third largest market for solar PV growth in the world with a cumulative capacity of 34,150 MW

- Overall installed capacity in 2015 was estimated to be sufficient to supply 3.5% of the nation’s annual electricity demand

KEY LEARNING

- Supportive Government policy can help build the business case for renewable energy

- Renewable energy providers should be incentivized and given proper market conditions to thrive
SUCCESS STORY 7
Affordability Solar PV for Rural Electrification, Laos

BACKGROUND
The electrification rate in Laos has steadily increased to 69% in 2009. The Government of Laos has undertaken an ambitious target of providing electricity access to 90% of the population by 2020 and renewable energy to reach 30% by 2025.

CHALLENGE / PROBLEM STATEMENT
Electricity access through PVs is a feasible option for locations that are not connected to the grid; however the high initial cost of solar installations is a major constraint.

SOLUTION
✓ Sunlabob, a Laos-based renewable company, approached rural electrification in Laos through a commercial rental method introducing high quality solar photovoltaic (PV) systems
✓ The PV module is installed on the top of a wooden pole. The battery and charge controller are placed in a locked box to which the village technician has the key, eliminating the risks associated with improper handling
✓ Sunlabob operates through renting the solar equipment to the Village Energy Committee (VEC), who is selected by the whole community. This not only empowers the community by giving them the control of setting prices and collecting rents but also by performing basic maintenance
✓ Solar-home-systems (SHS) and portable solar lamps are made available for usage
✓ Rents are charged lower than the spending on kerosene for lighting
✓ Families can save money by switching to solar PV

RESULT
✓ Using solar PV equipment provides various benefits to the families including
  o Safe light in the evening
  o Extended work hours
  o Portable solar lanterns are popular useful for family who live 2-3 days away
✓ The model has also created local entrepreneurs as sales and support personnel
✓ Sunlabob has also helped to set up the Lao Institute of Renewable Energy (LIRE) to carry out research and policy work to be an independent voice for renewable energy in the country
✓ Sunlabob has extended the model in Africa and is now providing the SHS systems for various sizes

KEY LEARNING
✓ For any off grid renewable energy project to be successful, community involvement and ownership is highly imperative
✓ It is important to develop local skill base and the establishment of small enterprises to run the franchises
✓ Such replicable and scalable models can be implemented all across ISA countries, where people do not have access to an electricity grid
SUCCESS STORY 8

Facilitating Private Investments for Solar Energy, Maldives

BACKGROUND

Installed capacity on the 194 inhabited islands of Maldives, home to 350,000 people, is about 140 megawatts (MW). Owing to the lack of indigenous conventional energy sources, power generation in Maldives is almost exclusively based on imported diesel fuel.

The proximity of Maldives to the Equator and the favorable solar radiation patterns make it a preferred destination for implementation of solar energy projects.

The Government of Maldives has undertaken a commitment of Accelerating Sustainable Private Investment in Renewable Energy (ASPIRE) which will enhance development of this new energy generation resource and help the government reach its stated goal of becoming carbon neutral by 2020.

CHALLENGE / PROBLEM STATEMENT

Maldives is a middle-income country that remains highly dependent on imported goods and is increasingly vulnerable to the effects of climate change.

As a result of its dispersed geography, the fuel cost for electricity generation ranges from more than 20 U.S. cents per kilowatt-hour (kWh) in the larger and more efficient island grids. Despite significant subsidies, the end-user tariff remains, constituting about 9% of spending in the poorest households.

The small size of the market, lack of a national grid, the remoteness of most islands and the scarcity of land and rooftop space has complicated the process of aggregating investments.

SOLUTION

✓ The Maldives Ministry of Environment and Energy, with support from the World Bank and from the Scaling Up Renewable Energy Program (SREP), a funding window of the Climate Investment Fund, designed a program centered on solar photovoltaic (PV) rooftop installations to take advantage of the nation’s high insulation while also coping with the scarcity of land.

✓ The support provided by World Bank yielded additional benefits such as credibility to the entire transaction, customized solutions to the country’s circumstances and classification of islands.

✓ The Bank assisted Ministry staff in contracting reputable advisors and providing advice for developing project documents, risk allocation, and procurement processes, all in conformity with International standards.

RESULT

The project has been able to overcome concerns among investor about the risk of non-payment by the publicly owned utility, political risk, currency convertibility issues, and the utility’s unfamiliarity with public-private partnerships.

✓ Till October 2015, 4 MW of Solar installation had already been done with 1.5 MW additional agreements signed.

✓ The Project aims at mobilizing 20-30 MW of installations to support Maldives achieve carbon neutrality by 2020.
KEY LEARNING

✓ Supporting investments is key to large scale adoption of renewable in the economy
✓ The policy should create enabling environment for the private sector to grow and compete
SUCCESS STORY 9

Solar Car Park and Mall, Philippines

BACKGROUND

Solar power is a promising renewable energy source for Philippines as it is located near the equator and receives high solar insulation.

Solar-power systems provider Solar Philippines and Philippine Government are working towards converting the country’s leisure establishments powered by conventional forms of energy to solar powered establishments.

CHALLENGE / PROBLEM STATEMENT

✓ Shopping malls contribute largely to the country’s electricity demand through its use in air conditioning, escalators, elevators etc as well as have large un utilized rooftops.

✓ Philippines proves to be an ideal market to reach grid parity as clean energy is available at a very affordable rate owing to high electricity prices and sunlight levels.

✓ Reducing their dependence on conventional forms of electricity can play a major part in reducing the country’s carbon footprint.

SOLUTION

SM’s Mall of Asia, one of the largest malls in Philippines, planned to support the largest solar installation on a commercial establishment in Philippines.

✓ PV cells were installed on the entire mall rooftop.

✓ The 1.5 MW of electricity generated can

  o Power 16,000 light fixtures, 59 escalators and 20 elevators

  o Help generate 2 million Philippine peso savings per month

  o Operate for more than 25 years

RESULT

✓ More than 30% of the mall’s electricity needs are fulfilled by solar installation.

✓ Over 30 years, it is expected to offset over 80,000 tonnes of carbon dioxide, equivalent to planting over 400,000 trees.

✓ This mall also houses the world’s largest solar powered car park. The 2.7 megawatt solar carpark is one of the world’s largest on-site solar projects.

KEY LEARNING

✓ Unlike many solar projects, which displace vast farmlands or forests, the rooftop installation occupies previously unused space and provides a “green roof” to shade parked cars.

✓ Any entity, regardless of their reliance / dependence on government schemes / subsidies can facilitate transition to clean energy.

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SUCCESS STORY 10

Commercial Solar Power Park, Sri Lanka

BACKGROUND

Currently, Sri Lanka depends on conventional non-renewable sources of energy such as fossil fuel to meet over 60% of its annual electricity demand.

There has been a major thrust on exploring alternative energy sources through the policies and the Government of Sri Lanka aims to generate at least 20% of its electricity through renewable sources by 2020.

CHALLENGE / PROBLEM STATEMENT

Large solar installations are fret with the following challenges

- Lack of financial support
- Risk of dealing with various middle men involved

SOLUTION

To meet the growing energy demand supply gap and to reduce the dependency of fossil fuels, a commercial facility, i.e. a 500 kW state owned solar power plant was set up in Hambantota with an aim to add 500 kW to the national grid. The solar power plant was set up in two phases:

- The first phase was completed with financial aid from the Japanese Government and the second phase was completed with aid from the Korean Government
- The generated power will be sold to Ceylon Electricity board

The surrounding community members were technically trained to maintain and operate the power plant, thus providing them a source of localized livelihood.

RESULT

- The plant is expected to offset 963 tonnes of CO₂ and saving 429,800 litres of diesel
- Being a first of its kind project the plant contributes to building knowledge capital on operating a commercial scale solar power generation project in Sri Lanka

KEY LEARNING

- Small scale renewable energy projects are best suited for areas located far from the national grid as the cost of connecting these areas to national grids equals the high initial investment for any solar project
- Diverse financing options and Government ownership increase the chances of successful completion and accountability of such a high investment facility
SUCCESS STORY 11

World’s Largest Solar Farm - Community Corporate Partnership, Thailand

BACKGROUND

Thailand has great solar potential, especially the southern and northern parts of the northeastern region. In 2013 installed photovoltaic capacity nearly doubled and reached 704 MW by the end of the year. At the end of 2015, with a total capacity of 2,500-2,800 MW, Thailand has more solar power capacity than all the rest of Southeast Asia combined. Thailand aims to increase its solar capacity to 6,000 MW by 2036.

Thailand’s commitment to increase its solar energy potential could only be realized through large scale projects.

CHALLENGE / PROBLEM STATEMENT

- A large solar installation requires active participation from the community members
- Community was hesitant as they were concerned that the high capacity power plant would emit polluting fumes and waste

SOLUTION

- In a step towards meeting Thailand’s commitment, a solar power plant was envisaged and constructed with capacity of 73 megawatts in the central province of Lopburi, about 150 km north of Bangkok
- The Natural Energy Development company and CLP Thailand Renewables joined hands to build the 55-megawatt photovoltaic solar plant in Lopburi with financial assistance from Asian Development Bank
- The project is registered and has obtained pre-finance certified emission reductions under the Clean Development Mechanism, which attracted several local lending partners, including Bangkok Bank, Kasikornbank, and Siam Commercial Bank

RESULT

- The project emerged as a successful “Corporate-community” partnership
- Poor farmland has been transformed into organic farms which are model for other farmers
- Excess electricity from solar irrigation systems is donated to communities and local schools to light classrooms and power fans
- It was estimated that the plant would help the country reduce carbon dioxide emissions by over 1.3 million tonnes throughout the 25-year project period and cut fuel imports by over 35,000 tonnes per year

KEY LEARNING

- For any renewable energy project to be implemented, cooperation from the community is imperative
- The manifold benefits of such initiatives can only be realized to their full potential if the community is fully aware and participating in the process
SUCCESS STORY 12

Community Capacity Building for Solar Energy, Timor-Leste

BACKGROUND

Basis the 2011 baseline study conducted by Mercy corps, 70% of Timor-Leste households relied on kerosene as their main source of energy despite the unreliability and non-dependability on the resource. Burning kerosene to produce light is extremely inefficient and, in addition, its indoor use can have severe negative effects on the health of users.

