

ACCELERATING SOLAR INVESTMENT FOR ENERGY SECURITY

Dissertation

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“Accelerating Solar Investment for Energy Security”

is an original work and the same has not been submitted to any other institute for the award of any other degree.

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LIST OF ABBREVIATIONS

PPA	:	Power Purchase Agreement
NSM	:	National Solar Mission
PV	:	Photo Voltaic
DC	:	Direct Current
AC	:	Alternating Current
PR	:	Performance Ratio
kWH	:	Kilowatt-hour
NREL	:	National Renewable Energy Laboratory
EPC	:	Engineering, Procurement and Construction
DPR	:	Detailed Project Report
EPIA	:	European Photovoltaic Industry Association
EIA	:	Environmental Impact Assessment
O&M	:	Operation and Maintenance
FiT	:	Feed-in Tariff
SPV	:	Special Purpose Vehicle
GW	:	Giga-watt
MENA	:	Middle East and North Africa
APAC	:	Asia-Pacific
GBI	:	Generation Based Incentive

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REC	:	Renewable Energy Certificate
RPO	:	Renewable Purchase Obligation
UNFCCC	:	United Nations Framework Convention on Climate Change
NAPCC	:	National Action Plan for Climate Change
RGVY	:	Rajiv Gandhi Gramin Vidyutikarana Yojana
MNRE	:	Ministry of New and Renewable Energy
IFC	:	International Finance Corporation
IDFC	:	Infrastructure Development Finance Corporation
ADB	:	Asian Development Bank
IDF	:	Infrastructure Debt Funds
GHI	:	Global Horizontal Irradiance
DNI	:	Direct Normal Irradiance
OA	:	Open Access
RBI	:	Reserve Bank of India

EXECUTIVE SUMMARY

Solar sector is expected to face an increase in investment and improvement of cost competitiveness. Some of the drivers are recent volatility in solar stock driven largely by oil price weakness and balanced supply-demand. Strong demand is expected from the US and improving demand from China and other emerging solar markets counterbalances any potential demand weakness in the UK and Japan. While powerless oil costs could remain an augmentation, little effect would be seen on sun oriented interest essentials and expects a few organization particular positive impetuses as far as execution of new and existing venture. The financial aspects of sun oriented have enhanced essentially because of the decrease in sunlight based board expenses, financing expenses and equalization of framework expenses. Roof sunlight based request in the U.S. is relied upon to quicken as renting organizations extend all the more in states get new wellsprings of financing and client reception increments. Relationship between oil cost and sun based stock execution has expanded altogether since oil broke beneath \$100/barrel. This has not been the situation in the later past and we accept oil to a great extent does not influence power costs and hence ought not to influence solar energy.

Chapter 1: INTRODUCTION

1.1.ENERGY SECURITY

Energy security is the link between national security and the accessibility of natural resources for energy consumption. Access to modest energy has ended up crucial to the working of cutting edge economies. Notwithstanding, the uneven dissemination of energy supplies among nations has prompted considerable liabilities. Huge open doors for energy productivity and renewable energy assets exist over wide geological zones, rather than other energy sources, which are moved in a predetermined number of nations. Quick dissemination of renewable energy, energy productivity, and mechanical enhancement of energy sources is relied upon to result in huge energy security and monetary advantage. The current world depends on an immeasurable energy supply to fuel everything from transportation to correspondence, to security and wellbeing conveyance frameworks. Energy assumes a critical part in the national security of any given nation as a fuel to power the monetary motor. . Dangers to energy security incorporate the political precariousness of a few energy creating nations, the control of energy supplies, the opposition over energy sources, assaults on supply foundation, and also mischances, characteristic fiascos, terrorism, and dependence on outside nations for oil.

