Identifying Best Practices in Public-Private Partnerships in Renewable Energy

By

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Post Graduate Diploma in Management
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ABSTRACT

Public-Private Partnerships (PPP) have emerged as a means to develop physical and social infrastructure assets in developing countries. PPPs enable governments to attract private sector investment in public infrastructure services, which would supplement public resources or release them for other public needs. They also allow governments to utilize the efficiency and expertise of the private sector in providing public services which have been traditionally delivered by the public sector.

There has been an increased focus on developing alternatives to fossil fuels in recent times for sustainable development, which has put the spotlight on renewable energy sources. Renewable energy sources have largely been developed in the advanced economies, with emerging markets lagging behind. A possible reason could be that despite the rapid reduction in the cost of generating renewable energy in the past few years, the cost is still higher compared to the cost of conventional energy sources such as coal and natural gas. Increased private sector participation in the sector through the PPP mode may help to improve technologies and reduce costs in emerging markets, as has been the case in many developed countries.

The aim of this thesis is to study some of the successful PPPs implemented in the renewable energy sector in emerging markets and identify best practices that have contributed to the success of these arrangements. These findings can be used as learnings for similar renewable energy programs in developing countries worldwide.

Keywords: public-private partnerships, PPP, renewable energy, emerging markets, developing countries, South Africa, India, public policy, REIPPP, Charanka solar park, Gujarat, solar energy, solar parks, rooftop solar.

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Motivation for thesis and methodology

There has been an increasing focus on renewable energy in recent times with an aim to provide access to affordable, reliable and sustainable energy to millions of people in developing countries worldwide. Fossil fuels have limited reserves and with the current rate of consumption, they are not expected to last for long. According to the BP Statistical Review of World Energy 2014, the global proved oil reserves are sufficient to meet only about 53 years of global production; while the global proved natural gas reserves are sufficient to meet only 55 years of production and global coal reserves can meet 113 years of production only.[1] Further, these fossil fuels emit greenhouse gases that lead to local pollution, global warming, and climate change. The United States Environmental Protection Agency estimates that the Earth's average temperature has risen by about 1.4° F over the past century and is projected to rise another 2 to 11.5° F over the next hundred years. Even small changes in temperature can lead to drastic and dangerous climate changes.[2] In such a scenario, development of renewable energy sources is key to sustainable economic growth and development.

The governments of developing economies are often fiscally constrained and do not have the necessary budgetary resources to promote and develop sustainable energy sources. As a result, it becomes important to attract private sector investment in this sector. The private sector also brings in technical expertise, which improves efficiency and reliability. Public-private partnerships (PPP) have emerged as an innovative solution for the governments of developing countries to partner with private entities, with appropriate allocation of risks and returns between the two parties. If implemented properly, PPPs have the potential to attract large investments and can be a win-win situation for both the government and the private sector.

The aim of this thesis is to study some of the successful PPPs implemented in the renewable energy sector in emerging markets and identify best practices that have contributed to the success of these arrangements. The initial chapters focus on defining PPPs and describing the various forms of renewable energy sources. A case study methodology has been followed with a detailed study of two cases – the Renewable Energy Independent Power Procurement Program (REIPPP) of South Africa and the solar energy programs implemented in the state of Gujarat in

India. The cases begin with a background study and a description of the chain of events that led to the development of renewable energy programs. The cases then describe the methodology and framework followed by the respective governments to implement these programs in the form of a PPP. Finally, the key success factors and risks are identified which can be used as learnings for similar renewable energy programs in developing countries worldwide.

Introduction to PPP

What is PPP?

Public-Private Partnerships (PPPs) have developed as a means to improve physical and social infrastructure facilities through joint participation of private and government entities. PPPs combine the skills and resources of the private sector and the government sector by efficient allocation of risks and responsibilities.[3] Using the PPP mechanism, governments can utilize the technological expertise of the private sector. In a PPP arrangement, typically the private entity is responsible for designing, constructing, operating, and maintaining the capital asset and is compensated by a stream of payments from the government, user charges levied on the end-users, or a combination of both.

There is no standardized definition of a PPP. While most definitions include common themes – a contractual arrangement between government and a private entity, provision of public service by a private entity and appropriate allocation of risks and rewards between the parties – they vary with their emphasis. For example, the World Bank Group defines PPP as "arrangements, typically medium to long term, between the public and private sectors whereby some of the services that fall under the responsibilities of the public sector are provided by the private sector, with clear agreement on shared objectives for delivery of public infrastructure and/ or public services".[4] This definition points out that PPPs are not short-term arrangements and are characterized by clear demarcation of responsibilities. Similarly, the Canadian Council for Public-Private Partnerships defines PPP as "a cooperative venture between the public and private sectors, built on the expertise of each partner that best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards".[5] The Organization for Economic Cooperation and Development (OECD) defines PPP as "a long term agreement between the government and a private partner where the service delivery objectives of the government are aligned with the profit objectives of the private partner. The effectiveness of the alignment depends on a sufficient and appropriate transfer of risk to the private partners".[6]

PPPs have been used not only to build physical infrastructure in sectors such as energy, telecommunications/information & communication technology (ICT), transportation, water and sanitation, and solid waste, but also to improve social infrastructure such as education, public health, humanitarian relief, etc.

Need for PPP

There are four main reasons for governments to enter into PPPs. Firstly, PPPs enable governments to attract private sector investment in public infrastructure services which would supplement public resources or release them for other public needs.[8] This is important, especially in the context of emerging markets, whose governments routinely run budget deficits and lack funds for financing infrastructure projects. Secondly, PPPs allow governments to utilize the efficiency and expertise of the private sector in providing public services which have been traditionally delivered by the public sector. Private sector companies are usually more adept than public sector companies in implementing large projects efficiently with minimum cost and time overrun. Thirdly, the PPP mechanism allows governments to transfer either fully or partially the risk of owning and operating an infrastructure asset to a private party, which can reduce the overall project cost to the governments. This represents an efficient allocation of risks and rewards, with the private sector being compensated adequately for bearing these risks. Finally, PPPs allow governments to fully integrate the construction, operation, and maintenance of the infrastructure facility, which would incentivize the private entity to complete each project function in a way that minimizes whole-of-life project costs. As the private sector operator would have to manage the project for the tenure of the concession, it would ensure that the project is constructed in a manner that minimizes the construction costs as well as the operation and maintenance costs for running the project.

Different types of PPP

There can be different forms of PPP arrangements depending upon the extent of involvement of the private entity.[9] Figure 1 below depicts the spectrum of PPP arrangements.

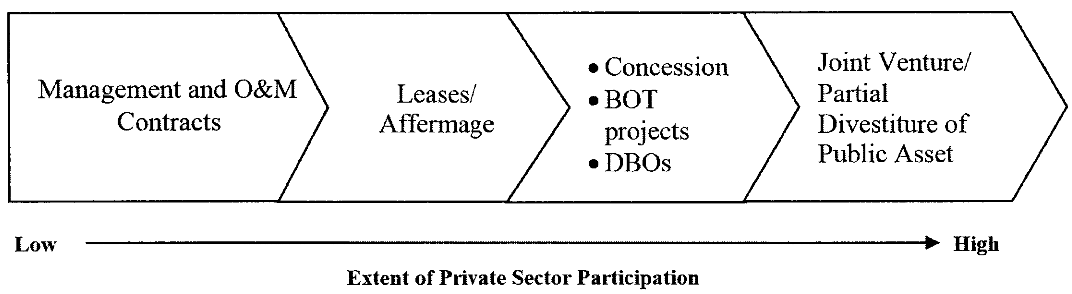

Figure 1: Types of PPP arrangements
Source: Public-Private Partnership in Infrastructure Resource Center, World Bank

A brief description of the different types of PPP arrangements follows.

1. *Management and Operation and Maintenance Contracts*

Management contracts include a range of contracts covering areas from technical assistance to operation and maintenance. The common features of such contracts are that the awarding authority engages the private operator to manage a set of activities for a limited time period, typically for a fixed fee. These contracts are generally short-term (between two to five years). Apart from the fixed fee, the contract may also include a performance-based fee and liquidated damages in the case of failure to achieve performance parameters.[10]

Such types of contracts are useful in the cases where the condition of assets is uncertain and the private party would be unwilling to accept extensive risk. They are commonly found in the water sector and, to a limited extent, in the energy sector, where more extensive participation of private parties is deemed to be politically sensitive or impractical.[10]

2. Leases and Affermage Contracts

Leases and affermage contracts are arrangements in which the private party operates and maintains the asset, but is not involved in financing the asset. These contracts differ from management contracts in that the private party does not receive a fixed fee, but instead recovers an operator fee from the consumers. In the case of a lease, the private operator retains the receipts collected from the users and pays a specified portion of the receipts to the awarding authority as a lease fee. In the case of an affermage, the consumers are charged an operator fee plus a surcharge, with the operator retaining the operator fee and the awarding authority retaining the surcharge.[11]

Such contracts are typically of a longer duration than management contracts (between eight to fifteen years) and require the private party to bear greater operating risk since it is exposed to tariff risk and does not receive a fixed fee. The financing of the asset remains the responsibility of the awarding authority. Lease and affermage contracts are used when private equity and commercial debt are not available for funding the asset or when the awarding authority wants to combine public financing with private sector efficiency. Lease contracts have been used in the transport sector to develop airport and port terminals.[12]

3. Concessions, Build-Operate-Transfer (BOT) and Design-Build-Operate (DBO) projects

A concession gives the private operator the long term right to use all utility assets conferred on it, including the responsibility for financing the assets and operating them. However, the asset ownership remains with the awarding authority. At the end of the concession period, all the assets are transferred to the awarding authority, including any assets purchased by the private operator. These are very long-term contracts (twenty-five to thirty years) wherein the private operator takes the risk for the condition of the assets as well as the investment. Concessions include taking over existing assets, or building and operating new assets. The operator typically obtains its revenues directly from the consumer.[13]

In a Build-Operate-Transfer (BOT) project, the awarding authority grants the right to develop and operate a discrete greenfield project to a private operator for a certain period (called Concession Period). A BOT project differs from a concession in that it involves a greenfield project and the revenues are obtained from a single offtake purchaser such as the government entity or a utility. As the project is greenfield, there are no cash flows from the outset. The operator is a special purpose vehicle to ensure that the project assets are ring-fenced and risks associated with the project are allocated appropriately.[13]

In a Design-Build-Operate (DBO) project, the public sector finances the construction and owns the new assets. The private operator designs, constructs and operates the assets. The operator does not assume any financing risk and will be paid a sum for designing and building the assets and an operating fee for the operating period.[13]

Figure 2 below depicts the contractual framework for a concession/BOT project. The concession agreement, executed by the government authority and the operator, is the principal contract governing the project. Other contracts include the lending agreements between the lenders and the project company, the shareholder agreement between project company shareholders and contracts for construction and operations of the project. The raw materials required for operating the project are secured by entering into an input supply arrangement with the input suppliers. The output offtake agreement with the offtake purchasers guarantees the purchase of output generated by the project at predetermined prices stipulated in the agreement. In the case of concessions, the payment stream is through tariffs charged from the consumer instead of an offtake purchaser.