An Asian Development Bank study has highlighted the urgent need for improved power supply distribution systems in nine districts of Timor-Leste: Aileu, Baucau, Los Palos, Maliana, Oecussi, Same, Suai, Viqueque and Kovalima.

For communities which have electric power, the power supply is chronically unreliable with power supply missing for weeks at times.

CHALLENGE / PROBLEM STATEMENT

✓ A very huge population lacks access to affordable and reliable electricity. It is financially difficult for the Government to extend the grid power extensively

✓ Solar technology seems to be a good alternative but the high capital cost involved is a major barrier

SOLUTION

✓ Solar offers good potential for off-grid electrification in Timor-Leste. Low population densities and low incomes in the rural areas in Timor-Leste make solar home systems a lower-cost electrification option compared to grid extension

✓ As a part of the ‘energy for all’ programme (E4A) funded by the European Commission, Mercy Corps implemented a project in Timor-Leste aimed at replacing kerosene with solar PV systems

✓ It provided clean and efficient source of household lighting, as well as power for key community institutions such as schools, health clinics and community centers

✓ Basis the need analysis of power utilization at different community locations, 12 PV systems with a capacity of 48W each, three PV systems each with an 85W capacity and one system with a capacity of 170W were installed at different locations

✓ The local community members were trained to install the systems themselves, which also provided them with the technical capacity to operate and maintain the equipment

✓ To create a community ownership model, the community was directed to make about 25% contribution of the total cost in the form of labour. In addition, each community developed a maintenance plan indicating how they would raise the funds to replace parts over time

✓ Other community locations such as schools and religious buildings agreed to charge a fixed rate for using the facilities and solar power for private events, such as weddings, parties, cultural occasions etc
RESULT

✓ At community level PV systems were not only able to reduce the dependence on kerosene, but also provided an opportunity for additional lighting and power for other new activities in the hours of darkness

✓ The Government of Timor-Leste increased its thrust on renewable energy adoption to be able to provide basic electricity services to off-grid communities

KEY LEARNING

✓ Market development programs would benefit from a package of core tools and guidance

✓ Technical capacity building also helps reduce installation costs of PV systems

✓ This information, coupled with behavioral change communication helps raise awareness on adoption of solar technology
SUCCESS STORY 13

Community Capacity Building for Solar Energy, Masdar City, United Arab Emirates

BACKGROUND

A report published by The International Renewable Energy Agency (IRENA) on the renewable energy prospects in UAE clearly states that:

- Renewable energy presents a lucrative economic opportunity in the United Arab Emirates (UAE)
- The report estimates that based on current incremental energy prices, the UAE could achieve at least 10% use of renewable energy by 2030 yielding an estimated net savings of USD 1.9 billion annually
- Numerous initiatives and policies have been introduced by Government bodies in the UAE and the country’s energy roadmap for 2030 clearly outlines the need to develop long-term sustainable energy sources

CHALLENGE / PROBLEM STATEMENT

- In a country like UAE where oil prices are predicted to remain low for the foreseeable future, a major challenge for the alternative sector is to offer cost-effective power outputs
- Large-scale solar implementation in the UAE is challenging because of the effect of dust and high temperature that can reduce their effectiveness

SOLUTION

- Masdar City was envisaged as the world’s most sustainable eco city and is part of the Government’s commitment to move towards renewable energy
- Masdar uses clean energy generated on site from 10 MW rooftop solar technology and one of the largest building mounted photovoltaic installations in the Middle East
- This offsets nearly all of the electricity in Phase 1, reducing the need for power produced by fossil fuels

RESULT

- A few thousand people are living and working in Masdar City and continues to add new businesses, schools, restaurants, apartments and much more
- The Masdar Institute campus, the first building in the city, 30% of the base electrical load of the campus is provided by SunPower solar panels, which produce approximately 1.8 GWh yearly resulting in 51% less energy than average buildings in the United Arab Emirates

KEY LEARNING

- The city creates a sample for all eco cities across the world in the future
- Policy reforms and stakeholder awareness are key factors that determine the success of renewables in any country
SUCCESS STORY 14

Solar Street Lighting, Nepal

BACKGROUND

Nepal is a mountainous country and the terrain for extending the grid becomes very challenging due to geographical variations, poor transportability, and fragmented settlements. Lack of adequate capital adds to the problem in providing energy access to the last mile. Solar power seems to be the most feasible and useful source of electricity to meet the power demand.

With support from credit agencies such as (Asian Development Bank), the Nepalese Government is providing subsidies for small-scale solar systems for households that don’t have access to the power grid. Other solar systems are used in the sparsely populated hills to power water pumps, computer and telecommunication systems, and vaccine refrigerators in health clinics.

CHALLENGE / PROBLEM STATEMENT

✓ Streets form very important community places which require electricity on a continuous basis. In times of power outage, there is a high risk of accidents due to dark streets
✓ Street lighting, especially in sparsely populated communities, puts excessive demand on grid for continuous provision of electricity

SOLUTION

✓ Since the new solar powered LED lamps usually use far less energy than the current 250-watt sodium vapor lights, they would help reduce both electricity demand and carbon emissions
✓ 2010 onwards, 1,000 solar streetlamps were installed around city centers in Nepal under one component of an Energy Access and Efficiency Improvement Project financed by a $65 million concessional loan from ADB
✓ The project is co-financed with grants of USD 4.2 million from the Clean Energy Financing Partnership Facility—supported by the Governments of Australia, Norway, Spain, and Sweden—and USD 300,000 from the Climate Change Fund

RESULT

✓ The solar streetlamp program implemented by the Nepal Electricity Authority helped in lowering peak electricity demand
✓ It is also expected to reduce CO₂ emissions by an estimated 15,000–20,000 tonnes annually
✓ Improved road safety and personal security in high-profile areas frequented by both tourists and low-income vendors
✓ The initial cost of a solar street lamp was around USD 2,000 per piece which could be repayed within 5 to 7 years
✓ They provide uninterrupted light irrespective of grid electricity
✓ The solar street lighting has been extended to other parts of Nepal
✓ The community is also contributing in some projects in Kathmandu and other parts of Nepal where 15% of the cost is now being contributed by the community

KEY LEARNING

✓ Small applications of solar like the street lights can be great success specifically based on local requirements
✓ International aid reduces the financing barrier and helps in better adoption of new technologies among the community members. As the community becomes aware, it is ready to support the technologies financially as well
SUCCESS STORY 1

Refinancing of Solar Portfolio, France

BACKGROUND

Sonnedix France SAS is an independent solar power producer and has 66 solar projects with 795 MW of controlled capacity and 353 MW of operating / complete capacity in 9 countries. The company also has a pipeline of solar PV projects in excess of 1,000 MW.

Sonnedix is constantly looking to further grow its PV portfolio and it is important to free up capital by means of refinancing of its operational assets. It has aligned 6 ground mounted assets with a total installed capacity of 57.3MWp located in France. All plants reached Commercial Operation Date (‘COD’) between July 2011 and August 2012. The electricity produced is sold to EDF, a French utility company, via 20-year Power Purchase Agreements that have an average remaining life of 16 years and two months as of January 2016.

CHALLENGE / PROBLEM STATEMENT

- This is the one of largest refinancing in France for solar assets
- Structuring of such diverse projects require various advisors which will have to work in complete coordination to finish the transaction

SOLUTION

- Sonnedix was advised by various advisors including Linklaters (legal advisor) and Astris Finance (financial advisor). The lenders were advised by Marsh (insurance), Deloitte (model audit), OST Energy (technical) and Clifford Chance (legal)
- Three lenders were brought together as lead arrangers: Natixis, Banco Santander and The Bank of Tokyo-Mitsubishi UFJ, Ltd, a member of the MUFG Group
- Natixis also acted as facility agent, account bank, documentation and technical bank, with Banco Santander as the insurance bank and The Bank of Tokyo-Mitsubishi UFJ, Ltd as the modelling bank
- Astris Finance used a unique technology and structuring toolbox to optimize portfolio refinancings across several SPVs
- OST energy acted as the Technical Advisor for the lenders carrying out a yield and performance analysis, site visits and a technical review of the entire project

RESULT

- The offer took advantage of attractive market conditions to increase the quantum of debt and improve the quality of the debt (extended maturity, lower coverage ratios and tighter margins)
- The transaction was completed for EUR 203 million, largest in France
- The transaction was completed in record time
- The refinancing allowed Sonnedix to free-up cash, reinforce the long-term stability of their French fleet and create value for shareholders

KEY LEARNING

- Thorough technical, financial and legal analysis leads to easier refinancing transactions
- Other solar power producers can gain from such experience to free up their cash for future growth
SUCCESS STORY 2
First Solar Cycle Lane, The Netherlands

BACKGROUND
Solar panels have the potential to generate enough electricity to power entire cities, but they also require a lot of space. rooftops or open fields are not the only places, where we can install solar panels. Bike lanes/roadways can also be leveraged for installation of PVs.