Remote oil supplies are powerless against unnatural disturbances from in-state clash, exporters' hobbies, and non-state on-screen characters focusing on the supply and transportation of oil assets. The political and financial shakiness created by war or different elements, for example, strike activity can likewise keep the best possible working of the energy business in a supplier nation. Case in point, the nationalization of oil in Venezuela has activated strikes and challenges in which Venezuela's oil creation rates have yet to recoup. New dangers to energy security have developed as the expanded world rivalry for energy assets because of the expanded pace of industrialization in nations, for example, India and China. Albeit still a minority concern, the likelihood of

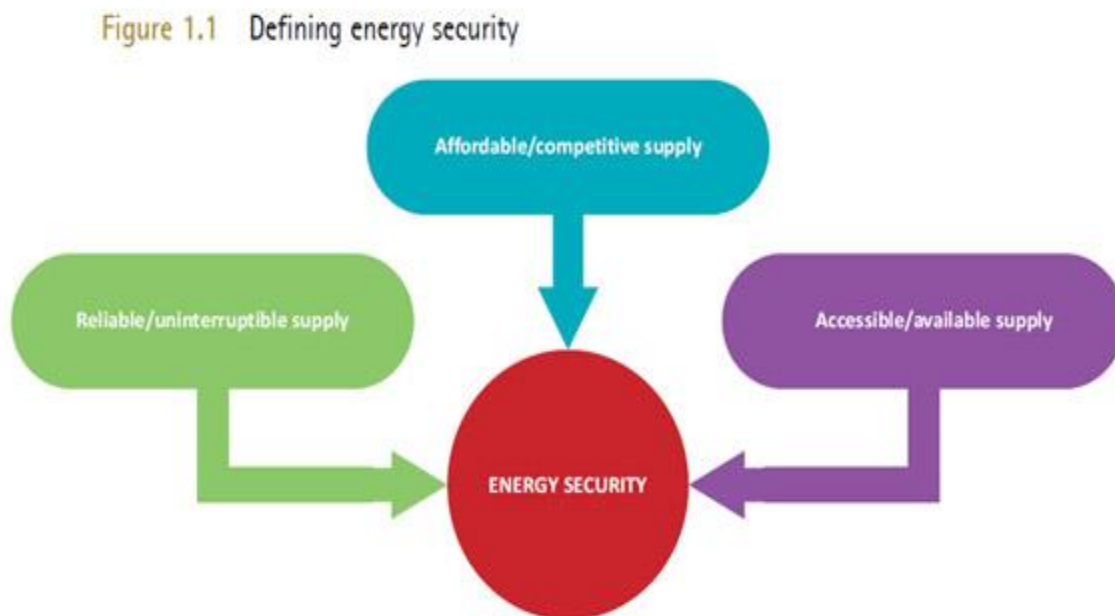
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value rises coming about because of the topping of world oil generation is likewise beginning to draw in the consideration of in any event the French government. Expanded rivalry over energy assets might likewise prompt the development of security compacts to empower an impartial dissemination of oil and gas between real powers. Then again, this may happen to the detriment of less created economies.

1.2.IMPORTANCE OF ENERGY SECURITY

Long term measures to expand energy security focus on diminishing reliance on any one wellspring of imported energy, expanding the quantity of suppliers, abusing local fossil fuel or renewable energy assets, and decreasing general request through energy protection measures. All the worry originating from security dangers on oil sources long term efforts to establish safety will help lessen the future expense of importing and trading fuel into and out of nations without needing to stress over mischief going to the products being transported

Fig 1. Defining Energy Security



Note: unless otherwise indicated, all tables, figures and boxes in this chapter derive from IEA data and analysis.

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Japan, absolutely subject to imported oil, consistently presented the utilization of common gas, atomic force, fast mass travel frameworks, and actualized energy preservation measures. The United Kingdom started abusing North Sea oil and gas saves, and turned into a net exporter of energy in the late years.

Expanding energy security is likewise one of the purposes for a piece on the advancement of characteristic gas imports in Sweden. More noteworthy interest in local renewable energy advances and energy protection is conceived. India is completing a real chase for residential oil to diminishing its reliance on OPEC, while Iceland is all around cutting edge in its wants to wind up energy free by 2050 through sending 100% renewable energy.

1.3.OPTIONS FOR ENERGY

1.3.1. PETROLEUM:

Petroleum, overall known as "raw petroleum," has turned into the asset most utilized by nations all around the globe including Russia, China (really, China is generally subject to coal (70.5% in 2010)) and the United States of America. With all the oil wells situated the world over energy security has turned into a principle issue to guarantee the wellbeing of the petroleum that is being gathered. In the Middle East oil fields get to be fundamental focuses for harm due to how intensely nations depend on oil. Numerous nations hold key petroleum holds as a support against the monetary and political effects of a energy emergency. It is the ratio of genuine energy produced; to the energy the plant would have created if it was operating at its maximum capacity.