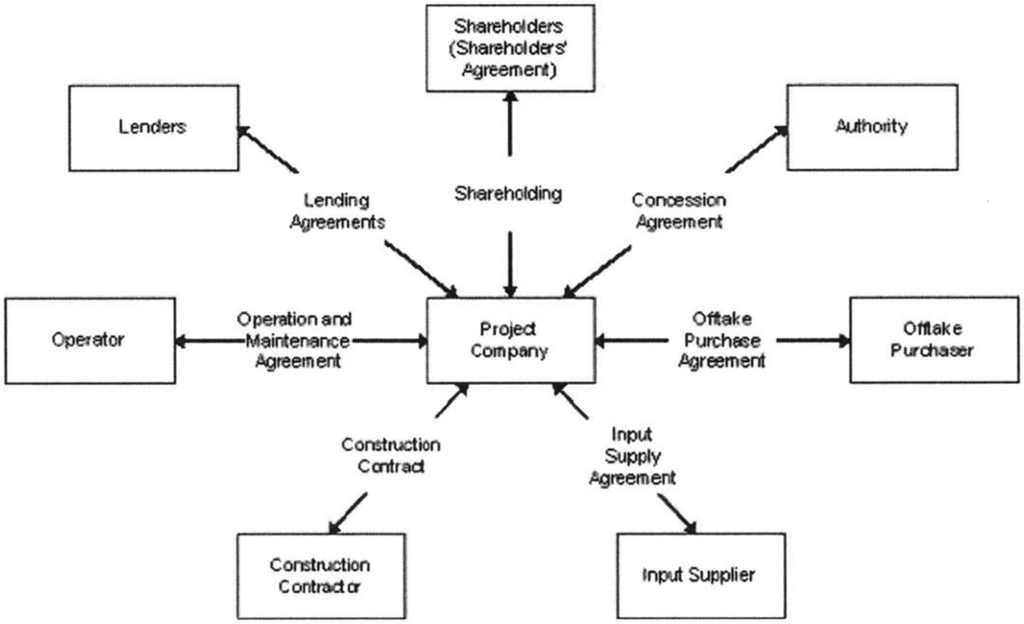

Figure 2: Contractual framework for a BOT project/Concession

Source: Public-Private Partnership in Infrastructure Resource Center, World Bank

Concessions and BOT arrangements are commonly used in the transport sector (road, railway, airport and mass rapid transit projects), power sector, and the water sector.[14]

4. *Joint Ventures*

Many countries prefer the joint venture (JV) model for PPP. In the case of an existing utility, shares in the utility are divested to the private sector. In the case of a new project, the project company is established with a joint ownership structure. The share ownership level of the government in the JV depends upon its intention – whether it wishes to transfer the project off balance sheet or it wishes to retain management control of the utility. The government usually retains control or negative veto power over certain issues, even though it has transferred a majority stake in the entity to the private sector. The operation and maintenance functions are assigned to the private sector by way of a management contract. The rights attached to different types of shares and between the shareholders are defined in the constitutional documents of the JV company and the shareholders agreement between the public sector and private sector entities.[15] The JV model has been used to develop projects in the water and sanitation sector.[16]

Thus, a wide range of PPP models have emerged which vary by ownership of assets, responsibility for investment, allocation of risk and duration of contracts. It may be noted that there is no single PPP model that can perfectly align the requirements of a particular project and country. The government must choose the most suitable model taking into account the country's political, legal and socio-cultural circumstances and the financial and technical features of the projects and sectors being considered for PPP.[17]

Procurement of PPP projects

Each country typically has its own regulations with respect to the procurement of PPP projects, mainly because of the complexity involved compared with conventional public procurement. For a successful PPP program, the procurement needs to be a transparent and neutral process based on the common principles of good governance.[18] In a developing PPP market, it is difficult to outline a suitable procurement process at the outset. Hence, in the early years of PPP development, many countries approve projects on an ad-hoc basis, however ensuring that the general public procurement guidelines are being met. Once the experience base is established, a more formal process can be finalized by the government.[19]

Before initiating the procurement process, certain pre-procurement tasks need to be completed which include the following:[20]

- Institutional due diligence – To assess the capability of the government agency handling the project and meeting the deficiencies, if any.
- Deciding procurement process – Defining the process and identifying stages requiring government approval.
- Project due diligence – Feasibility study, business case analysis, deal structure.
- Evaluation criteria and committees.

- Establishing a contract negotiation team.
- Appointing a transaction advisor.

Figure 3 below depicts the common steps for PPP procurement in countries having a matured PPP program.[21] The market sounding stage is used to get initial feedback from the market on the feasibility of the proposed PPP project. Prequalification assesses the technical and managerial competence of the potential bidders and helps to evaluate their financial soundness. A two-step tendering process is employed, the first step being request for proposals (RFP) and the second step being finalization and issuance of final tender. This helps the government and bidders to understand each other's requirements and the government can make appropriate revisions before issuance of the final tender. It also avoids costly detail design efforts of bidders prior to award of contract. A tender evaluation committee evaluates the tenders received based on the criteria established and selects the preferred bidder. Finally, the implementing agency and preferred bidder negotiate the final contract document, all third-party agreements (with lenders, sub-contractors and other parties) are executed and financial close is achieved.

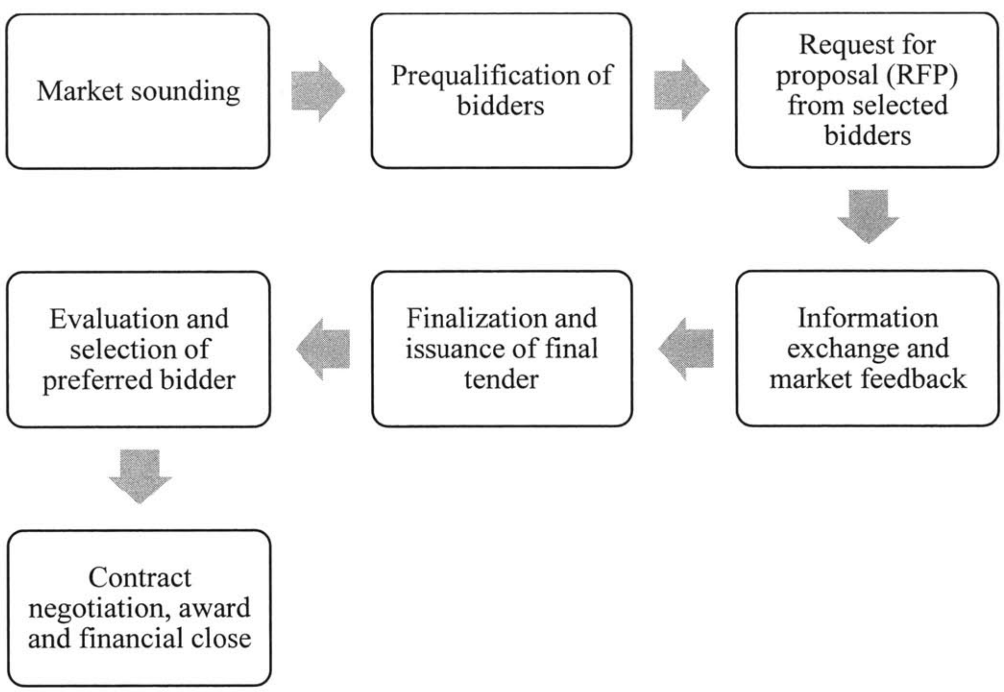

Figure 3: Procurement steps in a PPP program

Source: A Primer to Public-Private Partnerships in Infrastructure Development, UN ESCAP

Renewable energy and the need for PPP

Introduction to renewable energy

Renewable energy is energy originating from sources that can be replenished, such as sunlight, wind, water, geothermal heat, biomass, and biofuel.[22] These energy sources are inexhaustible, clean, and can be used in a decentralized way (i.e., they can be used in the same place where they are produced). They are also complementary to each other with a favourable integration possible. For example, solar photovoltaic cells could be used to supply electricity on sunny days (which are generally less windy) and wind turbines could be used to supply electricity on cold and windy days (which are frequently cloudy).[23]

There has been an increased focus on developing alternatives to fossil fuels in recent times for sustainable development, which has put the spotlight on renewable energy sources. Rapid technological advances in the past few years have reduced the cost of generation of renewable energy, making it a competitive alternative to energy generated from fossil fuels. In September 2011, the Secretary-General of United Nations, Ban Ki-moon launched Sustainable Energy for All (SE4ALL) as a global initiative with three interlinked objectives to be achieved by the year 2030:[24]

1. providing universal access to modern energy services;
2. doubling the global rate of improvement in energy efficiency; and
3. doubling the share of renewable energy in the global energy mix.

Developed countries and more than 85 developing countries have partnered with SE4ALL to further the cause of sustainable renewable energy on a country level. Governments, the private sector, and multilateral financial institutions are acting as key stakeholders in terms of mobilizing resources for this initiative.

Types of renewable energy sources

The various types of renewable energy resources are listed below.

Solar energy

Energy from the sun can be captured to generate electricity or heat in a number of ways. In the last few years, advancement in technology and economies of scale have reduced the cost of solar power. Power from small or medium-scale solar installations costs around 12-30 USc/kWh, which is expected to decrease further.[27] It is estimated that very soon, solar energy could become cheaper than conventional sources of electricity in many parts of the US and elsewhere around the world.

Solar power can be harnessed in multiple ways. Photovoltaic cells made up of silicon convert sunlight directly into electricity (direct current or DC); which is then converted into alternating current (AC) by an inverter and distributed to households and industries for use. Solar thermal collectors use heat-absorbing panels and a series of circulation tubes to heat water or buildings. Solar concentrated systems use parabolic mirrors to focus the sun's energy on a heat-collecting element, which contains a fluid that transfers heat to generate steam, which spins turbines and generates electricity. Finally a technique called passive solar design uses windows, skylights, building site and thermal construction material to heat and light buildings.

Wind energy

Wind energy is a pollution-free and inexpensive source of energy. The wind rotates the blades of a wind turbine, which converts the kinetic energy of the wind into mechanical energy; which is then converted into electricity using a generator. In 2010, top-performing wind farms in the US had an average cost of 7 USc/kWh, making wind energy the most competitive non-hydroelectric renewable source.[28]

Hydropower

Hydropower is produced by using the energy from moving water. It is the world's largest source of renewable energy. Most hydropower plants use dams to collect water in a reservoir and then release the stored water in a controlled way to spin a turbine and generate electricity. Some "run-of-river" plants operate with a smaller dam, but even these divert some portion of the river. Other projects use existing canal water and utilize the available water flow. Although hydropower does not generate carbon emissions, it has an ecological impact on the flora and fauna in the water bodies and often leads to displacement of people with loss of fertile land.[29]

Geothermal energy

Geothermal energy utilizes energy from underground reservoirs of steam and hot water. Superhot magma from the earth's core comes close to the surface of the earth and heats underground water. This creates reservoirs of very hot water and steam trapped in cracks and porous rock. Deep wells can be dug to utilize the heat content of this water and steam for generating electricity, heating, cooling, industrial processes, etc.

A geothermal heat pump exploits the temperature difference between the surface of the earth and the air. It is observed that in most places, the temperature 10 feet below ground level remains at 50-60° F throughout the year. In winter, the ground is warmer than the air and hence the pump pulls heat from the ground to heat households. In summer, the ground is cooler than the air and hence the pump pulls the warm air of households into the cooler ground. The excess energy can be used to heat water.

Geothermal plants are characterized by high initial costs of drilling and installation with low operation and maintenance cost. A new plant supplies energy at about 5 USc/kWh, while an existing plant may supply at lower rates of about 3-3.5 USc/kWh.[30] Even though geothermal energy is a cheap and clean form of energy, it could have a negative environmental impact due to local groundwater contamination and increased seismicity because of the drilling activity.

Biomass and biogas

Biomass energy is derived from plant sources such as crop and forest residues, corn kernels, energy crops, perennial grasses and fast-growing trees such as poplar. These plant materials can be treated in different ways to generate energy – burning in power plants to generate heat, fermenting to produce fuels such as ethanol, digesting by bacteria to produce methane for powering turbines, and so on. Most of the biomass commercially used currently is not produced from sustainable resources. A major challenge is to produce biomass energy in a sustainable way that reduces the climate change and does not have any side effects such as increases in the price of food.[31]

Biogas is produced from anaerobic decomposition of animal manure by bacteria. It consists mainly of methane (60 to 70 percent) and can be used to generate heat, hot water, and electricity, with the remaining digested manure used as fertilizer, mulch, or potting soil. It is most commonly used in rural areas in farms for generating electricity or space and water heating.[32]

Offshore wind, wave, and tidal energy

Offshore wind turbines generate energy in a similar way as compared to land turbines, except that they are located in the sea and are attached to the sea bed using a fixed foundation. The power generated from these turbines is transported to the shore through cables along the ocean floor. A new form of renewable technology helps to harness the marine hydrokinetic energy contained in sea waves using equipment such as buoys, clam-like shells in the bottom of the sea, and underwater versions of wind turbines. These technologies are still being tested and refined.[33]

Global renewable energy capacities

Global renewable energy generating capacity stood at 1,560 GW at the end of 2013.[35] Hydropower contributed about two-thirds of the total capacity, while wind, solar and biomass were the other major contributors. The source-wise breakup of generating capacity is detailed in Table 1.

Table 1: Source-wise breakup of global renewable energy capacity

Source: Renewables 2014 – Global Status Report, REN21

Source	**Total capacity at end-2013 (GW)**
Hydropower	1,000
Wind power	318
Solar PV	139
Biomass	88
Geothermal power	12
Concentrated solar power	3
Total	**1,560**

Due to efforts to mitigate climate change, there has been increased policy support for investment in renewable energy technologies around the world. As a result, renewable energy is contributing an increased share of the new power generation capacity added globally each year. In 2013, of the new power capacity added globally, renewables constituted about 56 percent.[35] Renewables comprised about 26.4 percent of the world's power generating capacity by the end of 2013 and supplied about 22.1 percent of the global electricity.[35] The source-wise breakup of electricity supply is depicted in Figure 4 below.