Upto 20% of the Netherlands', nearly 87,000 miles, of roads can leverage this.

CHALLENGE / PROBLEM STATEMENT
✓ Cities are crowded places. It is not easy to find space for the installation of solar panels
✓ Roads are large available open spaces but the cost involved is high
✓ There are possible challenges with finding materials that can endure high temperature fluctuations

SOLUTION
The stretch of cycle lane connecting Amsterdam and Krommenie, ridden by 2,000 cyclists daily, was selected to be converted into a ‘SolaRoad’. This stretch, if covered with solar panels instead of asphalt can generate electricity using a unique technology.
✓ SolaRoad is constructed with solar cells fitted in one travelling direction underneath a tempered glass top layer
✓ These solar panels are skid resistant, self cleaning and withstand the weight of solid steel balls being dropped on them
✓ Costing around €3m (£2.4m) and funded mostly by the local authority, the road is made up of rows of crystalline silicon solar cells, encased within concrete and covered with a translucent layer of tempered glass
✓ Thus, the existing road network proves to be an inexhaustible source of green power

RESULT
✓ The material used generates more than 3,000 kilowatt hours of energy which is more than the initially estimated production
✓ The state of California has also expressed interest in look at such solutions in its transport infrastructure
✓ However due to their location and the constant wear and tear, the amount of energy stored and generated is around 30% less than panels mounted on top of roofs
✓ In time, the solar power from the road will be used for practical applications in street lighting, traffic systems, electric cars (which drive on the surface) and households

KEY LEARNING
✓ The project is under pilot for three years and more robust endurance of the high stress of vehicular traffic will be critical for the project
✓ Promotion of new technology development is critical for taking solar to the next level
SUCCESS STORY 3

Financial Interventions for PV installations, UK

BACKGROUND

UK aims to derive over 30% of electricity from renewable sources by 2020 with 2% from small-scale sources. The United Kingdom (UK) Government has put forward a range of financial incentives to tackle climate change and ensure energy security.

CHALLENGE / PROBLEM STATEMENT

Large scale uptake of solar technologies requires mobilizing communities and encouraging them to adopt these in their day to day life.

SOLUTION

The ‘Feed-in-Tarriffs’ (FIT) scheme was designed to promote the uptake of low carbon electricity technologies by the public and communities in the UK and provides three financial Incentives:

- **Generation Tariff**: The energy supplier will pay a set rate for each unit (kWh) of electricity generated. The level of tariff is dependent on the technology and size of installation
- **Export Tariff**: All technologies receive a further 3.1p/kWh for each unit of electricity supplied to the grid. Currently, it is estimated as 50% of the electricity generated
- **Electricity bill savings**: Electricity generated on-site will reduce the amount of electricity required from the grid resulting in reduced energy bills

The FIT scheme is centered around offering guaranteed prices for fixed periods to enable greater number of investors

RESULT

- The introduction of the Feed-In Tariffs scheme (FiTs) in the UK has accelerated the deployment of PV technologies
- Over the years, the cost of installing PV systems has reduced significantly, more than what was predicted by Department of Energy & Climate Change (DECC) initially, enabling higher adoption

KEY LEARNING

- A healthy Return on Investment (ROI) can be made on PV installations provided the future installations focus on off-setting electricity required from the national grid
- While the cost of purchasing and installing solar PV technology has reduced dramatically since the introduction of the FIT, it still requires government support to continue
SUCCESS STORY 4
Integration of Solar energy to Grid - Learning from Germany

BACKGROUND
Renewable Energy (RE) is becoming a major mainstay of global energy mix as around 19.2% of world’s final energy consumption came from RE in 2014. The share is expected to increase as well owing to

- Falling cost of Solar and Wind
- Greener energy
- Micro generation being more effective in providing energy access

However, RE sources are not ‘firm’ sources of power and integrating it in the traditional grid is a challenge

CHALLENGE / PROBLEM STATEMENT
Solar generation has its own set of challenges making it difficult to integrate in the grid

- Renewable Energy needs more transmission and grids as the generation is more location specific and the distance between power generation and consumption can be large
- RE also needs smart grids and better power balancing technologies to be made useful based on demand
- RE generation is dependent on external factors like the sunshine or the wind speed which may not match with the demand
- Traditional sources of power still have to be retained to act as base loads in case the RE sources go offline

SOLUTION
Technological innovations are required to mitigate the challenges and effectively utilize solar and other renewable energy. Germany is one of the leading countries in the world to integrate RE in their grid supply. The following interventions were taken to achieve smooth transition

- Strengthening the grid and transmission network by adding additional interconnection lines between the sub national grids
- The base load is provided by excess coal generation capacity which has been designed to ramp up and down on an hourly basis. Other sources like gas and nuclear have also been designed to be flexible
- Better prediction of Solar outputs based on robust weather forecasting methodologies specially on better next day forecasts which allow the flexible power sources to be planned better
- Local intra-day power market is made strong and flexible to trade power at different points in time. The trading auction period has also been reduced from 1 hr to 15 minute slots to match demand and supply on a real time basis
- Technology improvement on frequency balancing problem from solar sources have helped preventing solar shut offs in case of higher or lower frequency outputs from large solar plants

RESULT
- Germany produced more than the total power demand of the country on May 15, 2016
- Renewables contributed 27.4% in gross electricity generation and 13.5% of the gross final energy consumption in 2014

KEY LEARNING
- The energy transition has to augmented by policy and regulation update
- The systems should be made flexible to incorporate new technology solutions
- Traditional sources of power may see value erosion if renewable energy is given first dispatch as in Germany
SUCCESS STORY 5

100,000-Roofs-Programme, Germany

BACKGROUND

By the end of the 1990s, wind energy already contributed a significant share to Germany’s electricity generation. The Electricity Feed-In Act (Stromeinspeisegesetz) from 1991 obliged grid operators to connect RE producers to the grid and give them preferred access over fossil energy. In 1998, the German government decided to significantly increase renewable energy to make it a central pillar of the power system. To achieve this target solar energy also needed to be scaled up significantly.

CHALLENGE / PROBLEM STATEMENT

Solar energy needed to be mainstreamed in Germany, though still being an economically unviable infant technology, which was at the time not able to compete with the other power generation technologies.

SOLUTION

✓ The 100,000-Roofs-Programme (HTDP) promoted the acquisition of rooftop PV systems from 1999 to 2003 by providing special loans with reduced interest rates through the German promotional bank KFW

✓ The HTDP was complemented by the Renewable Energy Sources Act (EEG) which replaced the Electricity Feed-In Act in 2000. This law provided PV system operators with a fixed feed-in tariff for a period of 20 years. Similarly to the Electricity Feed-Act, it furthermore obliged grid operators to prioritize RE and granted RE operators with statutory rights for grid connection

RESULT

✓ Installation of solar rooftop capacities of 346 MW between 1999 and 2003

✓ HTDP initiated total investment of 2.4 billion Euro and created nearly 10,000 jobs

✓ Most importantly, HTDP helped to initiate the market for solar PV by making an infant industry more mature and competitive:

  o In the subsequent years until the end of 2015, installation of about 40 GW solar power generation capacity in Germany out of which about 30 GW on rooftops

  o More than 1.5 million solar plants

  o In 2015, Germany generated about 37 TWh or about 6% of its total power generation from photovoltaics

KEY LEARNING

To mainstream and make them competitive infant technologies, the appropriate financing mechanisms must be complemented by adequate regulatory instruments. Neither financing nor regulatory instruments will be able to succeed alone, both must always complement each other.

✓ In Germany, the EEG provided the regulatory environment by making PV economically viable through feed-in tariffs and by granting preferential market access to RE

✓ The EEG was only successful because it was complemented by the HDTP, which provided promotional loans at reduced interest rates in order to help developers overcome the initial investment costs
SUCCESS STORY 6
Community Energy Self Sufficiency, Spain

BACKGROUND
Barcelona was the first European city to develop and implement a Solar Thermal Ordinance (STO) in 1999, making it compulsory to use solar energy to supply 60% of running hot water in all new buildings, renovated buildings, or buildings changing their use.

Water heating consumes a major chunk of electricity in Europe. In Barcelona alone, it is estimated that hot water represents 28% of the energy needs of households.

In addition, many other facilities in the community, such as swimming pools, laundries, canteens, hospitals, and food industry buildings, consume a significant amount of hot water; all of which have a noticeable impact on their energy bill.