1.3.2. NATURAL GAS:

Common gas has been a practical wellspring of energy on the planet. Comprising of for the most part methane, characteristic gas is delivered utilizing two routines: biogenic and thermogenic. Biogenic gas originates from methanogenic creatures

situated in bogs and landfills, though thermogenic gas originates from the anaerobic rot of natural matter profound under the Earth's surface. Russia is the current driving nation underway of characteristic gas. One of the most concerning issues as of now confronting regular gas suppliers is the capacity to store and transport it. With its low thickness, it is hard to manufacture enough pipelines in North America to transport sufficient common gas to match request. These pipelines are coming to close limit and even at full limit don't create the measure of gas required

1.3.3. **NUCLEAR POWER:**

Uranium for atomic influence is mined and advanced in assorted and "stable" nations. These incorporate Canada (23% of the world's aggregate in 2007), Australia (21%), Kazakhstan (16%) and more than 10 different nations. Uranium is mined and fuel is made essentially ahead of time of need. Atomic fuel is considered by some to be a moderately solid force source, being more regular in the Earth's outside layer than tin, mercury or silver; however an open deliberation over the timing of crest uranium does exist.

1.3.4. **RENEWABLE ENERGY:**

The sending of renewable advancements generally builds the differing qualities of power sources and, through nearby era, adds to the adaptability of the framework and its imperviousness to focal stuns. For those nations where developing reliance on imported gas is a huge energy security issue, renewable advancements can give option wellsprings of electric power and dislodging power request through direct warmth creation. Renewable biofuels for transport speak to a key wellspring of broadening from petroleum item.

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1.4.ABOUT SOLAR

Sunlight based energy is delivered by the sun. It can be bridled like whatever other kind of energy and used to make power to run homes and organizations. Structures can likewise be warmed by the warm energy delivered by the sun. Best of all, sun powered energy is free and does not trade off the earth. To tackle the energy from the sun and transform it into power, it is important to have sun oriented cells to gather and change sunlight based energy into useable power. These phones are regularly as boards that face the bearing of the sun to catch the most beams conceivable. Sun based energy cells can be utilized to create the force for a number cruncher or a watch. They can likewise be utilized to create enough energy to run a whole city. With that sort of flexibility, it is an incredible energy source. Fossil powers, similar to gas and oil, are not renewable energy. When they are gone they can't be recharged. Some time or another these fills will run out and after that humanity will either need to concoct another approach to give power or backpedal to life as it was preceding man's utilization of these things. Fossil energizes make gigantic contamination in nature. This contamination influences conduits, the air you inhale, and even the meat and vegetables that you eat. These powers are costly to recover from the earth and they are extravagant to utilize. Other, more Eco-accommodating energy sources like wind and sun oriented energies are generally cheap and simple to deliver.

1.5.ADVANTAGE OF SOLAR

Sun based energy i.e. energy from the sun give steady and unfaltering wellspring of sun oriented power as the year progressed. As our characteristic assets set to decrease in the years to come, it's critical for the entire world to move towards renewable sources. The primary advantage of sun oriented energy that it can be effectively conveyed by both home and business clients as it don't require any colossal set up like if there should be an occurrence of wind and geothermal force stations. Sunlight based energy advantages singular proprietors, as well as advantage environment too.

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1.5.1. No pollution:

Sun powered energy is non-dirtying, clean, solid and renewable wellspring of power. It doesn't contaminate the air by discharging unsafe gasses like carbon dioxide, nitrogen oxide and sulfur oxide. Sunlight based energy does not oblige and fuel and subsequently stay away from the issues of transportation of fuel or the stockpiling of radioactive waste.

1.5.2. Long lasting solar cells:

Sun based cells make no noise at all and there are no moving parts in sun powered cells which make them durable and require next to no upkeep. Sun oriented energy gives practical answers for energy issues where there is no power by any means.

1.5.3. Renewable Source:

Sunlight based energy is a renewable wellspring of energy and will keep on delivering power the length of sun exists. Albeit sun oriented energy can not be create amid night and shady days but rather it can be utilized over and over amid day time. Sun oriented energy from sun is predictable and consistent force source and can be utilized to tackle control in remote areas.

1.5.4. Low maintenance:

Solar cells for the most part don't require any support and run for long time. More sun powered boards can be added occasionally when required. Albeit, sun powered boards have introductory cost however there are no repeating expenses. Starting cost that is acquired once can be recuperated over the long haul. Aside from this, sun oriented boards don't make any commotion and does not discharge hostile smell.