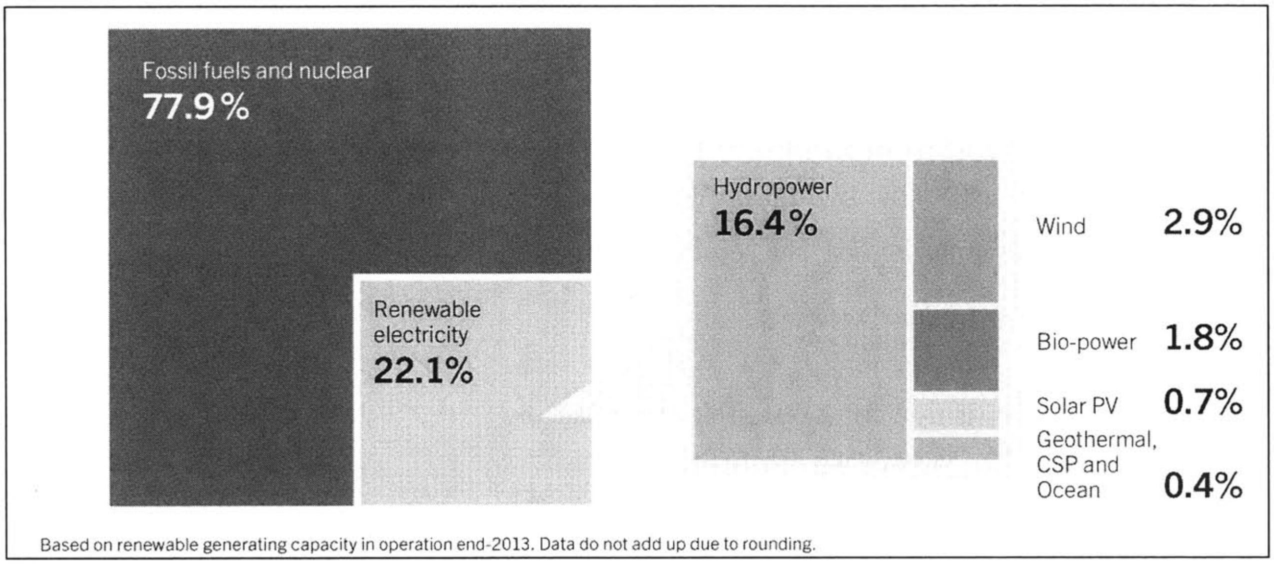

Figure 4: Source-wise breakup of electricity supply

Source: Renewables 2014 – Global Status Report, REN21

From Figure 4, it can be seen that, apart from hydropower, the other renewable sources comprise a very small fraction of the total global electricity supply. The top countries based on installed renewable energy capacity (excluding hydropower), along with the source-wise capacity, are listed in Table 2 below.[35]

Table 2: Top countries in terms of renewable energy capacity at the end of 2013 (excluding hydropower)

Source: Renewables 2014 – Global Status Report, REN21

Source (GW)	China	US	Germany	Spain	Italy	India
Wind power	91	61	34	23	8.6	20
Solar PV	19.9	12.1	36	5.6	17.6	2.2
Biomass	6.2	15.8	8.1	1	4	4.4
Concentrating solar power	-	0.9	-	2.3	-	0.1
Geothermal power	-	3.4	-	-	0.9	-
Total	**118**	**93**	**78**	**32**	**31**	**27**

Note: Totals may not add up exactly due to rounding

From Table 2, it can be seen that largest installed capacities in renewable energy are mostly in the developed economies. A possible reason could be that despite the rapid reduction in the cost of generating renewable energy in the past few years, the cost is still higher compared to the cost of conventional energy sources such as coal and natural gas. Wind power and hydropower are cheaper than conventional sources, but require countries to be naturally endowed in terms of these resources.

For the purpose of comparing the cost of generating power from renewable energy with other conventional sources of energy such as fossil fuels, the levelized cost of electricity (LCOE) is used as a convenient summary measure. LCOE represents the per-unit cost in real dollars of building and operating a power plant over an assumed financial and duty cycle. The key inputs to calculating LCOE include capital costs, fuel costs, fixed and variable operation and maintenance costs, financing costs and an assumed utilization rate for the plant. The US Energy Information Administration (EIA) estimated the LCOE of new generation sources for plants entering service in 2019 which is listed in the table below.[36]

Table 3: Estimated average levelized cost of electricity (LCOE) for new generation sources, 2019
Source: US EIA Annual Energy Outlook 2014

(in 2012 $/MWh)

Plant type	**Total system LCOE**	**Subsidy**	**Total LCOE including subsidy**
Conventional coal	95.6	-	95.6
Conventional Combined Cycle natural gas	66.3	-	66.3
Advanced nuclear	96.1	-10.0	86.1
Geothermal	47.9	-3.4	44.5
Biomass	102.6	-	102.6
Wind	80.3	-	80.3
Offshore wind	204.1	-	204.1
Solar PV	130.0	-11.5	118.6
Solar Thermal	243.1	-19.5	223.6
Hydro	84.5	-	84.5

From Table 3, we observe that despite availing subsidies, the cost of electricity from subsidized renewable energy sources such as solar PV, and solar thermal and non-subsidized renewable energy sources such as biomass and offshore wind, is higher than the conventional energy sources. Increased private sector participation in the sector through the PPP mode may help to improve technologies and reduce costs in emerging markets, as has been the case in many developed countries.

Need for PPP in the renewable energy sector

Sustainable energy is required for enabling inclusive and environmentally friendly growth. By promoting sustainable energy, policy makers can address a variety of issues ranging from climate change and local pollution to energy security and job creation. The transition from an energy sector that is currently dominated by fossil fuels, to one that focuses on low carbon emissions, presents unique business opportunities that could benefit a vast majority of the world's population, especially in the developing countries where access to power is limited.[37]

The participation of the private sector is key to bringing in the technology, expertise, and capital required to tap into the unrealized potential of renewable energy. This is true, especially in emerging economies, whose governments lack the budgetary resources and technical expertise required to invest heavily in renewables. For example, in the US, installed solar system prices have continued to fall through 2013 and the first half of 2014, despite the fact that photovoltaic (PV) module prices have remained relatively flat since 2012.[38] This decline in prices is due to increased competition among the private sector with a heavy focus on bringing down the PV system soft costs, such as installation labour, permitting and fees, customer acquisition and installer margins; and the non-module hardware costs.

The PPP model is most suited to attract private sector investment in renewable energy in emerging markets as project risks are suitably allocated to each party based on competence. The government can focus on the policy framework, project procurement and allocation. The private sector can focus on bringing in the technical and financial expertise to develop the project. Multilateral financial institutions like the World Bank, International Finance Corporation, the Asian Development Bank, the African Development Bank, and the European Bank for Reconstruction and Development, among others, are providing advisory services and financing transactions involving public-private partnerships in the renewable energy sector, mainly in emerging economies, to support sustainable growth and to address the issue of climate change.

Case: South Africa's Renewable Energy Independent Power Procurement Program (REIPPP)

Background

The Republic of South Africa is located at the southernmost tip of the African continent. The country is about one-eighth the size of the United States, with a land area of 1.22 million square kilometres.[39] As per the census of 2011, the total population of South Africa was 51.77 million.[39] South Africa has three capitals – Pretoria (administrative), Cape Town (legislative), and Bloemfontein (judicial), and nine provinces, which vary considerably by size. The smallest province, Gauteng, is highly urbanized and densely populated (1.4 percent of total land area having 23.7 percent of total population) whereas the largest province, Northern Cape, is vast and arid but sparsely populated (30.5 percent of total land area having 2.2 percent of total population).[39]

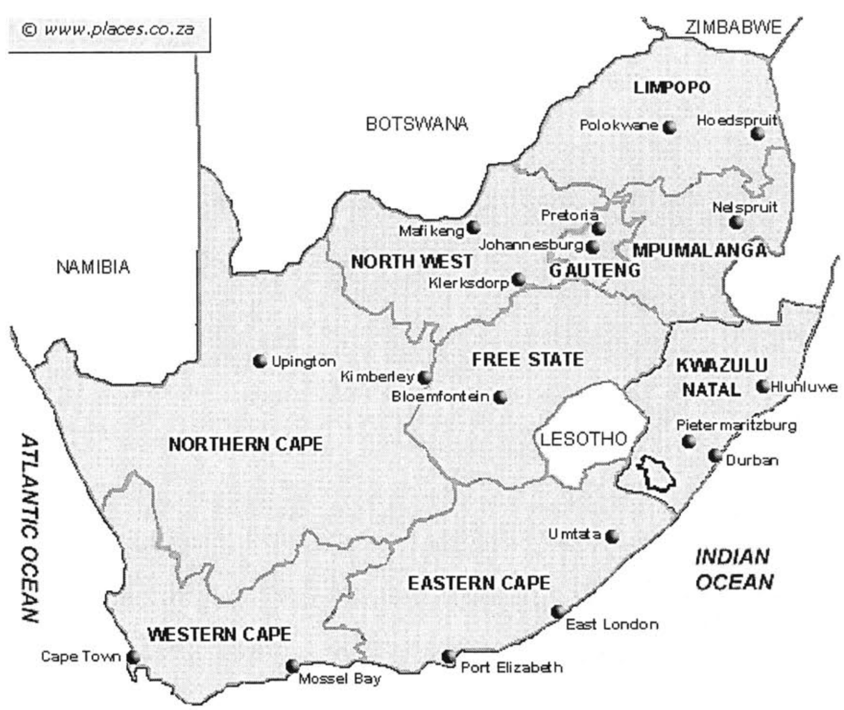

Figure 5: Map of South Africa

Source: www.places.co.za

South Africa has the twenty-fifth-largest economy in the world with a GDP of US$ 366.1 billion in 2013, and it is the second-largest economy in Africa after Nigeria.[40] The economy is services-driven, with about two-thirds of the GDP being attributed to the services sector. The sovereign debt of the country is rated BBB- by S&P and BBB by Fitch.[41] The South African economy has been plagued by concerns due to labour unrest and a volatile currency and the GDP growth has been sluggish in the past few years as compared to the developing Sub-Saharan Africa region. The comparison of past and projected GDP growth between the two regions is detailed in Table 4 below.[40]

Table 4: Comparison of GDP growth between South Africa and Sub-Saharan African developing nations
Source: World Bank

Year	**Annual GDP growth**	
	South Africa	**Sub-Saharan Africa (developing only)**
2010	3.1%	5.2%
2011	3.5%	4.5%
2012	2.5%	3.7%
2013	1.9%	4.7%
2014 (E)	2.0%	4.7%
2015 (P)	3.0%	5.1%
2016 (P)	3.5%	5.1%

E: Expected, P: Projected

The power sector scenario of South Africa is described in the following section, which lays a background for why the South African government chose to procure renewable energy and eventually formulated the REIPPP.

South Africa's power scenario

South Africa's electricity system consists of large power stations that are located near coal mines and industries in the interior of the country in Gauteng province. Long transmission lines transport electricity from the generating plants to the coastal areas. Coal provides 70 percent of the country's primary energy and more than 90 percent of its electricity. Eskom, a publicly owned national power utility, has a monopoly over power generation. The company generates 95 percent of the country's electricity, owns and controls the national high-voltage transmission grid, and distributes approximately 45 percent of electricity directly to consumers. The other 55 percent is resold by redistributors, including municipalities. As of March 31, 2014, Eskom had a generating capacity of 42.0 GW.[42]

In the 1970s, Eskom overestimated growth in demand for power and invested massively in enhancing its generation capacity. Due to overcapacity, by the end of the 1990s, South Africa's electricity prices were among the cheapest in the world. In 2007, Eskom's average electricity sales price was as low as 2.5 USc/kWh.[45] In comparison, the average electricity prices in the US in 2007 were 9.13 USc/kWh. However, by 2004, the power reserve margins, which refer to the capacity of the power producer to generate more energy than the system normally requires, were dropping sharply and were projected to turn negative in a few years. In response to this, there were interventions on both the demand and the supply side. On the supply side, Eskom initiated a New Build Program in 2005 to increase its generation capacity to 80 GW by 2026. Till 2013, Eskom had spent R385 billion (US$ 32 billion) on the program and commissioned 4,453.5 MW. An additional 16,304 MW of capacity is expected to be commissioned by 2017.[44] On the demand side, the National Energy Regulator of South Africa (NERSA), which regulates South Africa's electricity, piped gas and petroleum industries, allowed an increase in electricity tariffs to sustain the financial viability of Eskom. The increase in electricity prices in nominal as well as real terms from 1996-2012 is depicted in Figure 6 below.

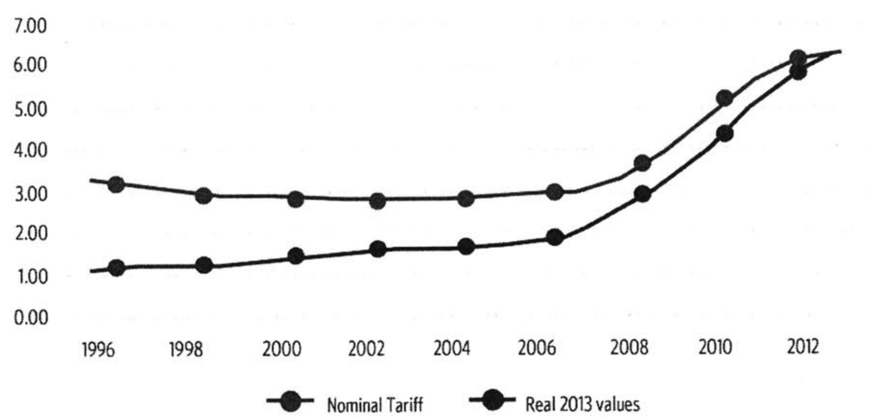

Figure 6: Average nominal and real Eskom electricity prices (USc/kWh)

Source: South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons, PPIAF

Renewable energy policy

The Department of Energy of South Africa (DOE), is mandated to come up with an electricity plan known as the Integrated Resource Plan (IRP), based on which new power generation capacity and sources are to be determined. The NERSA licenses new capacity within the limits set by this plan. The latest IRP is for the period of 2010-30 and was updated in 2013.