CHALLENGE / PROBLEM STATEMENT
Despite the high potential for solar energy use in Barcelona the solar thermal market remained underdeveloped

SOLUTION
✔ The local Governance body, i.e. The Barcelona City Council took concrete steps to enhance the use of renewable energy in its community, including the use of solar thermal energy for water heating
✔ The local Government not only pushed for installation of solar systems in Government buildings but also mandated for solar systems to be installed in privately owned buildings
✔ This was achieved through collective action, ranging complementary actions such as stakeholder engagement, capacity building, information campaigns and fiscal incentives
✔ Barcelona Energy Agency was empanelled to implement the technical expertise necessary for monitoring and assessing the Solar Thermal Ordinance

RESULT
✔ As of December 31, 2010, 87,600 square meters of solar thermal panels had been installed
✔ Solar thermal became the most widely used from of renewable energy, accounting for 52% of total renewable production in 2008
✔ Between 1999 and 2008, greenhouse gas emissions in Barcelona were reduced from 4,737,300 tonnes (3.15 tonnes per inhabitant per year) to 4,053,766 tonnes (2.51 tonnes per inhabitant per year)
✔ The Barcelona Model has been followed by over 70 municipalities in Spain
✔ The implementation of this ordinance created a surge in the demand for solar water heating systems thus creating, new market opportunities

KEY LEARNING
✔ Solar can be utilized basis local energy requirements and solar availability
✔ Clear policy direction provided by the authorities with appropriate mandates allows faster acceptance in the community
✔ Appropriate capacity building to complement the regulations helps in increasing acceptability of such programs
SUCCESS STORIES

North America
SUCCESS STORY 1

Sun2live solar plant installation at the International Airport, Antigua and Barbuda

BACKGROUND

Antigua and Barbuda is located in the heart of the Caribbean Sea, where tourism is the main driver of the economy. The two islands have a combined population of 91,000 and an electrification rate of approximately 88%. As is the case with majority island nations, Antigua and Barbuda is almost entirely reliant on imported fossil fuels which lead to high cost associated with electricity. The electricity sector of the twin islands is striving to become the greenest in the whole of the Caribbean and has taken ambitious renewable energy goals aiming at 10% of electricity to be sourced from renewables by 2020 and 15% by 2030.

CHALLENGE / PROBLEM STATEMENT

Expensive electricity combined with heavy reliance on imported fossil fuels to meet energy demands is the main challenge.

SOLUTION

In order to address these challenges and meet its renewable energy target, a state-of-the-art solar power plant has been installed at the V.C. Bird International Airport of Antigua. The 3MWp project is developed and constructed by PV Energy Limited. The project named as sun2live incorporates more than 12,000 polycrystalline photovoltaic panels, which makes this installation the largest in Antigua. The installation is part of a larger initiative to add 10 MW of solar capacity in the country, the remainder of which will be installed on the rooftops of public buildings and solar car parks.

RESULT

- The solar power system generate up to 4,645 MWh per year and therefore save a substantial amount of CO₂ emissions during the same period contributing towards reducing the carbon footprint of the twin islands
- The project will allow the Government to reduce the foreign exchange outlays for imported fossil fuel, and also help in developing indigenous energy resources contributing towards the goal of reducing the national carbon footprint

KEY LEARNING

- Equipping airports with eco-friendly and clean solar power is an approach, which requires detailed and farsighted analysis and preparations in the form of special glare studies to be conducted from safety standpoint. PV Energy had conducted these studies in this case
- Antigua and Barbuda has joined a growing list of facilities harnessing the power of sun, which are present in Australia, Kuala Lumpur, India, Palau International Airport and Indianapolis International Airport, which clearly states the fact that the idea is replicable and sustainable
SUCCESS STORY 2

Implementation of Sustainable Solar Energy, Bahamas

BACKGROUND

Electricity generation in Bahamas is almost based on thermal plants powered by petroleum fossil fuels. The economic burden associated with the electricity generation negatively impacts the competitiveness of the tourism industry. In order to meet the growing demand for energy, gradually the Bahamian Government has started to incorporate renewable energy (RE) and energy efficiency programs into national plans. The Bahamas National Energy Policy serves as a guide to total energy reform by the year 2033 through strategic steps including renewable energy source development, conservation and efficiency.

CHALLENGE / PROBLEM STATEMENT

The biggest challenge is the volatility in oil prices combined with increasing demand for energy which puts huge financial burden restricting economic growth and increasing inflation.

SOLUTION

In 2012, the Government along with the Inter-American Development Bank (IDB) and the Global Environment Facility (GEF) implemented a pilot project to install solar water heaters and photovoltaic solar systems in homes throughout the Bahamas at a project cost of USD 1 million. The project was designed in such a way to remove existing barriers to RE technology, facilitate the data collection, boost entrepreneurial activity in the region, develop new job streams and allow the public to lower electricity bills.

RESULT

- 134 solar water heaters and 33 photovoltaic solar systems were installed

KEY LEARNING

- The project followed amendment of existing acts and regulations to regulate the renewable energy industry for future
- It led to relevant guidance related to renewable energy getting introduced into the building code
- Fossil fuel imports and transportation costs declined
- The project also lead to a steady drop in the consumption of electricity by consumers

SUCCESS STORY 2

Implementation of Sustainable Solar Energy, Bahamas
SUCCESS STORY 3

Turtle Beach Resort Solar Water Heating Project, Barbados

BACKGROUND

Barbados has a high standard of living and is considered among the leading developing countries in the world. Hot water is not seen as a luxury but a basic requirement in households and commercial sector particularly in tourism industry. Hotels rely on hot water for laundry, cooking and air conditioning purposes. Prior to 1997, hot water was produced entirely from electric water heating system powered with diesel-generated electricity.

CHALLENGE / PROBLEM STATEMENT

The challenge is that electricity is very expensive in Barbados due to high cost of fossil fuel imports, amounting to about USD 0.278/kWh in 2013. This is aggravated by extreme volatility in the prices of fossil fuels due to the Fuel Clause Adjustment (FCA) mechanism, significantly impacting the hotel industry given their high reliance on hot water.

SOLUTION

In 1997, the management of the Turtle Beach Resort decided to invest in a solar water heating (SWH) system to minimize the costs and provide a reliable energy source. The system had a capacity to heat up 7,800 gallons water to 55 - 60 °C, sufficient for providing 40 gallons of water per room along with other ancillary services like catering. The system is capable of producing every day energy to the tune of 1,048 kWh. The project attracted total capital investment of USD 200,000 and had a maintenance cost of USD 2,650 per year. The policy support came in the form of 35% tax credit provided by the Government of French Polynesia.

RESULT

- In the same period, the system prevented about 655 tonnes of CO₂ emissions or about 41 tonnes per year
- SWH is a perfect example of the pioneering development and sustainable application of renewable energy technology in Barbados, which is among leading countries in the world in SWH water collector capacity, according to International Energy Agency (IEA)
- The small island developing state (SIDS), unlike other countries in the Caribbean, which are still heavily dependent on fossil fuels for water heating, dominates the regional market with its exports of SWH systems
- The tourism industry can benefit from exploring alternative sources of energy for provision of amenities
- Solar water heating technology makes economic sense for hotels on islands, where electricity prices are high
- Capital investments and maintenance costs of a solar water heating system are lower than the resulting, long-term savings

Between 1997 and 2013, the total savings from reduced energy consumption amounted to USD 1.48 million
SUCCESS STORY 4

Monte Plata Solar Project, Dominican Republic

BACKGROUND

The Dominican Republic is witnessing a steady rise in electricity demand owing to population increase and rapid economic growth. The island nation still relies primarily on fossil fuels, largely diesel and gas. Despite its solar irradiation 50% higher than Germany’s, there has been very little solar power development in the region. Caribbean Governments, utilities and independent power producers are beginning to support the development of renewable energy projects. The Dominican Republic aims to get 25% of its energy from renewable sources by 2025, and to reduce its carbon emissions by 25% from 2012 levels by 2030.

CHALLENGE / PROBLEM STATEMENT

✓ The challenge lies in liberating the island country from economic burden owing to expensive fuel imports and energy dependency.
✓ The inadequate power supply coupled with the transmission and distribution losses in the country’s aging grid system exceeding 30%.
✓ To increase the energy security and reduce the greenhouse gas emissions while supporting the community development, the Dominican Republic is looking for alternative sources of energy.

SOLUTION

In a positive development, the country’s first solar energy plant Monte Plata was inaugurated in March 2016 which is also claimed to be the largest in the Caribbean. The solar facility installation is a 33.4 MW photovoltaic solar array developed by Phanes Group in partnership with General Energy Solutions and Soventix. The first phase of the facility comprises 132,000 solar panels, which has tripled the number of solar panels in the Dominican Republic. After the completion of the second phase by the end of 2016, the array’s total capacity will rise to 67 MW, increasing the photovoltaic power output in the country fivefold and delivering more than 50,000 MWh of clean energy to the country’s grid annually.

RESULT

✓ The Monte Plata facility will provide clean electricity to more than 50,000 households and will save an estimated 70,000 tonnes of CO₂
✓ The project has created more than 300 direct jobs and 1,000 indirect jobs, with the majority being local jobs

KEY LEARNING

✓ The project is a success story demonstrating multiple stakeholders working together to co-create viable and bankable solar projects in emerging markets providing energy access and unleashing economic opportunities for remote communities.
SUCCESS STORY 5

Solar Water Heating Systems, Grenada

BACKGROUND

Grenada is a small island nation comprising of three islands: Grenada, Carriacou and Petite Martinique. The communities have a 99.5% electrification rate with 100% of the electricity generated through diesel-fired generator sets (DG sets). Generation of entire electricity through fossil-fuels and the small size of the total installed capacity present an opportunity for developing an integrated smart grid approach for Renewable Energy and present Grenada as a model case for developed nations to learn from. Grenada’s Sustainable Energy Action Plan aims at a minimum of 20% of electricity and transportation energy demand to be met by renewable energy by 2020.

CHALLENGE / PROBLEM STATEMENT

Dependence on oil imports and a weak economy has motivated the country to fulfill its energy requirements through a combination of renewable energy sources. As an aftermath of hurricane Ivan, sharp increase in electricity prices coupled with other challenges including access to technology, finance and capacity building presents a strong business case to scale up the renewable energy sector.