1.5.5. Easy Installation:

Solar panels are difficult to introduce and does not oblige any wires, lines or force sources. Not at all like wind and geothermal force stations which oblige them to be tied with penetrating machines, sun based boards does not oblige them and can be introduced on the roofs which implies no new space is required and every home or business client can create their own power. Additionally, they can be introduced in appropriated manner which implies no expansive scale establishments are required.

Solar power technology is enhancing reliably every once in a while and as our non-renewable source decrease it is essential for the entire world to move towards renewable wellsprings of energy. There are however a few things which is preventing sun based energy from being utilized all the more widely. Sun oriented energydisadvantages are certain to be overcome as innovation enhances and its utilization will increment as individuals start to comprehend the advantages offered by sun powered energy.

1.6.APPLICATION OF SOLAR:

Solar energy may be inert or active solar depending on how the sun's rays are captured, converted and distributed as power. Photovoltaic panels and thermal collectors use active solar techniques. Passive solar relies on designing buildings to use the rays of the sun when they reach the earth. Urban planning and home design today often rely on solar energy. Homes are placed on lots with south facing windows while northern exposures are less open. One traditional use of solar energy is the simple glass greenhouse.

The glass dividers and roof permit the sun's energy to go through and make an indoor space in the nursery that is a considerable amount hotter than the outside air. The primary reason for a nursery, notwithstanding, is to permit the energy of the sun to achieve developing plants as they need that sun based energy to thrive

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Sunlight based advancements are frequently alluded to as warm innovation. These are utilized progressively as a part of homes and organizations today to warmth spaces, give ventilation and to make heated water.

1.6.1. WATER HEATING:

The water spilling out of underground pipes or aquifers is excessively cool for the human body, making it impossible to be submerged in for long. We fill the pool and afterward sit tight for the sun to warm the water to a level that is agreeable to swim or play in. Daylight is utilized for heavenly bodies to give high temp water in ecological benevolent homes. The normal sun based water radiators are either emptied tube authorities or coated level plate gatherers. Unglazed plastic authorities are utilized for warming numerous new swimming pools. The utilization of sun based water radiators is expanding quickly. In the event that you anticipate introducing it in your home a heated water proficient can help you with your obliged requirements."

For some areas, sun based water warming frameworks can give the lion's share of boiling hot water a family needs. Reinforcement water warmers controlled by gas or power are additionally introduce however utilized just when shadiness or high utilization restricted the sun oriented producedhot water.

1.6.2. VENTILATION AND COOLING WITH SOLAR ENERGY

It is evaluated that 50% of the energy use in homes is because of warming and cooling of the home's inside spaces. This is maybe the primary motivation behind why sun powered energy is vital today for manufacturers, mortgage holders and environmentalists. The warm mass of different items can store the sun's energy and discharge it gradually to the air. Concrete, stone and water can assimilate heat from the sun amid the day and keep a room warm around evening time as the warmth is gradually discharged into the air. Environmentally amicable home outlines have made another kind of structural engineering where the objective of materials utilized is to catch however much of the sun's energy as could reasonably be expected. This decreases the measure of power or gas

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important to keep up solace in the home. One inventive idea is a sun powered or warm fireplace. This is a thin, vertical shaft uniting within a building with the outside. The sun warms the chimney stack and the warmed air rises regularly making an updraft of hot air that is discharged to the outdoors. As this sun based warmed air surges up the fireplace it draws cooler air into the base of the structure and makes wind stream. Cool air is maneuvered into the smokestack, warmed by the sun's beams and commonly ascends to the top. As it were, this is a cutting edge adjustment of the nursery method. Natural plants are additionally piece of a design plan for sun powered energy utilization. Trees are planted on the southern side of a home to channel the sun's beams. Contingent upon atmosphere, deciduous trees are frequently used for a Western presentation to decrease the sun's warmth amid evening hours.

1.6.3. SOLAR ENERGY IMPORTANT FOR WATER TREATMENT

Maybe a standout amongst the most valuable approaches to tackle sunlight based energy is in transforming water. Huge zones of the world experience the ill effects of yearly dry season conditions. Drinking salty or dirtied water spreads microscopic organisms and illness that can devastate a little town in a creating country. Water set in extraordinary plastic jugs and presented to the sun for 1-2 days the water is sanitized by the sun's heat. When water is rare; individuals have a tendency to drink whatever water they can discover. Filling two liter PET containers with water from a stream and laying those jugs on their side to give most extreme presentation to the sun can give safe drinking water.