South Africa is placing increased focus on renewable energy. The IRP 2010-30 had a carbon emission cap and targets for renewable energy generation capacity addition – 8.4 GW of new wind power and 8.4 GW of new solar PV power capacity to be set up by the year 2030. Due to South Africa's heavy dependence on coal for its power generation, it has a high per-capita carbon emission. In 2010, South Africa had a per capita carbon emission of 9.04 metric tonnes, which was significantly higher than the world average of 4.88 metric tonnes.[46] Such high emission levels could pose challenges to the international competitiveness of the economy in the future. Also, South Africa has favorable climate conditions for solar and wind power generation. Due to its subtropical location, it has a warm temperate climate with abundant sunshine.

The South African government had published an official Renewable Energy Policy White Paper in November 2003, with a target of 10,000 GWh of renewable energy generation by 2013, to be produced mainly from biomass, wind, solar, and small-scale hydro power projects. However, there was not much action to achieve the target set by the policy. Government policies aiming to tackle climate change have had a much more significant impact in enhancing renewable energy generation capacity than the official renewable energy policy. In 2009, at the UN Climate Change Conference in Copenhagen, President Jacob Zuma made a pledge to reduce the CO_2 emissions from South Africa to 34 percent below the business-as-usual scenario by 2020 and to 42 percent below by 2025. The IRP 2010-30 was subsequently developed based on the scenario of reduced carbon emissions and provided for renewable energy generation options. An emissions cap of 275 metric tonnes per annum of CO_2 equivalent was set for the power sector, which contributed to about half of South Africa's total carbon emissions.[45]

Feed-in tariff policy and transition to a competitive bidding process

To enhance renewable energy capacity, the South African government initially explored the option of renewable energy feed-in tariffs (REFIT). A feed-in tariff is a mechanism that pays households and organizations for generating green electricity and incentivizes generation of renewable energy. The REFIT policy approved by NERSA in 2009 allowed for tariff payments that covered the generation cost of producing renewable energy plus a real after-tax return on equity of 17 percent, which would be fully indexed for inflation. The initial published tariffs were 15.6 USc/kWh for wind, 39 USc/kWh for concentrated solar, and 49 USc/kWh for solar PV.[45] These tariffs were regarded as generous by private developers. However, there was uncertainty regarding the legality of feed-in tariffs within South Africa's public procurement framework and also regarding Eskom's intention to support the REFIT program by finalizing power purchase agreements and interconnection agreements within the stipulated timeframe.

In March 2011, the NERSA added to the uncertainty surrounding REFIT by releasing a consultation paper that called for lower feed-in tariffs due to change in a number of parameters, such as exchange rates and the cost of debt, since 2009. The comparison between the feed-in tariffs approved in 2009 and the tariffs proposed in 2011 is provided in Table 5 below.

Table 5: Comparison of REFIT prices in 2009 and 2011 (USc/kWh)

Source: South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons, PPIAF

Technology	REFIT tariff		
	2009	2011	% change
Wind	15.6	11.8	-25%
Concentrated solar	39.3	23.0	-41%
Solar PV	49.3	28.9	-41%

As seen from Table 5, there was a substantial decline in the new feed-in tariffs proposed. Further, the capital component of tariffs was no longer eligible for indexation.

The DOE and National Treasury commissioned a legal opinion which concluded that feed-in tariffs constituted non-competitive procurement and hence could not be allowed under the government's public finance and procurement regulations. In August 2011, the DOE announced that a competitive bidding process for procurement of renewable energy would be launched, known as the Renewable Energy Independent Power Procurement Program (REIPPP). After this announcement, the NERSA officially terminated the REFITs.

Institutional framework for the REIPPP

Prior to the REIPPP, efforts to introduce independent power plants were left to Eskom; however, these efforts failed to produce any results due to the lack of incentives for Eskom to weaken its own monopoly on power generation. The REIPPP was different, as it was instituted under the control of the DOE and not Eskom. Since the DOE did not have the resources to run a large multi-project, multi-billion dollar competitive bidding process for renewable energy, it sought the help of the National Treasury's PPP unit. A small unit called the DOE IPP unit was formed to run the process, with members of the technical staff of the DOE and the PPP unit. This unit functioned outside the formal departmental structure of the South African government.

The DOE IPP unit was a compact team with legal and technical experts having a track record in closing PPP transactions and was seen as a team of problem solvers rather than regulators. This helped to build trust among the public sector and private sector participants in the bidding process. The unit initiated a dialogue with private sector players on key REIPPP design and implementation issues at the start of the process, which continued throughout the process. The bidding process was conducted in a highly transparent manner, with deadlines being met to a large extent. The documentation was extensive, high quality, and available on the specially designed program website. There was extensive use of private advisers, both domestic and international, to design and manage the program, review the bids, and incorporate the lessons learned through the program.

The funding for the program was initially provided through a memorandum of agreement between the DOE, National Treasury, and the Development Bank of Southern Africa (DBSA). DBSA agreed to provide funding for the projects by way of senior debt and to provide a corpus of R80 million for funding the administrative expenses related to the program. Further, technical assistance was provided by bilateral donor agencies from Denmark, Germany, Spain, and the

UK. In 2011, the National Treasury made available R100 million for the program, part of which was utilized for repaying DBSA.[45] This money helped to finance the first round and part of the second round of bidding. Subsequently, the program has become self-financed through bidder registration fees and fees paid by successful IPP project companies. These funding arrangements have enabled the program to remain outside the government budget for subsequent bidding rounds.

Bidding process

The formal Request for Proposals (RFP) for the REIPPP was issued in August 2011, with the bids due for submission within three months of the release of the RFP and financial close of the projects due within six months of announcement of preferred bidders. The REIPPP envisaged procurement of a total of 3,625 MW over a maximum of five tender rounds. There were caps on the total capacity to be procured under individual technologies as well as the price for each technology. The caps on the capacities to be procured under individual technologies served to increase competition among the bidders.

The RFP consisted of three sections – general requirements, qualification criteria, and evaluation criteria. The documents also included a standard Power Purchase Agreement (PPA), an Implementation Agreement (IA), and Direct Agreement (DA). The PPA was to be executed between the IPP and Eskom (the off taker) for a tenure of twenty years with tariffs denominated in South African Rand. The IA was to be executed between the IPP and the DOE, which provided a sovereign guarantee to the IPP against payment default by Eskom. The DA provided step-in rights to lenders in the case of a default. The PPA, IA and DA were non-negotiable documents developed as a result of extensive consultation with the public and private stakeholders.

Bidders had to provide bank letters indicating tie-up of project debt, which meant banks had to undertake significant due diligence and shared a large proportion of development risk. The participating bidders were required to demonstrate significant pre-bidding commitment as they had to identify the project sites and pay for early development costs from their own pockets.

Bid bonds of US$12,500 per MW of proposed installed capacity were required to be deposited, and this amount would be doubled once the preferred bidder status was announced. The bid bonds would be subsequently released if the bidder was unsuccessful in the bidding stage or once the project achieved commercial operation.

The selection of bidders was based on a 70/30 weightage to price and economic development considerations. A regulatory review determined that the REIPPP would not be subject to the national PPP regulations, which required a complicated and time-consuming value-for-money (VFM) analysis and numerous consultations with stakeholders and the National Treasury PPP Unit.

Bid evaluation and outcomes

The bids were evaluated based on a two-step process. In the first step, the bidders had to satisfy minimum threshold requirements in six areas – environment, land, commercial and legal, economic development, financial, and technical. The environmental review examined the requisite clearances whereas the land review examined the tenure, lease registration, and proof of land use application. The commercial review looked at the project structure and acceptance of the PPA. Economic development considerations included criteria such as local job creation, ownership, socioeconomic development, etc. Financial review was linked to a standard template used by evaluators and technical review included examining specifications for each type of technology.

Bids that cleared the threshold requirements moved to the next step of evaluation, with a 70/30 weightage for bid prices and economic development respectively. The economic development considerations were converted into a composite score which covered various aspects such as job creation, local content, ownership, management control, preferential procurement, socioeconomic development, etc. Bids having the highest scores were selected.

Four rounds of bidding for the REIPPP have been completed to date, with the number of bids received increasing in each successive round except for the last one. A summary of the number of bids, capacity and investment in each round is provided in Table 6 below.[45, 47]

Table 6: Summary of REIPPP bidding rounds

Source: South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons, PPIAF and DOE Preferred Bidder's Announcement, April 2015

	Round 1	**Round 2**	**Round 3**	**Round 4**
Announcement date	August 2011	November 2011	May 2013	July 2014
Bidding end date	November 2011	March 2012	October 2013	August 2014
Capacity offered	3,625 MW	1,275 MW	1,473 MW	1,105 MW
Number of bids received	53	79	93	77
Total capacity for which bids were received	2,128 MW	3,233 MW	6,023 MW	5,804 MW
Number of preferred bidders selected	28	19	17*	13
Total capacity awarded	1,416 MW	1,044 MW	1,456 MW	1,121 MW
Total investment by preferred bidders	US$ 5.97 billion	US$ 3.53 billion	US$ 4.50 billion	US$ 1.94 billion

* Two preferred bidders of Round 3 yet to sign for financial close

The tariffs for power generation from each technology decreased significantly in successive rounds due to increased competition. The evolution of tariffs from the REFIT to REIPPP is summarized in Table 7 below. [45, 47]

Table 7: Tariff evolution from REFIT to various rounds of REIPPP (USc/kWh)

Source: South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons, PPIAF and DOE Preferred Bidder's Announcement, April 2015

	Wind	**Solar PV**	**Concentrated Solar**
REFIT	15.6	49.3	39.3
REIPPP			
Round 1	14.3	34.5	33.6
Round 2	11.3	20.8	31.6
Round 3	7.5	10.0	16.6
Round 4	5.1	6.5	NA

Private sector participation

A key highlight of the REIPPP program has been the diverse nature of the project developers, sponsors, equity shareholders, financiers and engineering, procurement and construction (EPC) contractors.

Equity shareholders

The 64 projects bid out in the first three rounds of REIPPP were promoted by more than 100 different sponsor entities, of which 46 sponsors participated in more than one project and 25 participated in three or more projects.[45] Prominent equity shareholders included Old Mutual (insurance and asset management company) with equity stake in 16 projects, Standard Bank of South Africa (one of South Africa's big five commercial banks) with equity stake in four projects, the Industrial Development Corporation (a national development finance institution) with equity stake in nine projects, and Africa Infrastructure Investment Fund (a specialist infrastructure fund) with equity stake in three projects.

Financiers

The majority of the projects (56 out of 64) bid out in the first three rounds was funded using project financing.[45] Of the remaining eight projects, one was financed through a corporate bond, another project was corporate financed with subsequent debt refinance and the balance six were corporate financed. About two-thirds of the total investment was through debt, a quarter through equity and shareholder loans and the balance from corporate finance. Eighty-six percent of the debt has been raised domestically.

The majority of the debt funding (64 percent) came from the five large commercial banks of South Africa - Standard Bank, Absa Bank, FirstRand Bank, Nedbank and Investec - with the balance coming from development finance institutions (31 percent) and pension and insurance funds (5 percent). The banks were either lead arrangers or participating lenders (senior/mezzanine debt). The tenure of the bank debt ranged from 15 to 17 years from the commercial operations date with a spread of 310 to 400 basis points over the Johannesburg Interbank Average Rate (JIBAR).[45] Development finance institutions such as the Industrial Development Corporation (IDC), the Development Bank of Southern Africa (DBSA) and insurance and pension funds such as Old Mutual, Liberty and Sanlam provided the balance debt funding. The commercial banks were expected to sell down their existing debt in the REIPPP projects to insurance and pension funds to free their balance sheets for further exposure in the upcoming bidding rounds.

The first three rounds of the REIPPP also saw participation from international development finance institutions like the International Finance Corporation (IFC), the African Development Bank (AfDB), European Investment Bank (EIB), Netherlands Development Finance Company and Overseas Private Investment Corporation (OPIC).

Engineering, Procurement and Construction (EPC) contractors

Forty-nine EPC contractors have been involved in the REIPPP projects of the first three rounds, with some of the contractors participating in more than one project as either primary or secondary contractor. The contractors are domestic as well as international from countries such as Spain, Germany, Italy, Norway, and India. Wind turbines have been supplied primarily by European companies while PV suppliers have been from Europe, China and Korea. Many international EPC contractors have set up local subsidiaries in South Africa, contributing to local job creation.