SOLUTION

Solar water heaters are commonly used in tourism and residential purposes. Most of the thermal collectors are imported from Barbados and Dominica and there is a potential for increasing the use of solar water heaters.

To increase access to solar water heaters for households, a unique program Caribbean Solar Finance Programme (CSFP) was jointly implemented by United Nations Industrial Development Organization (UNIDO), the Organization of American States (OAS), and the Energy and Security Group (ESG) working in partnership with the Grenada Public Service Co-operative Credit Union (GPSCU). The program was designed to increase the capacity for financing by the credit unions that service the credit needs of the target population and increase awareness about the benefits of the solar water heaters for residential and tourism purposes.

The program elements included training course for officers in credit unions for lending a solar water heater, consumer credit facility offering low-cost and long-term facility and a consumer awareness campaign designed to raise awareness.

RESULT

- By the end of 2008, more than 4500 solar water heaters have been imported
- Solar water heaters have gained increasing acceptance amongst the country’s numerous resorts where air-conditioning and water heating are the two major power consumers
- Integration of Solar PV into the country’s disaster management system (example- hurricane shelter camps)

KEY LEARNING

- Business linkage with local sectors like tourism acts as a driver for adoption of new technologies
- The success of the CSFP program demonstrates its potential to be replicated in other geographies and has been implemented in St. Lucia
SUCCESS STORY 6

Central America’s Solar Success Story, a Case Study of Honduras

BACKGROUND

Honduras is gradually emerging as a solar energy success story. It has a large potential for solar photovoltaic generation and is a practical solution for servicing energy-isolated rural communities. Honduras has a renewable energy goal of generating 80 percent of its energy from renewable by 2020. Clarity on regulations and incentives for investors has set the country apart from its neighbors, where a lack of clear rules and price stability are hindering solar development.

CHALLENGE / PROBLEM STATEMENT

Honduras strives to reduce its dependency on imported fuels. The earlier power sector reforms in the country attracted little investment owing to country’s small size and perceived low revenues.

SOLUTION

- In 2013 the Government launched its premium tariff of USD 155 per megawatt-hour for the first 300 megawatts of PV capacity brought on-line by July 31 of that year.
- The 2013 reforms were targeted towards exploiting country’s excellent solar potential through targeted incentives to leverage investments.
- In 2015, Honduras ranked second largest producer of solar electricity in Latin America.
- The solar growth has been phenomenally fast with 23 solar farms being approved in 2014 with a total of 609 MW representing an investment of USD 1.6 billion.
- Several other projects are slated to come on-line in the coming years.

RESULT

- In 2015, Honduras ranked second largest producer of solar electricity in Latin America.
- The solar growth has been phenomenally fast with 23 solar farms being approved in 2014 with a total of 609 MW representing an investment of USD 1.6 billion.
- Several other projects are slated to come on-line in the coming years.

KEY LEARNING

- The 2013 incentives created a ‘first come, first served’ basis that set the industry rolling.
- Similar incentive schemes can be launched in neighbors like El Salvador and Nicaragua to kick-start the adoption of renewables.
SUCCESS STORY 7

Cooperative model for scaling solar applications, Minnesota, USA

BACKGROUND
Tri-County Electric Cooperative (Tri-County) serves approximately 13,000 meters in the southeastern corner of Minnesota, USA. The member composition is mainly residential and farmland, averaging about four members per mile of line, and agriculture is the primary economic driver in the area.

CHALLENGE / PROBLEM STATEMENT
Tri-County’s service territory has a challenging topography and is heavily wooded which makes power distribution and connectivity with the grid difficult. Therefore it was required to look for decentralized system of electrifying the county.

SOLUTION
Like any other co-op, local control and ownership was a primary goal. Tri-County considered various financing and ownership models before deciding on the tax equity flip model, facilitated by the National Renewables Cooperative Organization (NRCO). Federated Rural Insurance Exchange served as the tax equity investor.

Under the ‘tax equity flip model’, the cooperative forms a taxable subsidiary, and this subsidiary and the tax equity investor form a special purpose entity (SPE). The SPE constructs, owns and operates the array, and has a purchase power agreement with the cooperative for the output. In the first stage of five or more years (based on the IRR achievement), all distributions and tax benefits (investment tax credits, accelerated depreciation, etc.) from the SPE are distributed to the owners in a 99 to 1 split: 99 percent to the tax equity investor and 1 percent to the cooperative subsidiary.

After the initial stage, the split ratio “flips”: 95 percent to the cooperative subsidiary and 5 percent to the tax equity investor. At that point, the cooperative subsidiary can buy out the tax equity investor of the remaining ownership at fair market value.

RESULT
Based on the installed cost, especially the soft costs associated with the contracts and agreements required, Tri-County would have opted for a larger array to leverage economies of scale. The initial plan was to develop a 40 kW array it was soon expanded to a 73.8 kW array prior to construction because of member interest. In the end, Tri-County affirmed that the array was a good decision, and that it has been a success for the cooperative and its members at many levels.

Additionally, Over the years, surveys amongst the members of community have showed a 10% to 20% interest in solar systems.

KEY LEARNING
- Co-operative model for community solar systems can be a successful model if structured in an innovative manner
- The model can be scaled in the ISA countries, specifically those with lower access to electricity
SUCCESS STORIES

Oceania and Australia
SUCCESS STORY 1

Solar Panels success story, Australia

BACKGROUND

Australia is on the cusp of an energy revolution. It is certainly pioneering the change by embracing the solar technology and leading the world in taking control of their power bills. Installation rates are highest in South Australia and Queensland, and in some suburbs of Brisbane and Adelaide where more than half of all homes have solar panels. Similar to homes, businesses are also lured to increasingly turn to solar in order to keep a check on their power bills.

CHALLENGE / PROBLEM STATEMENT

Australian households generally have high power bills and there are high peak energy demands in Australia during summer season.

SOLUTION

- A typical residential PV system in Australia is sized somewhere between 1.5-5kW, or 6 to 20 panels
- Rooftop PV combined with solar batteries is also emerging as an exciting opportunity for generation of clean power and save even more on bills
- The success of the program can be attributed to the state’s feed-in tariff incentive programs, whereby each unit of solar power exported to the electrical grid is rewarded
- The rates of PV system have also fallen to the tune of 75% over the past few years

RESULT

- Australia has a penetration rate of 15% across all households having solar panels on roofs which makes it the highest number of solar panels on people’s roofs per capita anywhere in the world
- The power bills have decreased, especially during peak times, when electricity consumption soars up
- Rooftop solar means less polluting power leading to healthy cities and towns
- It also serves as an avenue for employment generation contributing to overall economic development
- Solar PV has also played a significant role in reducing peak energy demand periods

KEY LEARNING

- Enabling innovative schemes like Solar Feed-In Tariffs have already proved to be a huge success in other countries like Germany and the UK, and hence it has a potential of being replicated in other geographies
SUCCESS STORY 2

Tarewa mall powered by solar energy, New Zealand

BACKGROUND

Tarewa Mega Centre, a community mall in Whangarei, Northland is located in an area where the per kWh energy costs are among the highest in New Zealand. The energy demand increases in summers due to increased air conditioners usage. Tarewa’s air-conditioning system uses 326,542 kWh of electricity per annum at a cost of USD 90,122. This required installation of a solar PV electricity generation system, which can tap the abundant sunshine during the summer months utilizing the large unused roof top spaces of malls.

CHALLENGE / PROBLEM STATEMENT

The challenge faced by the region was one of the highest energy costs in the New Zealand. There was also a need to have protection against the relentless rise in electricity prices.

SOLUTION

The mall has an installation of 240kW of solar system with 926 solar panels to power the entire air-conditioning system at Tarawa’s 7550m² community shopping complex. It is New Zealand’s largest commercial solar power system. The ‘one of kind’ solar power system was innovatively designed in the form of a shipping container housing all the inverters, monitoring and junction boxes. It has been designed to supply 70-80% of the center’s daytime baseload energy needs.

RESULT

✓ The system aims at offsetting 80-90% of the air-conditioners’ operating costs
✓ The owners of the mall are protected against electricity price increases
✓ It gave financial benefit to the tenants by factoring in solar portion in their bills which was lower than grid tariffs

KEY LEARNING

✓ It was a win-win situation for both the tenants and the owners of the mall, who saw it as a long term investment, in an area where the energy rates are amongst the highest in the country
✓ It also proved that large scale solar projects are possible and commercially and financially viable in New Zealand paving a way for many such projects to follow
SUCCESS STORY 3

Rukua Mini-Grid Solar Project, Fiji

BACKGROUND

Rukua is a village settlement on the island of Beqa, dependent heavily on diesel generator systems, benzene and kerosene lamps for its basic electricity and lighting needs. Over the years, the villagers have incurred significant fuel costs linked to price increases and the high cost of transportation. Fiji fully embraces the United Nation’s Sustainable Energy for All (SE4All) initiative and the Fijian Government, by the year 2020, aims to provide all Fijians with access to modern energy services which are also affordable, clean and reliable.

CHALLENGE / PROBLEM STATEMENT

One of the major challenges facing the country is the provision of basic reliable and affordable electricity services to the remote and maritime rural communities. Fuel imports on average represent about 1/3 of Fiji’s total import bill, which also has enormous economic, environmental and social impacts on ordinary Fijians.

SOLUTION

- The project was funded by the Inter Action Corporation (IAC), facilitated by the Japanese Government and coordinated by the Fiji Government through the Department of Energy (DoE), which provided local components such as house wiring, underground reticulation systems, battery houses, transportation & logistical assistance, as well as technical personnel from the Rural Electrification Unit. The community partnership took a centre-stage in the project implementation
- The project has developed essential infrastructure for electricity generation and distribution, and demonstrated active role played by the local community
- The project is managed by a village committee and they no longer face the financial burden of buying expensive fossil fuels for their electricity needs
- This is a successful demonstration of a public-private-donor community partnership which highlights the benefits of renewable energy and its advantages for a small island economy
- The project is replicable as similar investments in solar energy power systems are suitable for some remote islands where grid extension is not economically viable

SUCCESS STORY 3

Rukua Mini-Grid Solar Project, Fiji
SUCCESS STORY 4

500 KW Solar Panel Project, Nauru

BACKGROUND

Nauru is a small oval shaped and raised coral equatorial island located about 40 kilometers south of the Equator with a total land area of 21 Km². It is the smallest state in the South Pacific Ocean, and the third smallest state by land area in the world. The Nauru Utilities Corporation currently meets over 99% of its energy demand using diesel fuel oil generators. The Government has ambitious plans and the Energy Road Map sets a target of 50% of Nauru’s energy demand to be generated from renewable energy sources by 2020. Nauru has limited scope of wind and biomass energy, which makes solar energy the most viable option for meeting the targets. Water is a scarce resource and Nauru produces its own demand of water through reverse osmosis.

CHALLENGE / PROBLEM STATEMENT

Nauru is a remote island lying at the end of fuel oil supply chain which puts a premium on the price of the oil. The small island has land at a premium and there are limited buildings available for solar rooftop projects as most of the buildings are old and have asbestos roofs.

SOLUTION

- The ground mounted project was set up on a waste land fill used for dumping non-organic and phosphate mining wastes
- The project funding was secured via a grant mechanism from United Arab Emirate

RESULT

- After the first month of operation, the project produced 3% of the energy demand

KEY LEARNING

- The set-up is expected to produce 876,000 kWh in an entire year
- Waste land was used which would have otherwise been difficult to use for other purposes
- Clean energy source saved CO₂, SOx and NOx emissions resulting from the burning of high sulphur content diesel fuel oil

- Phosphate mining activities create a lot of dust in the environment which reduces the efficiency of solar power production by 20%. Frequent maintenance of panels is required by washing them during prolonged sunny periods
- Water being used for washing panels also needs to be efficiently utilized and hence there are plans underway for capturing and storing the used water
- Limited land availability on small islands pose a problem for solar installations, however this is a unique approach to utilize waste lands
La’a Lahi (Big Sun) Solar Field, Tonga

BACKGROUND

As an emerging tourist destination with 17,000 residents, Vava’u focus was to reduce the import of diesel for power generation. To aid this reduction in importation, the Tonga Energy Road Map also popularly known as TERM lays an ambitious ten year road map to reduce Tonga’s vulnerability to oil price shocks and achieve an increase in quality access to modern energy services in an environmentally sustainable manner.

CHALLENGE / PROBLEM STATEMENT

The main challenge is import of highly expensive diesel, which poses an economic burden, resulting in a need to explore alternative sources of energy.

SOLUTION

- The TERM implementing Unit and Masdar launched an extensive solar energy project, aimed towards maximizing fuel savings in 2011
- The project funded by UAE-Pacific Partnership Fund aimed towards increasing renewable energy (RE) generation projects in Pacific island countries
- The La’a Lahi (Big Sun) 512 kW solar farm was constructed to supply 67% of power from the existing conventional, diesel - based micro-grid

- Advanced control technologies are used to maximize solar power production while minimizing possible disturbances to the grid in terms of stability or the need for grid infrastructure upgrades. Performance was monitored through automatic data reporting in Tonga and Masdar

RESULT

- The plant satisfies 17% of Tonga’s annual electricity demand and replaces 280,000 litres of diesel fuel per year
- Carbon dioxide emissions are reduced by 724 tonnes per year
- The project lead to reducing electricity tariffs across Tonga by 1%
- Local job development during the construction phase was equivalent to USD 400,000 contributing to economic development of the local population

KEY LEARNING

- The project’s phenomenal penetration to the tune of 67% and performance data substantiated the business case for renewable energy deployment and subsequent reduction in the fuel import needs and associated costs
SUCCESS STORY 6

The e8 Solar Power Project, Tuvalu

BACKGROUND

Like many Small Island Developing States (SIDS), Tuvalu, an archipelago consisting of nine coral islands in the South Pacific Ocean, has been heavily reliant on imported fuel for its diesel-based power generation system. Tuvalu, with sunlight almost throughout the year, has a high potential of using solar power as a source of energy. The e8 which comprises ten leading electricity companies from the G8 countries, enabled Tuvalu to operate its first grid-connected solar power generation system.

CHALLENGE / PROBLEM STATEMENT

Soaring oil prices and high vulnerability to climate change were the main drivers for the Government of Tuvalu and the Tuvalu Electricity Corporation (TEC) to switch to an energy system based on increased use of renewable energy sources.

SOLUTION

✓ The project features a 40 kW grid-connected solar system that accounts for about 5% of Tuvalu’s capital peak demand, and 3% of TEC’s annual household consumption. Solar panels were installed on the top of the spectator’s stands roof at the nation’s capital city’s football stadium.

✓ The project was funded through a donation-type financial model where USD 410,000 was financed through an e8 donation supplemented by a Japanese Government grant.

RESULT

✓ In its first 14 months of operation, Tuvalu’s consumption of generator fuel was reduced by 17,000 litres.

✓ The project provides power to Tuvalu’s households, healthcare facilities, small- and medium-sized enterprises and other local development infrastructure.

✓ Apart from this, the project aimed at promoting the use of renewable energy in SIDS, transfer technological expertise to counterparts in the Pacific region, create a pilot model of grid-connected solar power generation in the region and send across a clear message about global and concerted action for promotion of sustainable energy to address climate change.

KEY LEARNING

✓ During planning phase the set up’s resistance against salt and water corrosion damage must be planned and closely monitored post commissioning.

✓ Strong political momentum and support of key local actors (in this case Tuvalu Government and Tuvalu Electricity Company) is instrumental in ensuring the success of such projects and further ensuring their scalability and replicability.

✓ The implementation of solar power systems in island states require longer time estimations and stronger logistical management.
SUCCESS STORY 7

Solar Powered Desalination Plant, Vanuatu

BACKGROUND

On Ambae and Aniwa Islands, local population depends upon rain water as the source of potable water. The quality of the water supplied is heavily affected by volcanic activities on the islands of Ambae. A desalination plant is required to supply safe water to the local residents.

CHALLENGE / PROBLEM STATEMENT

The project addresses the challenge of provision of safe and clean drinking water to local population and responding to climate change.

SOLUTION

- The 50 kWp solar-powered sea-water desalination plant has been set up by Hitachi Plant Technologies Ltd (HPT). The Government provided support in terms of providing land area for installation and employing local PWD engineer and technician to manage and operate the solar RO plant for Ambae and Aniwa.
- Design, supply, supervision of installation, testing and commissioning of the solar RO plant and providing trainings and 2 year warranty upon completion of the plant were the main obligations of the implementing entity.
- The financing for the project is supported by Pacific Environment Community (PEC).

RESULT

- The project is estimated to provide access to a safe supply of water to the healthcare centre and approximately 10,500 people on Eastern Ambae as well as provide water to approximately 350 residents on the Island of Aniwa.

KEY LEARNING

- The project has the potential of being replicable and the Governments of Samoa, Tuvalu, Cook Islands, Nauru, the Solomon Islands, Fiji, Federated States of Micronesia, Kiribati, Niue, Palau and Republic of Marshall Islands have successfully accessed the PEC Fund in the past for national renewable energy and seawater desalination projects.
SUCCESS STORIES

South America
SUCCESS STORY 1

Project for Renewable Energy in Rural Market (PERMER), Argentina

BACKGROUND

Argentina has been a leader among the developing countries for introducing reforms in the power sector. It has a relatively high rate of electrification at around 95% but still 2.5 million people in rural areas lack electricity service. This requires provision of basic electricity service in an efficient and sustainable manner to communities beyond the reach of the grid.

CHALLENGE / PROBLEM STATEMENT

It is difficult to meet the energy needs of rural low-income population.

SOLUTION

Project for the Renewable Energy for Rural Markets (PERMER) aims at providing electricity through provincial “off-grid concessions” that are negotiated or bid out for minimum subsidy and regulated by independent provincial regulating agencies. Under this approach concessions will be granted to private bidders that require the lowest subsidy for serving a given area.

The delivery model is based on public-private partnership, whereby the Government contributes through funding of equipment and subsidizing the user tariffs and concessionaires are responsible for service and maintenance. Involvement of private sector makes the services sustainable.

The PERMER program followed a top-down model, which also involved community participation in information provision and decision making.

RESULT

- Between 1999 and November 2011, the project served 11,489 households
- 1,598 solar home systems (SHS) were installed in public buildings
- Total installed capacity of SHS is 1530 kW, wind home systems is 809 kW and of renewable energy technology based home systems is 58 kW

KEY LEARNING

- A pioneering innovative approach to provide electricity to rural households and minimize the subsidy
- The project has immense scope of being replicable as in 1999 it started with participation from just two provinces - Jujuy and Salta and upon maturity became a project of national stature
SUCCESS STORY 2

The Euro-Solar Program, Bolivia

BACKGROUND

Bolivia, one of the poorest Latin American countries has one of the highest average annual irradiation in the World (5.7 kWh/m²/day to 7 kWh/m²/day). With this high potential, several residential photovoltaic systems have already been installed in the country. Energy access programs of Multilateral Development Bank (MDBs) and development partners include Decentralized Infrastructure for Rural Transformation, Decentralized Electricity for Universal Access, KfW Renewable Energies Program.