Key success factors for the REIPPP

The REIPPP has secured investment commitments for renewable energy projects amounting to US$ 16 billion for a capacity of 5,037 MW.[45, 47] This has made it among the top ten privately funded renewable energy programs in the past few years. It is considered to be among the most successful public efforts to attract private investment in the infrastructure sector in Africa. Competitive bidding reduced the power tariffs over the three bid rounds and the projects have been implemented at a relatively faster pace.

The key success factors for the REIPPP as outlined by the Public-Private Infrastructure Advisory Facility (PPIAF) of the World Bank Group are listed below.[45]

Political support

The success of the REIPPP was largely due to the political support from the South African government. There had been a long history of policy statements on renewable energy, but the most important commitment came from President Zuma during the COP15 (Conference of Parties to United Nations Framework Convention on Climate Change) meeting in Copenhagen and the COP17 meeting in Durban where the government signed the Green Accord with business and other stakeholders. The program was successful because of the resolve shown by the political establishment to reduce South Africa's carbon footprint even though the country had no binding obligation under the United Nations Framework Convention on Climate Change (UNFCC) or the Kyoto Protocol. The economic development requirements of the REIPPP, which constituted 30 percent of the bid evaluation, helped to generate political support and public approval.

Unique functioning of the DOE IPP unit

The ad hoc status of the DOE IPP unit, which functioned independent of the DOE, enabled the program to have a problem-solving approach rather than mere adherence to government policies and procedures, and enforcement of rules. Further, the REIPPP team had a considerable amount of experience working with the private sector with knowledge of PPP contracts and credibility with public and private sector stakeholders.

Self-financing mechanism of the program

The REIPP was able to remain off the government budget through its access to funding from the DBSA, donor agencies, the National Treasury fund. Subsequently, the program became self-sufficient by collecting fees from closed projects.

Quality of transaction advisers

The DOE IPP unit selected experienced transaction advisers, both local and international, to transfer best practices in PPPs and renewable energy procurement to the South African context. Teams from legal and financial advisory firms sat together to draft the procurement documents and contracts. Due to the excellent collaboration between these firms, the procurement process was well managed.

Competitive bidding structure

The transition from REFIT to a competitive bidding process resulted in large reductions in tariffs for each type of renewable energy being procured. As a result, the government was more than willing to support the REIPPP going forward. Also, the design of the program was altered from a one-off tender to a series of bidding rounds. This built confidence among the investors and helped generate high competition in each successive bidding round. The number of bidders increased significantly as bidding progressed.

Exemption from national PPP regulations

The REIPPP was exempted from adhering to the national PPP regulations by defining Eskom, which was the off taker and contractor in the REIPPP program, as an entity different from a governmental agency. The national PPP regulations would have required a complex, time-consuming and expensive review process with wide ranging consultations with key stakeholders and the National Treasury PPP unit. This process involved 24 elaborate preparation steps and four opinions on the process issued by the National Treasury. The process had to be followed irrespective of the size of the project and was characterized as being slow and cumbersome by the private sector. The exemption of REIPPP from this process helped to fast-track the program.

Non-negotiable program characteristics

The REIPPP eliminated time-consuming negotiations over project documents with multiple bid winners and restricted opportunities for gamesmanship amongst the bidders by making the main project documents – the PPA and the IA, non-negotiable. Also, the financial data that bidders had to provide for evaluation of bids was standardized and there was a requirement for the bids to be fully underwritten by way of debt and equity. This requirement prevented bidders from under-bidding to win contracts and subsequently renegotiating to secure a more profitable deal.

Global market factors

The REIPPP was launched at a time when there was a slowdown in the OECD markets. As a result, it attracted considerable attention from the international private sector, which resulted in increased competition during bidding and lowered power tariffs.

Mature banking system

The mature banking system of South Africa also contributed immensely to the success of the REIPPP. The banks provided liquidity, long tenure debt (which is key for infrastructure projects) and also had prior experience of project finance and PPP transactions. They also constituted a smaller but functioning secondary market consisting of bonds and syndicated debt. Banks played a major role in the REIPPP achieving financial close for multiple projects simultaneously during each bidding window.

Support from multilateral financial institutions and donor agencies

Due to the focus of the REIPPP on renewable energy and economic development requirements, the program garnered support from multilateral development banks and bilateral donor agencies in the form of grants, concessional finance and innovative financial instruments. Donor agencies and development banks were also open to issuing bonds to refinance the REIPPP debt and providing donor-capitalized facilities for subsidized transaction support and credit enhancements.

Key challenges for the REIPPP

The REIPPP faces some key challenges in the future, which have been outlined by the PPIAF in its report and are listed below.[45]

Sustainability of the procurement process

One of the key success factors of the REIPPP has been its ad-hoc nature. The program was housed in the DOE IPP unit which functioned independent of the DOE and was off the government budget. The managers of the program emphasized on problem solving rather than imposing rules and regulations in the form of a regulator. However, as the program grows, it will have to be formalized in structure for the program to be sustainable in the future. This formalization in structure could lead to delays and indecision. The challenge for the government would be to preserve the success factors of the program post institutionalization of the program.

Failure to meet economic development requirements

There is a possibility that the economic development requirements might not yield the desired results. Many new South African industries set up for producing renewable energy components for the REIPPP are expected to face challenges in a global industry affected by over-supply and intense competition. Job growth resulting from these requirements would not be sustainable in the future and would lead to increase in power cost. Further, local communities may not experience benefits from the program as they expected them to be. According to the program requirements, one percent of the revenues accruing from each REIPPP project is to be invested in community development. However, few project developers have prior experience in designing effective programs. Inability of the REIPPP program to deliver in these areas could lead to local community dissatisfaction, which could undermine the overall political support for the program.

Also, there are issues with regard to monitoring the economic development activities of all the awarded projects over the life of the concessions. At the end of the third round of bidding, there were 64 IPP projects with a life of 20 years and each project had as many as 17 economic development targets, monitored on a quarterly basis. The monitoring work for projects shall require a substantial number of permanent professional staff and an ongoing government budget allocation.

Transmission constraints of Eskom

Eskom's plan for enhancing transmission capacity has not been synchronized with the award of REIPPP power projects. Also the company is strapped for funds, which limits its ability to invest in new transmission capacity. It has clarified that it will not be able to fund grid strengthening beyond the requirements of the third round of REIPPP. The problem with transmission infrastructure is not due to the shallow connections (transmission infrastructure from power plant to nearest substations) which are being constructed by developers themselves, but due to lack of deep connection investments which are required to be done by Eskom to evacuate power from the remote project locations. As per the contracts, in such cases Eskom would be liable for deemed energy payments even if no energy is being fed into the grid. This could lead to reputational risks for the REIPPP program going forward if Eskom is unable to construct transmission infrastructure in time.

Financial health of Eskom

Eskom is under significant financial distress currently with questions being raised over the management of the company. The net profit of Eskom has declined by 46% from R13.25 billion for the financial year ended March 31, 2012 to R7.09 billion for the year ended March 31, 2014; despite an increase in revenues from R114.85 billion to R139.51 billion during the same period. The leverage of the utility has increased over the period, with the total debt to EBITDA ratio increasing from 6.46 times in 2012 to 10.96 times in 2014 and the debt service coverage ratio decreasing from 3.50 times in 2012 to 1.21 times in 2014. If Eskom's financial health continues to deteriorate, the sovereign guarantee would have to be invoked to make payments to the IPPs, which could affect the credit standing of the government. The solution being proposed is unbundling the key functions of Eskom into separate generation, transmission and distribution companies and privatizing some or all of these unbundled companies. If Eskom were to be restructured, the resulting entity would inherit the PPA contracts and sovereign guarantees from the parent company. The creditworthiness of such an entity would be a key concern for both the IPPs and the government.

Recovery in global renewable energy market

If the global slowdown affecting the renewable energy market is reversed, and there is renewed growth in the industry, the interest in REIPPP among global investors and operators is likely to reduce, particularly if the economic development criteria of the program (which constitute 30 percent of the bid evaluation) become more onerous for the developers.

Bottoming of renewable energy tariffs

The bid prices have largely bottomed out due to increased corporate balance sheet funding, stringent negotiations with EPC contractors and cost-effective sourcing of components. The spreads that domestic banks are charging on project debt have remained unchanged over the three rounds and foreign banks are unlikely to finance the projects due to lack of foreign exchange protection. In fact, if the domestic banks are unable to down sell the existing REIPPP debt from their books, the spreads might actually increase due to increased liquidity premium. On the other hand, the South African government is likely to press for lower bid prices as the tariffs in South Africa are still higher than what are being achieved under other jurisdictions. This may lead to reduced bankability of the projects and declining private sector interest.

Learnings from the REIPPP

The REIPPP provides a successful example to other developing countries on how to procure renewable energy projects quickly and effectively. Not all factors contributing to the success of the REIPPP can be replicated due to country-specific differences, however it does provide a lesson as to what are the essential requirements for a successful PPP in renewable energy. The key learnings from the program (adopted from the PPIAF report) are listed below.[45]

Governments should adopt a business-friendly approach

The REIPPP experience demonstrates that if tariffs are reasonable and key risks are mitigated, the private sector would be willing to invest in renewable energy. Private sector players appreciated the problem-solving nature of the DOE IPP unit, the consultations that DOE IPP undertook for key design and implementation issues, the adherence of the program to project deadlines, use of private sector advisers and the business friendly approach of the program. These factors can be easily replicated across countries.

Donor agencies and development finance institutions are excellent resources to be utilized

Donor agencies and development finance institutions (DFIs) are committed to promoting sustainable energy resources and hence are inclined to help with renewable energy programs. Donor funding helps to design and manage procurement of programs such as REIPPP and to reduce project preparation costs by paying for standardized documentation. Donors also provide credit enhancements for project sponsors. DFIs provide partial risk guarantees that strengthen the sovereign guarantees in countries which have below-investment grade credit ratings. The key requirement for participation by these institutions is a well-designed program for procuring renewable energy.

A convincing case should be made for renewable energy

Most developing countries require a convincing case to be made for justifying the procurement of renewable energy, which tends to be costlier than conventional forms of energy.

In the case of South Africa, the REIPPP was preceded by several years of policy proposals that supported mitigation of climate change. Also there was a looming power shortage in the country and lack of action by Eskom on IPPs provided a substantial case for going forward with the REIPPP. As the tender design work started, the DOE IPP unit emphasized the economic development characteristics of the program. This helped build a case for renewable energy through the generation of jobs and development of rural areas and generated interest in investors interested in social impact such as pension funds. Economic development requirements helped to offset the high power costs of renewable energy by generating tangible benefits for the local community.

Program design should suit country specific requirements

Developing countries should choose a program design that suits their country's specific circumstances. In the case of REIPPP, the government was considering whether to go for a feed-in tariff regime or to introduce competitive tenders. FITs have been the standard approach in renewable energy programs and have lower costs of management than competitive tenders. Further, prices can be controlled by price caps or periodic tariff adjustments. However, the REIPPP experience suggested that competitive tenders are an attractive alternative to FITs as there was a substantial decline in tariffs due to competitive bidding. Though competitive tendering has high initial transaction costs, it is more cost-effective in the long run in the case of lower tariffs.

Procurement mechanism and documentation and processes should be watertight

An effective procurement mechanism is essential for the success of a program such as the REIPPP. The program should have clear evaluation criteria, well drafted documentation in the form of power purchase agreements and implementation agreements, and suitable credit enhancement mechanisms such as sovereign guarantees. Many countries only have a tariff policy in place without a proper procurement mechanism, which leads to few projects achieving closure. Private sector players require a clear framework within which they shall invest with a consistent and timely implementation plan.

Case: India – Gujarat's Solar Power Programs

Background

Gujarat is the seventh largest state of India, located on its western coast. It is one of the most prosperous states of the country, with a per capita GDP of Rs. 106,831 (US$ 1,696) in 2013-14 which is 33 percent more compared to the national per capita GDP of Rs. 80,388 (US$ 1,276) for the same period.[48] As per the census of 2011, Gujarat ranks tenth amongst Indian states in terms of population with a total population of 60.4 million.[48] More than 60 percent of the state's population is in the working age group of 15-59.[48] The State Domestic Product (SDP) of Gujarat, which measures the total output generated by the state for a fiscal year, has been growing at an average growth rate of 10.1 percent between 2005 and 2013, which is higher than the national average growth rate of 7.6 percent.[48]

In terms of power generation, Gujarat is a power-surplus state with a total installed power capacity of 28,423.4 MW as of January 31, 2015. The breakup of generation capacity across private and public (state and central government) entities is provided in Table 8 below.[49]

Table 8: Power generation capacity in Gujarat as of January 2015

Source: Central Electricity Authority, India

Ownership/sector	Capacity (MW)
State	7,596.7
Private	17,194.8
Central	3,631.9
Total	**28,423.4**

Out of the total installed capacity, 22,661.84 MW or 80 percent of the power generation capacity is thermal (coal, gas and diesel based).[49] However, Gujarat is one of the few Indian states that has adopted renewable energy on a large scale. The current renewable energy capacity of the state is 4,430.1 MW, which is the third largest in the country after Tamil Nadu and Maharashtra. The breakup of renewable energy generation capacity based on source is provided in Table 9 below.[49]

Table 9: Source-wise breakup of renewable energy capacity in Gujarat

Source: Central Electricity Authority, India

Generation source	Capacity (MW)
Wind	3,477.9
Solar	902.5
Biomass	41.1
Hydro	8.6
Total	**4,430.1**

The following section describes the power sector reforms in Gujarat, which enabled it to become a power-surplus state and attract the attention of private sector investors. These reforms also helped create an enabling environment for the subsequent implementation of the PPP programs in the state.