CHALLENGE / PROBLEM STATEMENT

It has been observed that post installation management and maintenance of these renewable energy community systems is not proper. However, making use of renewable energy is one of the best options because provision of electrical power to the rural population is a great challenge due to geographical conditions, low population density and long distances of remote rural areas to electricity networks.

SOLUTION

EURO-SOLAR proposed a novel approach to traditional rural electrification projects by mainstreaming renewable energy and linking power generation to a series of goals including improvements in education and health, development of productive activities, skills building within the community and a gender focus.

The Euro-Solar program aimed towards fostering human development in socio-economically marginal rural communities is benefitting them through installation of a mixed system of photovoltaic and wind power generation systems.

Communities were provided with Euro - Solar kits comprising of electricity generation system. The kit also consisted of two basic healthcare measures needed by the community: a water purifier to supply fresh water and a refrigerator for medical use. Communication system was also provided that enabled beneficiary community to connect with the rest of the world.

RESULT

- In the initial phase, installation of 45 kits for electricity generation benefitted 4,523 families in isolated communities
- The project between 2007 and 2013 installed 59 hybrid systems (PVS-wind) for the operation of computer equipment, refrigerators, water purifiers, battery charger, satellite antenna and IP telephony in the beneficiary communities
- The program also ensured capacity building aimed at community members to ensure equipments are well managed and maintained

KEY LEARNING

- Euro-Solar is a good example of a project combining poverty alleviation and low-carbon development
- Owing to the success of the EU led program, it has been implemented in eight Latin American countries: Bolivia, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay and Peru
SUCCESS STORY 3

The Sun Shines for All
Business Model, Brazil

BACKGROUND

There are approximately 25 million people in Brazil that do not have access to electricity. Prior to 1990s, the Brazilian Government launched a number of initiatives to expand electric grid to provide power to rural areas. However, the 1990s marked a period of extensive power sector deregulation in the country. The privatized corporations also focused on servicing locations with existing grids. At that time Agroelectric System of Appropriate Technology (STA) under the guidance of its founder - Fabio Rosa evolved new business model The ‘Sun Shines for All’ (TSSFA) to serve the needs of millions of potential customers left without access to electricity.

CHALLENGE / PROBLEM STATEMENT

- Utility companies little experience and interest in working with low-income rural markets and off-grid communities
- Lesser involvement of Brazilian Government due to electric utilities being privatized in the late 1990s

SOLUTION

- The TSSFA business model targeted towards the bottom of the pyramid leased a complete package that provided customers with the service of electricity. Solar home kit, included hardware needed to generate energy, along with the installation service and products that use electricity generated by the solar home system
- All of these tangible inputs are owned by STA and only the service provided by these materials are leased to customers, who pay a monthly fee for the privilege of having access to electricity

RESULT

- The solar home system could be rented for USD 10/month plus an initial installation fee
- The project provided energy access to customers, who saved from paying sales tax that would be required if they purchased the systems
- There were social benefits in terms of improvement of quality of life and income generation and environmental benefits including mitigation of disposal issues at the end of product’s life cycle

KEY LEARNING

- It is important to understand the local market, community and politics. In this case, rural poor were not interested in buying solar panels but were more interested in having access to the conveniences that electricity provides
- The models for rural communities should have features that end customers need. For example in the current model, customers could even get out of the contract at any time by paying the cost of un-installation. This was important for customers who believe that the grid may eventually be extended to their neighborhood
SUCCESS STORY 4

The Copiapó Solar Energy Project, Chile

BACKGROUND

Chile, as a country, is characterized by incredibly attractive solar resources. The Atacama Desert in Northern Chile is widely considered the World's best solar resource and this area also happens to be the home to the lion's share of the country's mining activities. The mining sector needs firm power round the clock and much of Chile has been dependent on pricy fossil fuel imports from its neighbors to supply this power.

CHALLENGE / PROBLEM STATEMENT

Chilean mines face a clear challenge as the country is running short on energy and the mines are interested in lowering the overall operation and maintenance costs by reducing the costs associated with energy.

SOLUTION

Addressing the twin challenges is the pioneering 24-hour solar project by SolarReserve in Chile's Atacama desert which can compete on price against other baseload generation. The Copiapó Solar Energy Project will deploy a combination of dual solar technologies - concentrated solar power (CSP) tower technology with molten salt thermal energy storage combined with solar photovoltaic (PV).

The project will comprise of two 130 megawatt (MW) solar thermal towers with energy storage, combined with 150 MWs of PV panels for daytime generation. This hybrid concept will maximize the output of the facility at a highly competitive price of power.

The project which is scheduled for commercial operation in 2019 is going to be the first facility of its kind in Chile and will be the largest solar power plant in the world.

RESULT

✓ The project will deliver reliable, clean, non-intermittent baseload power 24 hours a day, delivering over 1,800 gigawatt hours (GWh) annually with a storage capacity of 14 hours
✓ 260 MW of firm baseload power would be produced, which is critical to the mining sector operating at a capacity factor and availability percentage equal to that of a coal fired power plant
✓ The project has the potential of providing power equivalent of 560,000 homes
✓ There are economic benefits associated with the project in the form of job opportunities for over 1,200 workers during construction phase and around 100 permanent jobs for plant operation and maintenance

KEY LEARNING

✓ The project represents a game changer for solar energy as its is the first solar plant to operate at a capacity factor and availability percentage equivalent to that of a carbon combustion power plant like coal, oil, or natural gas, and that too also without the climate damage
✓ This hybrid technology practically has the potential to power the entire country of Chile using two phenomenal Chilean resources, salt and sun
✓ There is a lot of potential for providing energy through solar power plants in Argentina, and Perú as they have similarly high solar resource along with large mining projects that require baseload energy supply
SUCCESS STORY 5

Improving Health Facility Infrastructure (IHFI) project, Guyana

BACKGROUND

The acquisition of reliable and affordable power determines the success of healthcare facilities in developing countries, especially those in remote rural areas. Guyana, a country in South America despite of having significant experience in deploying solar technologies in rural areas faced a problem in ensuring their long term sustainability on account of lack of technical, financial and institutional support.

CHALLENGE / PROBLEM STATEMENT

Rural and urban health facilities suffer from inadequate energy services due to intermittent, poor or unavailability of grid electricity. Poor quality of electrical power at grid connected facilities also defeats the purpose by damaging sensitive laboratory equipments.

In Guyana, previous efforts to provide solar systems to ‘off - grid’ facilities have not been sustainable over the long term because of inadequate training of local technicians, lack of maintenance funds, and often poorly designed and installed systems.

SOLUTION

✓ U.S. Agency for International Development (USAID) launched the ‘Improving Health Facility Infrastructure’ (IHFI) program to help the Ministry of Health electrify remote rural health facilities with solar power

✓ The project involves implementing solar photovoltaic energy systems by the Government of Guyana for health clinics, schools and homes funded locally and by international donors

✓ Energy efficiency studies in the form of audits were conducted for large hospitals

✓ Energy assessments of rural health facilities were undertaken to arrive at a priority list remote health clinics, which may be suitable sites for solar installations

✓ The project emphasized on ensuring system sustainability through capacity building and training carried out in cooperation with the Guyana Energy Agency (GEA)

RESULT

✓ Solar PV installations done at rural health facilities like Hinterland health clinics

✓ Two standardized PV system designs were created, which specifies all components, including the PV modules, inverters, batteries, wiring and other balance of system materials which helped in ensuring system sustainability by providing a common set of materials and protocols for vendors, technicians and end-users

✓ Energy audits conducted in public hospitals like Georgetown to expand energy efficiency and institutional capacity in the country

KEY LEARNING

✓ Extensive stakeholder engagement from program conception to completion is a key factor governing long term sustainability of the community welfare projects
SUCCESS STORY 6

The Rural Electrification Program, Peru

BACKGROUND

Peru is the third-largest country in South America, with a population of over 24 million. The need for electricity is substantial in Peru, especially in rural areas. Nearly half of more than 24 million Peruvians live in poverty, and one-third of the population lacks access to the electric grid. Recognizing this, the Peruvian Government has made rural electrification one of its highest priorities highlighting the importance of investing in basic infrastructure like electricity, as part of national development agenda. Sierra has average solar radiation levels which can reach 5 kWh / m² / day.

CHALLENGE / PROBLEM STATEMENT

The country is faced with a challenge of lack of electricity along with scarcity of other infrastructure services which inhibits economic development and limits the quality of medical care and the availability of educational opportunities.

SOLUTION

The Peru Rural Electrification Program started in 2006 and focused on efficient and sustainable electrification service by working with the existing electricity distribution companies and ensuring that they prepare, execute, and operate rural electrification subprojects as part of their regular commercial operations.

For the first time, renewable energy options were fully integrated into rural electricity services. A national tariff for regulated service with household off-grid PV system was established.

For promotion of efficient use of electricity, a business development services approach was used focusing on outreach to small business through NGOs, developing marketing strategies for the electricity supplier and promoting productive use of electricity.

The Project was financed by a World Bank loan for USD 50 million and a Global Environmental Facility (GEF) grant for USD 10 million.

Nine distribution companies in 16 regions participated in co-financing the project.

RESULT

- The project provided services to 105,000 households and small enterprises representing about 450,000 people
- There were a total of 2,900 new connections benefitting schools, health clinics, and community centers
- 7,100 solar home systems (SHS) were installed in remote rural areas with total beneficiaries about 31,500
- The project promoted adoption of electricity-using equipment by more than 21,000 rural producers, including women, which increased productivity and income levels

KEY LEARNING

- The project model has proved to be successful and as a result upon Government’s request, loan has been approved by the Bank in 2011 for the second phase
- The project innovation lies in more efficient and sustainable grid extension approach by mobilizing support and additional financing through active involvement of distribution companies
CONCLUSION
The global demand for electricity is likely to increase by more than 70%, leading to a 16% increase in energy-related CO2 emissions by 2040. In order to curb the rise in greenhouse gas emissions and meet the climate goals agreed during COP21, renewable energy needs to scale up as a source for providing electricity. The good news is that in the last decade, global growth in renewable energy generation capacity has been significant. Energy modeling studies by the International Energy Agency indicate that renewable energy may reach up to 50% in the European Union by 2040, around 30% in the People’s Republic of China and Japan, and above 25% in the United States (US) and India. Solar, a major contributor to the renewable energy mix is scaling up rapidly with capacity more than trebling over the past four years. Despite this growth, the solar sector is plagued by certain challenges, the biggest being the lack of availability of finance, especially in the developing countries. Other challenges include access to technology, sustainability of the installed systems and capacity of the communities. Addressing these challenges and ensuring the access, reliability and affordability of this energy source requires concerted efforts from Governments, bilateral and multilateral organizations, corporate, industry and other relevant stakeholders.

The compendium is a collation of success stories from across the globe highlighting the factors contributing towards solar energy development, in economically and socially diverse countries of Africa, Asia, Europe, North America, Oceania and South America geographies. Every country had a unique set of challenges, which when addressed through policy interventions, availability of finance and unique business and technology innovations lead to path breaking success stories.

**Africa**

Africa presents a unique scenario with respect to the rest of the world. According to estimates, Africa will register the highest average annual growth of 2.6% (between 2012 and 2040) and double its energy consumption to 44 quadrillion Btu by 2040. This comes as a result of growing population and exponential economic growth that is expected in the region, to the tune of 4.8% every year on average from 2012 to 2040. In line with this growing demand, solar comes across as a distinctive solution to serving the energy needs. Given Africa’s geographical and climatic conditions, it has the potential of becoming the world leader in solar energy generation.

Of late, many African nations have increased their policy commitments towards renewable energy. 10 GW of renewable energy capacity addition is planned by 2020, while there is a potential to generate 300 GW by 2030. During the study it emerged, that countries like Egypt, Morocco and Kenya are leading the effort to switch to utilize solar energy while Africa’s smaller countries including island nations have also set ambitious renewable energy targets.

It is evident that Africa is deploying modern solar based systems to eliminate power shortages, electrify homes, spur local economy and create entrepreneurs. These applications of solar energy have also been found to facilitate cost-effective transformation as the cases studied suggest that the solar home systems and other applications provide a cost benefit over use of kerosene in the rural set up. Africa demonstrates high diversity in the applications of solar energy which is used for solar home systems, baking, drip irrigation, cooking, desalination, water supply and micro-grids, being a few of them. Morocco has emerged as the largest Concentrated Solar Power (CSP) market with the launch of the ‘Noor’ project.

Climate change and energy access are two major issues that the continent faces and both find an answer in solar energy. However, Africa is constrained by limited flow of capital. ISA can play a major role in channelizing the flow of capital to scale up solar energy applications which has been put to use in various forms.
Asia

Energy demand is projected to significantly increase in the Asia and Pacific region by 2030 and reach to 316 quadrillion Btu by 2040. Coupled with the growing demand, prevalence of energy poverty across Asia is widespread with almost a billion people still without access to electricity. The situation demands innovative ways to generate power in a socially, economically, and environmentally sustainable manner such as solar energy.

There have been positive developments in the sector with countries like China and India leading the way. In 2015, China set new world records for solar power installations and India also ranked among the top countries for solar PV capacity additions.

The largest continent with countries from diverse socio-economic backgrounds has varied needs ranging from providing affordable energy access, rural electrification, mobility, public lighting, to meeting growing power demand and creating eco cities. The solutions identified through these cases include solar home systems with flexible financing options, solar applications for street lighting and aiding mobility. The cases from India, UAE and China indicate how policy can aid development of large scale solar PVs in locations like a canal, assist development of new cities built completely on solar power and creation special economic zones which will fuel the solar economy.

Asia is largely constituted of emerging economies, which are in dire need of reliable, affordable and environmentally friendly source of power to fuel their growth. ISA can support these economies by enabling them develop indigenous policy frameworks and assist cooperation in terms of technology exchange and transfer amongst member countries.

Europe

Between 2000 and 2015, the share of renewables in the EU’s total power capacity has increased from 24% to 44%. In 2015, about 75 GW was added; bringing the region’s total to almost 95 GW of operating solar PV capacity. UK, Germany and France contributed more than 75% to this output.

Europe has been at the forefront of renewable technology adoption and integration. Therefore, the challenges faced by Europe include next level complexities like integration of very high percentage of renewable energy with grid, freeing up financial resources for setting up new plants and testing of new technologies like solar powered cycle track which opens new horizons for solar energy.

The cases from Europe provide learning through their experience in setting up policy measures which have led to faster adoption of solar and highlighting solutions to the challenges listed above. These cases not only provide guidance for countries who want to take up solar in a big way but also set up new direction of growth for solar across the globe.

ISA can help European countries to form technology coalitions and create a market to attract investors from developed countries for investing in developing countries.

North America

North American countries covered for the study include United States and other small island countries. 2015 was a record year for the US, with solar PV installations exceeding new natural gas capacity for the first time. Solar at 7.4 GW along with wind were the leading sources of new power capacity in 2015. The main factors governing success of solar energy in the region are the ambitious targets taken by the National Governments, fiscal measures pertaining to tax benefits and the need stemming from local economy demands, like the need for economically sustainable tourism industry in island nations.
The island nations thriving on tourism face challenge in the form of heavy cost incurred in the import of fossil fuels aggravated by the volatility in the prices of the fuel which creates a direct business case for solar energy as these countries receive relatively consistent sunlight throughout the year.

The solutions adopted by these countries consist of large scale deployment of solar water heaters to supply water for domestic and commercial purposes including resorts. The study also reflects the use of large solar PV at airports and community locations.

**Oceania and Australia**

Australia’s solar market has been predominantly residential, with rooftop systems on almost 16% of homes as of early 2016, although the commercial and large-scale sectors started to take hold in 2015.

The country cases covered under Oceania were either facing problems in the form of high electricity bills or lack of access to reliable electricity. The island nations are burdened by the fossil fuel imports.

Solar applications include rooftop solar systems, grid-connected systems and large PV panels deployed serving malls, villages, islands and desalination plants to meet community needs and support local industries like tourism and mining. The success of the projects depends upon participation of the local community and building participatory models that foster collaboration and prove to be a win-win model for all the concerned stakeholders.

**South America**

In South America, the main challenge brought out, in the cases, was the access of electricity for rural households. Large scale integrated plans have been developed and implemented by various actors to provide access to electricity, better healthcare facilities supporting the overall sustainable development of the rural communities. There is also a case of Chile demonstrating the use of solar energy in supporting industrial activities like mining.

These large scale programs have been successful due to public-private partnerships, support from financial institutions like World Bank, active involvement of agencies like USAID, Government bodies and Utility companies. The governing success factor remains community participation and capacity building in case of the programs targeted towards their development.

ISA’s platform can be leveraged to foster cooperation and collaboration amongst the various multi-actors to provide greater access to solar energy.

**Way Forward**

Solar energy, as the cases have suggested, has been a game changer and contributed towards achievement of social and economic objectives of sustainable development by ensuring energy access and security. Positive developments through focused interventions in this area would help achieving world’s most pressing development goals. The success stories clearly bring forth the crucial role played by the multi-actors like the national Governments, who are cognizant of the fact that solar energy is an important means of realizing their vision of providing clean and affordable electricity to their citizens in line with Sustainable Development Goals. They have deployed various mechanisms in the form of tax incentives / schemes, providing concessional finance, developing special zones and mandating enabling rules / regulations. The multilateral development bodies have also been very active in this space. The study also highlights the contributions of various multi-lateral agencies (such as ADB, IFC and World Bank), NGOs and private companies who have been instrumental in improving the affordability and availability of solar energy in these countries. The study clearly suggests that the sustainability of these models is possible only with cooperation and cross-support from these different stakeholders.
However, these case studies suggest that the ultimate success of solar deployment programs across the world rests on a cumulative effect of four success factors:

- Enabling policy framework has been crucial in guiding and supporting large scale adoption of solar technologies through ambitious Government programs, legislative reforms, fiscal and monetary measures.
- Innovative Business Models which have been developed taking into account local considerations to uniquely address the needs of the beneficiary community.
- Facilitative financial mechanisms to provide enormous amount of finance needed for these developmental challenges.
- Participatory models directed towards increasing the capacity and involvement of local community.

There is a lot that the countries can learn from each other and ISA can provide the right platform to enable this knowledge transfer. With the setting up of the knowledge centre and exchange platforms such as RE–Invest, ISA will bring investors, developers, Government, multi-lateral and bi-lateral agencies to a common ground to further the cause of climate justice through solar energy.
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