Power sector reforms in Gujarat

Gujarat was not always the power surplus state that it is currently. The power sector was in a dire state in 2001, when Mr. Narendra Modi, the current prime minister of India, became the chief minister of Gujarat for the first time. The erstwhile Gujarat State Electricity Board (GSEB), which was a state owned company responsible for generation, transmission and distribution of electricity, had posted a loss of Rs. 22.46 billion for FY2000-01, on total revenues of Rs. 62.80 billion.[50] The company had huge interest costs of Rs. 12.27 billion, with transmission and distribution losses at 35.27 percent.[50] Due to this, load-shedding (which refers to interruption of electricity supply to avoid excessive load on power generating plants) was frequent, leading to reduced productivity. As a result of the mounting losses, GSEB did not have funds to enhance its generation capacity, nor could it convince private sector players to invest in the sector. Reforming the power sector became a top priority for Modi as he understood that ensuring a continuous supply of electricity is crucial for the state's economic growth.

The first step that Modi took was to appoint Ms. Manjula Subramaniam as the Chairperson of GSEB and Principal Secretary for Energy and Power sector. She had been a joint secretary in the prime minister's office from 1993 to 1998, and had played a key role in the liberalization and reform of the country's economy during that time. Subramaniam realized that

GSEB was a behemoth and could not be managed as a standalone entity. However, she did not rush into the immediate restructuring of the organization. She focused her attention on two key aspects – improving the financial position of GSEB and building employee morale.[50]

Subramaniam discovered that GSEB had availed loans from banks and financial institutions at unfavourable interest rates of 18 percent and higher. She convinced the financial institutions to lower their interest rates through debt restructuring. This had an immediate impact on the financials of GSEB, leading to a cost saving of Rs. 5.00 billion in FY2002-03. Next, she examined the PPAs entered into by GSEB with private players for purchase of power and realized that the power suppliers had inflated the heat rate (which is a measure of generator efficiency), due to which they were charging more tariff than required. Hence, she decided to renegotiate the existing PPAs. There was resistance from the private players, but after some hard bargaining by the government which continued for 18 months, the tariff rates were lowered, leading to further savings of Rs. 6.75 billion in FY2002-03 and Rs. 10.00 billion in FY2003-04.[50]

Subramaniam also found that employee morale was low, as many employees feared for their jobs due to the looming restructuring and reform process, and were getting alienated from GSEB as an organization. She appointed a consultant to suggest ways for improving employee loyalty and morale. Based on the recommendations given by the consultant, from mid-2002, the GSEB board began taking special efforts to reach out to employees. It commenced training programs at all levels to ensure the employees that while there may be a redeployment of people, no one would be laid off. Senior officials began holding 'town hall' meetings, where they would share details of the financial position of the company and encouraged employees to ask questions. An internal newsletter was also initiated to enhance the flow of communication from top to down. As the employees were assured of retaining their jobs, they started actively participating in discussions for future reforms, with a 'reforms progress management group' being set up comprising of GSEB employees.[50]

Simultaneously, the Modi government initiated the plugging of leakages in the distribution system. Power pilferage in Gujarat then ranged from 20 percent in urban areas to up to 70 percent in rural areas.[50] The government passed a law against power thefts and set up five dedicated police stations across the state to focus on power theft cases. It also began taking stringent action against consumers who had large power bill arrears including disconnecting their power supply. Some rural areas had unmetered power supply, which stopped altogether as GSEB entered into a structural loan re-adjustment with the Asian Development Bank to fund meter installation.

After the initial steps aimed at restoring the health of GSEB, the government decided to restructure the utility. In May 2003, the Gujarat government passed the Gujarat Electricity Industry (Reform and Reorganization) Act, which split GSEB into seven companies dividing the functional responsibilities of generation, transmission, distribution and trading of electricity among these companies. This enabled better management and more efficient operations.

Another key reform undertaken by the government was the separation of the distribution feeder lines that supplied power to rural areas into two lines – one for agriculture and the other one for household and other needs. This was part of the Jyoti Gram Yojna, announced by Modi in 2003 to supply round-the-clock power to villages. This reform was initiated because a single feeder line had limitations as villagers got power for only 12-15 hours a day which was of poor quality and at odd hours. Also, since the tariff for agricultural power was lower, many people used the subsidised supply for household purposes resulting in losses for GSEB. Though rural residents had to pay higher power bills than the past, they cooperated with the government once they realized that they were assured of uninterrupted and better quality power. A study by the Indian Institute of Management, Ahmedabad estimated that the savings in the capital expenditure due to implementation of this project were about Rs. 230.00 billion or about 5,000 MW.[50]

Further, the government ensured that Gujarat Electricity Regulatory Commission (GERC), which is the power sector regulator for the state, was independent of political pressures. This has allowed GERC to revise tariffs every year so that the state bridged the gap between the average cost of supply and the average price paid by the consumers.

All these reforms led to GSEB staging a drastic turnaround. The state electricity board posted its first profit after tax of Rs. 2.03 billion in FY2005-06. By FY2010-11, net profit had risen to Rs. 5.33 billion and transmission and distribution (T&D) losses had fallen to 20.13 percent. Due to the clampdown on power pilferage, the tariff collection efficiency was close to 100 percent.[50] As soon as these fundamental issues were resolved by the government, private players expressed willingness to invest in the power sector. Currently, more than 60 percent of the total installed power generation capacity in Gujarat is owned and operated by the private sector.[49]

Despite the aforesaid reforms, certain issues remain for the power sector in Gujarat. Though there has been a reduction in T&D losses in Gujarat, it is still higher compared to certain states such as Himachal Pradesh (11 percent), Andhra Pradesh (16 percent) and Kerala (18 percent).[52] Also, cost of power in Gujarat has been high traditionally and continues to remain so. This is because the share of hydropower in Gujarat, which is a cheaper source of power generation, is low (only about 2.7 percent of the total installed capacity).[49] A sizeable proportion of the power (about 24 percent) comes from gas-based plants, and the high cost of gas has caused these plants to operate at sub-optimal loading factor.[49] Further, the thermal power plants of Gujarat are located far away from the coal-fields (which are situated mainly in eastern and central India), leading to high transportation cost for coal.

Despite these issues, the power sector of Gujarat has exhibited a remarkable transformation from being a power deficit state a decade ago to becoming a power surplus state and paved the way for large investments from the private sector.

Renewable energy in Gujarat

Potential of renewable energy in Gujarat

As mentioned earlier, Gujarat is one of the most industrialized states in India with a large requirement of uninterrupted power supply. In terms of sources of power generation, the hydropower potential of Gujarat is limited and thermal power plants are dependent on coal hauled from coal-fields located about 1,500 km away. In terms of environmental issues, Gujarat has an inadequate forest cover, serious problems of soil erosion/degradation, waterlogging and expanding wastelands. Further, it is plagued by water shortages, sinking water tables, salinity and salt ingression.

On the other hand, Gujarat is rich in terms of renewable energy resources – it receives 300 days of sunshine in a year, has wastelands located in the Rann of Kachchh region with vast unutilized land and high solar radiation, 1,600 km shoreline with potential to develop wind turbines, waste-to-energy options that harness bio, agro and industrial waste. As a result, it makes sense for Gujarat to exploit its renewable energy resources. Table 10 below summarizes the renewable energy potential of Gujarat.[53]

Table 10: Renewable energy potential of Gujarat

Source: GEDA website

Renewable energy source	Resource	Energy Generation/Saving Potential
Sun	Solar Radiation 300 days 5.6 - 6.0 kWh/m^2/day	1,740 units of electricity generated per m^2 of solar panel installed
Biomass	24 million tonnes	900 MW of electric power could be generated to meet energy requirements of almost all villages in Gujarat.
Biogas	200 lakh cattle population (Dung available at 70% collection efficiency)	Could generate 5.6 million cubic meter of biogas per day to cater cooking gas to 2.8 million families or generate electric power equivalent to 933 MW
Biogas energy plantation	67 lakh hectare wasteland	Could yield 67 million tonnes of Biomass which can sustain power generation to the order of 15,000 MW
Wind	Coastline and hilly regions	5,000 MW
Tidal	Gulf of Kachchh Gulf of Khambhat	9,000 MW 9,000 MW

The renewable energy map of Gujarat listing the major facilities constructed/under development is depicted in Figure 7 below.

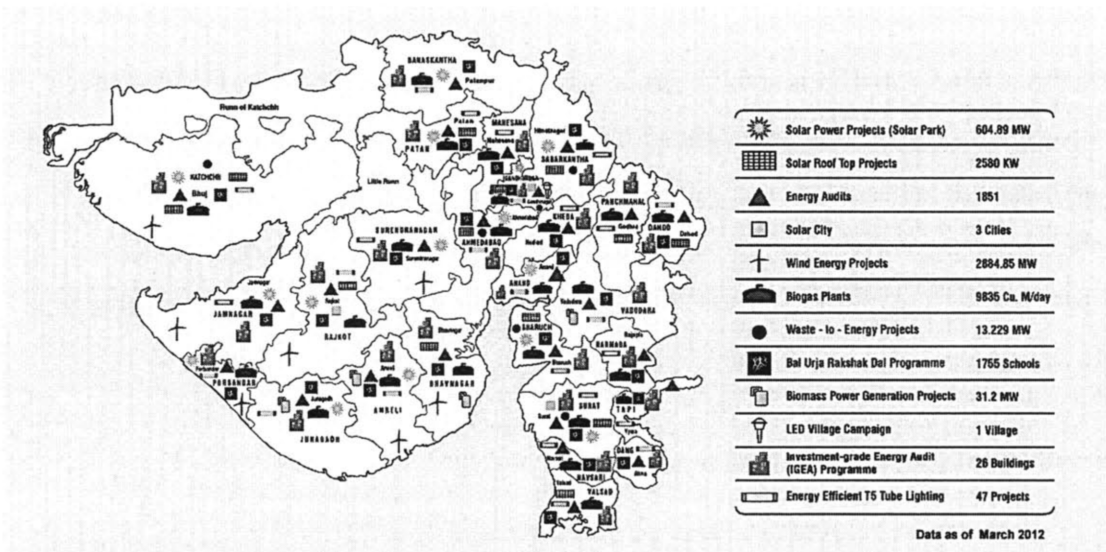

Figure 7: Renewable energy map of Gujarat
Source: GEDA

Gujarat Energy Development Agency

Gujarat Energy Development Agency (GEDA), a government enterprise responsible for renewable energy development and energy conservation in the state of Gujarat. It has played a leading role in developing a long-term renewable policy and implementing sustainable energy programs across the state. It has over three decades of experience of completing several pioneering renewable energy and energy efficiency projects and programs that have demonstrated techno-economic viability.[53]

In 1979, GEDA introduced the Surya Cooker (solar cooker) to the public, which was the first renewable energy based consumer product to be offered to the public and it met with an enthusiastic response. This was later adopted by the central government on a nationwide level through the National Solar Cooker Promotion Program in 1982-83. The Surya Cooker has served as a prototype program for GEDA, providing several important designs, development and marketing insights that have been critical for promotion of later renewable energy technologies.[53]

GEDA has been instrumental in introducing several new technologies for mass use through design of innovative programs, involvement of NGO network, implementation strategies and promotional initiatives. GEDA's programs have helped fulfil the basic energy needs of remote and tribal areas. These programs have also contributed to rural development, grassroots employment, and led to a boost in agricultural productivity, energy efficiency and a reduction in carbon emission levels.[53]

Solar Power Policy of Gujarat – 2009

With rapidly growing demand for electricity, and increasing reliance on imported sources of fossil fuels in recent years, India has initiated steps to tap into and develop the large potential for solar energy based power generation. In 2010, the Government of India launched the Jawaharlal Nehru National Solar Mission (JNNSM) to facilitate solar power development. The Mission has set an ambitious target of deploying 20,000 MW of grid connected solar power by 2022. It aims to reduce the cost of solar power generation in the country through: 1) long term policy; 2) large scale deployment goals; 3) aggressive R&D; and 4) domestic production of critical raw materials, components and products, so as to achieve grid tariff parity for solar power by 2022.[56]

The Government of Gujarat, taking advantage of the favourable policy regimes and high solar irradiation in the state, launched its own Solar Power Policy in 2009. The salient features of the policy are summarized in Table 11 below.[57]

Table 11: Salient features of the Solar Power Policy – 2009

Source: Solar Power Policy-2009 document, Government of Gujarat

Operative period of policy	Till March 31, 2014. Solar power plants installed and commissioned during this period shall be eligible for policy incentives for 25 years from date of commissioning or their lifespan, whichever is earlier
Installed capacity and capacity cap	Maximum of 500 MW during operative period of the policy with a minimum project capacity of 5 MW each

<table>
<tr><td>Tariffs</td><td>Energy generated would be sold to distribution licensee in the state at levelized fixed tariff per unit for 25 years under a Power Purchase Agreement as follows:
<table>
<tr><th>Particulars</th><th>Tariff for PV projects (Rs./kWh)</th><th>Tariff for solar thermal projects (Rs./kWh)</th></tr>
<tr><td>Projects commissioned before December 31, 2010</td><td>13.00 (first 12 years)
3.00 (13^{th} to 25^{th} year)</td><td>10.00 (first 12 years)
3.00 (13^{th} to 25^{th} year)</td></tr>
<tr><td>Projects commissioned between December 31, 2010 and March 31, 2014</td><td>12.00 (first 12 years)
3.00 (13^{th} to 25^{th} year)</td><td>9.00 (first 12 years)
3.00 (13^{th} to 25^{th} year)</td></tr>
</table></td></tr>
<tr><td>Grid connectivity and power evacuation</td><td>The evacuation facility from the solar substation to the transmission company (Transco) substation shall be approved by the Transco after carrying out system study. The power shall be injected by the solar power plant at 66 KV. The transmission line from solar substation to Transco substation shall be laid by the Transco.</td></tr>
<tr><td>Sharing of Clean Development Mechanism (CDM) benefit</td><td>The solar power project developer shall pass on 50 percent of the gross benefits of CDM to the distribution licensee with whom the PPA is signed.</td></tr>
<tr><td>Role of GEDA and GPCL</td><td>GEDA and Gujarat Power Corporation Limited (GPCL) will facilitate and assist the project developers in the following activities:

Identifying suitable locations for solar projects, preparing a land bank, creating/upgrading connecting infrastructure such as roads
Facilitating Right of Way, water supply, clearances and approvals under the purview of the state government
Recommending project for benefits under policy declared/to be declared by the Government of India
Promoting R&D activities for cost effective, sustainable and environment friendly technologies in collaboration with international and local reputed institutes
Develop manpower skills by tying up with training/educational institutes through PPP
</td></tr>
</table>

With the Solar Power Policy of 2009, Gujarat became the first state in India to have its own solar policy. The Solar Power Policy of Gujarat offered lower tariffs compared to the Jawaharlal Nehru National Solar Mission promoted by the central government (Rs. 17.00/kWh for 25 years). However, the Gujarat government worked on better and faster implementation of projects and provided infrastructure facilities to developers. This led to significant interest from domestic and foreign investors and led to the development of various solar power programs in the state. Currently, Gujarat has the highest installed capacity of solar power in the country which includes a solar power park with an installed capacity of 280 MW.

Charanka Solar Park

The Charanka solar park is spread over about 2,000 hectares in the wastelands of the Rann of Kachchh, which is a salty marsh at the edge of the Thar Desert that borders Pakistan. The location is well connected by roads and railway – the nearest national highway (NH 15) is about 20 km away and the nearest railway station (Santalpur) is about 30 km away. It is also close to ports – the nearest sea port (Kandla) is about 180 km away.[58]

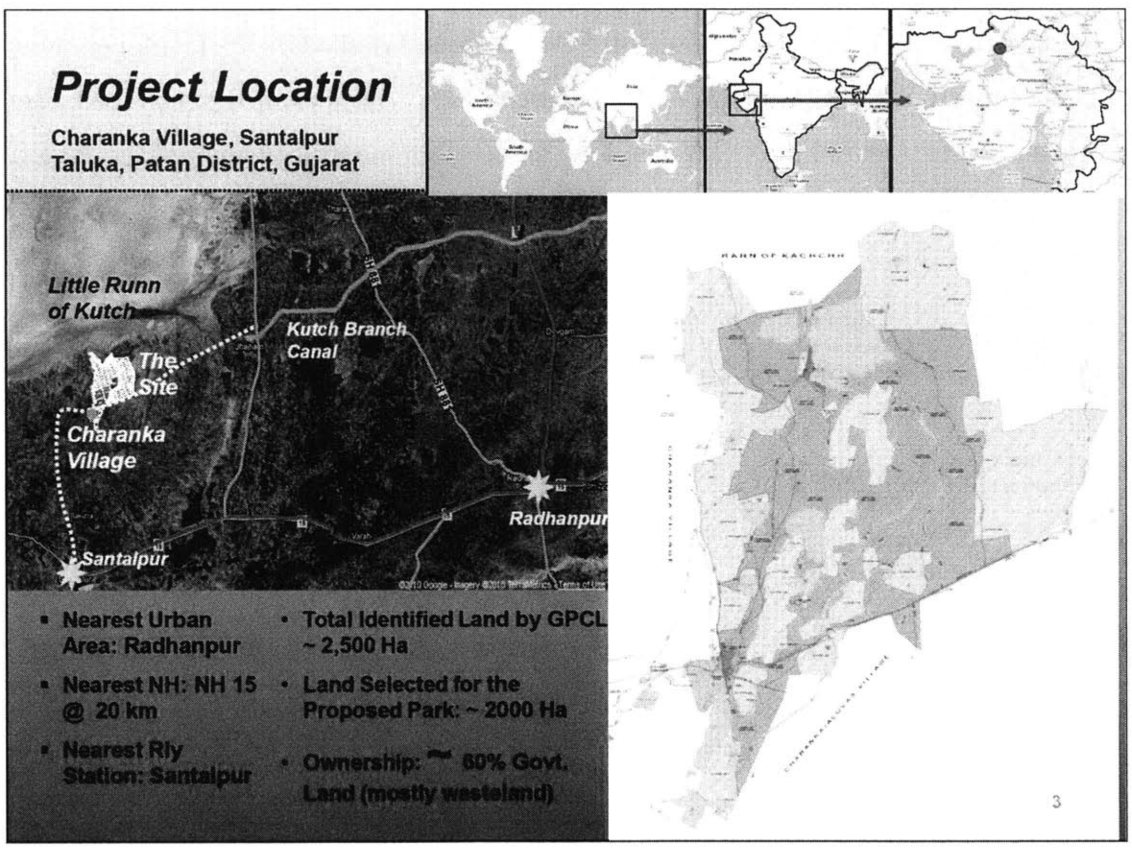

Figure 8: Charanka Solar Park – location and salient features

Source: GPCL Solar Park presentation

The Charanka solar park is considered as the world's first multi-developer, multi-facility, multi-technology and multi-beneficiary solar park. The park is being developed as a public-private partnership with Gujarat Power Corporation Limited (GPCL) as the implementing agency on behalf of the government. GPCL was responsible for acquiring the land for the park and leasing it to private developers. It has also provided critical infrastructure to private developers such as access roads, evacuation infrastructure including substations, auxiliary power distribution network, communication network, safety towers, fencing, environmental protection facilities such as sewage treatment plants, green belt/buffer zone, water for cleaning etc.[59] The Gujarat government has entered into power purchase agreements for a period of 25 years with the private developers to purchase power at Rs. 15/kWh for the first twelve years and Rs. 5/kWh from the thirteenth to the twenty-fifth year.[61]

The total available area in the park can be used to set up solar plants with an aggregate capacity of about 500 MW. Of this, about 280 MW has been installed by 22 developers with capacities ranging from 1 MW to 25 MW as of March 2013.[60] The installed plants are based on multiple technologies – Thin Film PV technology and Crystalline Silicon technology. The solar park also has a capacity to produce 100 MW of wind power, with two pilot scale windmills of 2.1 MW already commissioned, making the park the biggest solar-wind hybrid park in the world. It also accounts for 342,400 tonnes of carbon emission reductions (CER), making it one of the largest CER contributing project in the renewable energy sector.[59]

The cost of development of the solar park was Rs. 45.46 billion (US$ 733 million) which included Rs. 5.50 billion for infrastructure and land acquisition and Rs. 39.96 billion of developers investment in solar power plants.[59] About 60 percent of the land used for the park was government land.[58] The park helped generate employment for more than 1,000 people on a permanent basis. The project was formally launched on December 30, 2010 and commissioned within 15 months on April 19, 2012.[59]

The tangible and intangible benefits of the solar park for the state of Gujarat are summarized in Table 12 below.

Table 12: Benefits of the solar park program

Source: GEDA presentation

Tangible benefits	Intangible benefits
• Basic infrastructure development benefits shared with local villages • Setup of communication network • Provision of irrigation water • Sizeable developer investment • Temporary and permanent employment generation • Economic upliftment of rural area	• Increase in water conservation • Increase in vegetation cover • Reduction in the desertification process • Reduction in carbon emission • Enhancing aesthetic value of the area • Social upliftment

Gandhinagar Solar Rooftop Program

Background

Gujarat has a long-term goal of making its capital, Gandhinagar, a solar-powered city. To achieve this goal, the government of Gujarat initiated the Gandhinagar Photovoltaic Rooftop Program. This program aims at maximizing installations of solar photovoltaic (SPV) systems on rooftops and terraces of private homes; commercial and institutional buildings; and government buildings in Gandhinagar. These SPV systems convert sunlight into electricity, which feeds into the electrical grid. The program is a first of its kind in India and aims to be a benchmark for green energy generation at a household-level. The target capacity for Phase I of the program was 5 MW. The program was structured as a public-private partnership, with a bidding process to identify the project developers. The International Finance Corporation (IFC) provided advisory service to the government of Gujarat to implement the project.[64]

Key parties involved in the program

The key parties involved in this program and their roles and responsibilities are summarized in Table 13 below.[62]

Table 13: Key parties involved in the Gandhinagar Solar Rooftop Program

Source: Gandhinagar Solar Rooftop Program website

Entity	Role of the entity
Government of Gujarat	The Energy & Petrochemicals Department of the government formulated the program in consultation with other participants
Gujarat Energy Development Authority (GEDA)	As the nodal agency for renewable energy projects in Gujarat, GEDA provided financial support for the program
Gujarat Power Corporation Limited (GPCL)	GPCL was the Project Implementing Agency (PIA), acting as a facilitator for the project developer, rooftop owner, offtaker and other government agencies
Gujarat Energy Research and Management Institute (GERMI)	GERMI is a state government-owned autonomous research institute for research and development in energy sector. GERMI acted as the bid process coordinator wherein it invited bids for selection of the project developers
International Finance Corporation (IFC)	IFC was the transaction advisor for the program, providing services such as preparation of draft agreements, modalities and technical advice
Solar Rooftop Project Developer	The developer would be selected by a competitive bidding process by GERMI and was responsible for building, financing, owning, operating and maintaining the rooftop solar units. The developer had to provide a green incentive to the rooftop owner for the utilization of roofs
Solar Rooftop Owner	The rooftop owners would provide their roofs to the developer for setting up the SPV system on long term basis and would earn a green incentive per unit generated from the system
Torrent Power Limited	Torrent is a private power distribution company with a distribution license for Gandhinagar. It would act as an offtaker in this program and would purchase the clean power generated from the projects

Implementation structure

The implementation structure of the Gandhinagar Solar Rooftop Program is depicted in Figure 9 below.[62]

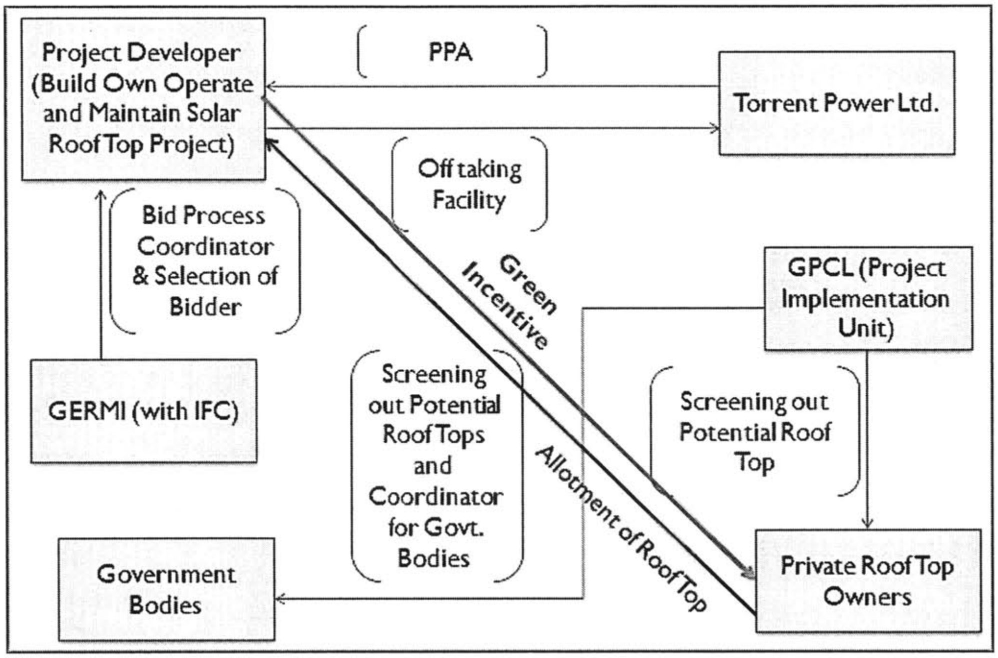

Figure 9: Implementation structure for the Gandhinagar Solar Rooftop Program

Source: Gandhinagar Solar Rooftop Program website

The project developer is selected by GERMI using a competitive bidding process. The developer then enters into a power purchase agreement (PPA) with Torrent Power (distribution licensee) for offtake of electricity generated from the SPV systems. GPCL is responsible for screening potential government-owned and private-owned rooftops which are allotted to the private developers. It was envisaged that public/government buildings would constitute 80 percent of the total rooftop capacity and private buildings would constitute the balance 20 percent. The developer was responsible for building, financing, owning, operating and maintaining the SPV systems. The rooftop owners receive a monthly/bi-monthly amount from the project developer called as Green Incentive, for allowing the developer to use their rooftops and terraces. The amount of Green Incentive depended on the electricity generated by the SPV system and fed into the grid.

Competitive bidding outcome

In January 2011, expressions of interest were invited from potential developers/investors for the rooftop solar program. There was strong interest in the program, with 38 firms expressing expression of interest.[65] Subsequently in August 2011, IFC issued the draft bid documents and a pre-bid conference was conducted. A RFP for the project was issued to interested bidders. Site visits were carried out with nine interested potential bidders in October 2011. In January 2012, bids were received from four parties (technical and financial). Bidding was carried out for two 2.5 MW solar projects for a 25 year concession period each.[65] The bids were evaluated in February 2012, with the evaluation criteria being lowest tariffs quoted. Two US-headquartered companies, Azure Power and SunEdison each won a 2.5 MW project based on the bidding results.[63] The tariffs quoted by the winning companies are summarized in Table 14 below.[65]

Table 14: Tariff details of winning bidders for the Rooftop Program

Source: IFC presentation on Gandhinagar Solar Rooftop Program

(Rs./kWh)	Azure	SunEdison
Quoted Tariff	11.21	11.793
Payment by Torrent	11.21	11.793
Reimbursement to Torrent by government	0.07	-
Green Incentive	3.00	3.00

The project agreements, including the PPA were executed in April 2012 with the project implementation commencing from May 2012. In January 2013, the developers and government departments entered into the Green Incentive lease agreements. The total investment envisaged in the program from the private sector was US$ 12-15 million.

Present status of program

The first rooftop PV plant of 60.48 KW was commissioned on the government-owned Lokayukta building in March 2013. For SunEdison, the capacity of SPV systems to be installed on government buildings was reduced from 2 MW to 1.685 MW. As a result, the total installed capacity of the program reduced from 5 MW to 4.685 MW. The entire capacity was commissioned by March 2014. The capacity split and sector-wise distribution of installations is summarized in Table 15 below.[65]

Table 15: Capacity split and sector-wise distribution of solar installations for the Rooftop Program

Source: GERMI presentation on Gandhinagar Solar Rooftop Program, July 2014

Sector	Azure Power		SunEdison		Total	
	No of installations	Net capacity (kW)	No of installations	Net capacity (kW)	No of installations	Net capacity (kW)
Government	21	2,001	17	1,685	38	3,686
Residential	161	501	113	501	274	1,002
Total	**182**	**2,502**	**130**	**2,186**	**312**	**4,688**

Benefits of the rooftop solar program

The benefits of the rooftop solar program are manifold and are listed below.[64, 65, 67]

- There are savings in developing transmission infrastructure and reduced transmission and distribution losses as the electricity is generated close to the load centres as opposed to large scale ground-mounted solar plants which are located at a distance from urban areas and require augmenting existing transmission infrastructure to transport the electricity to the city.
- Rooftop solar increases energy security through distributed generation as opposed to concentrated generation at a single power plant and offers a solution to meet peak loads in great measure.
- Rooftop solar can leverage a larger retail investor base in the city and self-replicate on a large scale as solar PV systems are modular, relatively easy to install, and require low maintenance.
- The program is easy to develop (in terms of permitting, siting & clearances) as opposed to large projects which face significant hurdles and delays due to land acquisition, clearances and approvals from various regulatory authorities.
- Value is unlocked by using under-utilized residential and government building rooftops for the program and land usage is optimized.
- Improved access to electricity – 10,000 people benefit from improved energy services at affordable prices with virtually no state subsidies.
- Mobilization of private sector investment – The program attracted about US$15 million in private investment to Gujarat.

- Mitigating climate change – The rooftop solar program helps in decreasing carbon emissions by 7,154 metric tonnes annually and also helps in reducing water consumption.
- Proof of concept – The program has demonstrated the technical, regulatory, and financial viability of rooftop solar panels, which will enable the expansion of solar power in Gandhinagar and elsewhere in India

Replication in other cities and across India

The government of Gujarat is looking to replicate the Gandhinagar rooftop solar PV initiative across the state through development of similar projects across five large cities in the state – Vadodara, Rajkot, Mehsana, Bhavagar and Surat. A PPP based model, similar to the one used in Gandhinagar, would be used, with the project developers selected through a competitive bidding process. The government has targeted a combined installed capacity of 25 MW from the program, the city-wise breakup of which is depicted in the table below.[65]

Table 16: City-wise breakup of targeted capacity for solar rooftop program

Source: GPCL website

City	Capacity addition (MW)
Bhavnagar	3.5
Rajkot	6.5
Mehsana	5.0
Surat	5.0
Vadodara	5.0
Total	**25.0**

Vadodara became the second city in Gujarat to adopt the solar rooftop concept. In June 2014, Madhav Solar Private Limited won a 25 year concession for setting up a 5 MW solar rooftop PPP project. The project is expected to attract US$ 8 million in private investment, provide 9,000 people with better access to power and reduce greenhouse gas emissions by 6,000 metric tonnes annually. The Vadodara project clearly benefited from the lessons of the Gandhinagar program experience. Many of the obstacles faced in the pilot project had been addressed and resolved and the results of the program were proven. Consequently, the Vadodara PPP took less time to implement. The programs in the other four cities are also under implementation.[70]

Cities outside of Gujarat are also taking note of the solar rooftop concept with other metro cities like New Delhi and Kolkata also eyeing the model. Other states such as Odisha and Punjab are also looking at replicating the solar rooftop program in their major cities.

Challenges facing the rooftop solar concept

Despite the promise that the rooftop solar concept holds in terms of large scale replicability and ease of development, it also faces some key challenges which are listed below.

Capital costs

The capital costs per MW of rooftop solar PV systems are about 20 percent higher than large-scale PV systems.[72] This is due to higher installation costs, small-sized components, lower economies of scale, and a smaller base for spreading fixed costs.

Government regulation

Government policies and incentives are key to facilitate implementation of rooftop solar PV in spite of the rapidly falling technology costs. Given the difference in capital costs of the rooftop solar projects and the ground mounted large scale projects, separate tariffs for rooftop projects are required for gross metered systems. Although some states such as Gujarat, Maharashtra, Karnataka, among others, have separate tariffs for this segment, the rest of the states are yet to create the right incentive structure for developing the rooftop solar market.

Interconnectivity

For smaller kilowatt-scale projects, the point of interconnection needs to be defined at different voltage levels which is critical to maintain grid safety. Connecting various small generation projects without specifying interconnection standards can threaten the safety of the grid and the overall project. Further, the local distribution utility should clarify sharing of interconnection costs and associated network capacity enhancements with the project developers.

Technical standards of equipment

The technical standards for specification, installation, and maintenance of rooftop projects should be clearly defined to ensure high quality, safe and reliable installations. This leads to higher efficiency and maximizes the life of the assets.

Financing options

Currently, simple consumer financing solutions for solar installations are unavailable in the market. Many consumers may not have the liquidity to pay for the entire solar system upfront. The capital expense has to be financed by scheduled commercial banks, non-banking finance companies or co-operative banks in the same way as a car loan or any other personal loan. Solar rooftops are already viable without subsidy for the commercial and industrial segments in several Indian states. These two segments account for more than half of capacity addition till now. The residential segment, which has a bigger growth potential, is expected to be viable in the next few years. However, currently the power tariffs in residential segment are subsidized across the country.

Accessing rooftops for long duration

A key challenge in the commercial segment is getting access to the roof area for 20-25 years. The commercial rooftop space, such as in a hotel or a hospital in India, is a valuable real estate with many competing uses. Hence, it becomes difficult to dedicate this space for solar project for a longer period in a contracted arrangement.

Capital cost subsidy reduction

The central government has planned to cut the subsidy on rooftop solar plants from 30 percent to 15 percent due to decline in price of solar panels, large target set for rooftop solar power plant and limited availability of funds for subsidies.[69] A subsidy-free scheme for solar rooftops requires access to easy consumer financing options for successful implementation.

Learnings from the Gujarat solar power programs

The solar power programs implemented by the government of Gujarat provide some key learnings that could be useful not only to the other states of India, but also to other emerging economies worldwide looking to enhance private sector participation in the renewable energy space.

An enabling environment is essential for participation by private sector

The government of Gujarat improved the investment climate for the power sector in the state by restructuring the electricity board, plugging leakages in the transmission and distribution system and enabling tariff revisions making it attractive for investors to invest money in the sector. This paved the way for increased private sector interest in the state.

A policy framework must be established to incentivize investment in renewables

Gujarat always had a keen interest in renewable energy, with GEDA having been a pioneer in introducing the solar cooker in India in the 1970's. Gujarat was the first state in India to have its own solar policy. As a result, it had the first mover advantage and was able to attract players keen to invest in the renewable energy space. Although the tariffs as per the state policy were lower compared to the national solar policy, the Gujarat government focussed on faster clearances and smooth implementation of projects and also provided infrastructure facilities to developers. For the Charanka solar park, land acquisition was done by GPCL and the acquired land was handed over to private parties for development. This led to speedy project implementation within 16 months. This made Gujarat a very attractive destination for private players.

Multilateral financial institutions should be utilized for advisory and financing activities

The Gujarat government utilized the services of International Finance Corporation (IFC) as a lead transaction advisor for the Gandhinagar Solar Rooftop Program. IFC was able to use its vast experience in structuring successful PPPs worldwide to provide technical, legislative, analytical and marketing support for the project. It recommended a transaction structure for the program and helped to manage the bidding process, including preparation of bidding documents and evaluation of bids. Besides IFC, the Asian Development Bank (ADB) also provided a US$ 100 million loan to the Gujarat government for developing the transmission infrastructure for evacuating power from the solar power plants located in the Charanka solar park. Thus, multilateral institutions are useful resources, which should be tapped for their expertise in structuring and financing PPP projects, especially in the field of sustainable energy.

Right incentive structure for stakeholders key to success of renewables

The Gandhinagar solar rooftop program provided a balanced incentive structure that was attractive to both private investors as well as the rooftop owners. Attractive tariffs along with right of access to public/government buildings that constituted 80 percent of the total rooftops was key in attracting the interest of multiple bidders. Further, the responsibility of assessing the suitability of the rooftop for the program was that of GPCL. The rooftop owners received a Green Incentive for providing access to their rooftops and this helped monetize the value of their unutilized rooftops.

Conclusion

Development of renewable energy sources is essential to combat the effect of climate change and ensure sustainable development. The governments of emerging countries are not in a position to allocate extensive budgetary resources towards developing renewable energy technologies due to fiscal constraints. PPP is emerging as a way to enhance investment by the private sector in renewable energy and to bring in the necessary technological expertise required to make sustainable energy affordable to all.

From the case studies of the South African REIPPP program and the Gujarat solar power programs, it is clear that there are some common factors that contribute to success of PPPs in the emerging markets. These factors include: a strong political will to promote and implement renewable energy technologies, a policy framework that incentivizes investments, an enabling environment with minimal regulatory hurdles, effective handling of the bidding process, clear and robust documentation of contractual framework in the form of concession agreements, participation of multilateral and foreign donor bodies which bring in their expertise in structuring such deals, alignment of incentives of various stakeholders and so on.

Each economy has its own myriad set of issues which need to be resolved for investment to materialize. However, with the basic set of policies and procedures in place as described above, PPP can be used as a powerful tool to free the limited budgetary resources of the government and usher in the technological expertise of the private sector.

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