1.7. INDIA SOLAR INDUSTRY

India is densely populated and has high sun powered insolation, a perfect mix for utilizing sun oriented power as a part of India. In addition, its other energy assets are generally rare. In the sunlight based energy division, some vast activities have been proposed, and a 35,000 km² (14,000 sq mi) region of the Thar Desert has been put aside for sun powered force ventures, sufficient to create 700 to 2,100 GW. In July 2009, India disclosed a US\$19 billion arrangement to deliver 20 GW of sun powered power by

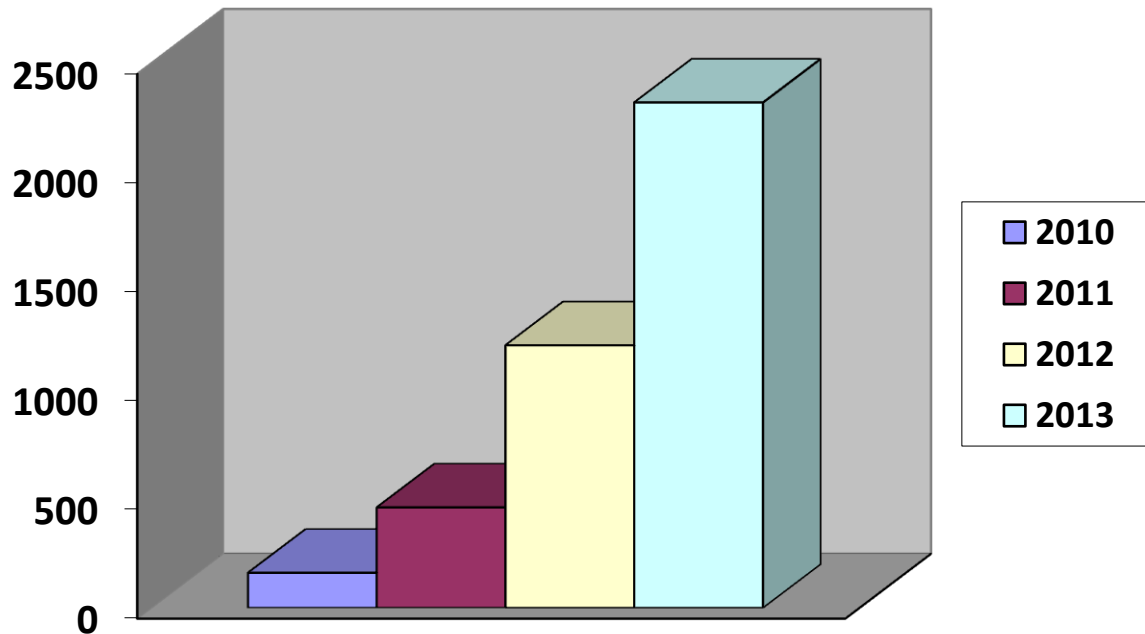
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2020. Under the arrangement, the utilization of sun oriented fueled hardware and applications would be made mandatory in all administration structures, and healing centers and inns. In January 2015, the Indian government altogether extended its sun powered arrangements, focusing on US\$100 billion of venture and 100 GW of sun oriented limit by 2022.

India is confronting a flawless tempest of variables that will drive sun based photovoltaic (PV) reception at an "irate pace through the following five years and past". The falling costs of PV boards, generally from China additionally from the U.S., have concurred with the developing expense of framework power in India. Government support and plentiful sunlight based assets have additionally served to increment sun oriented selection, however maybe the greatest element has been need. India, "as a developing economy with a surging white collar class, is presently confronting a serious power deficiency that regularly runs somewhere around 10% and 13% of every day need". India is wanting to introduce the World's biggest Solar Power Plant with 4,000 MW Capacity close Sambhar Lake in Rajasthan.

There are different elements that we have to consider before putting into a sun powered force plant. A considerable measure of eagerness has been seen among individuals about the utilization of Solar Energy as a substitute of traditional wellsprings of energy. On the other hand, at present, with the force sponsorships in India, sunlight based works temperate just in those zones that are utilizing diesel generators as an essential wellspring of power. The whole payback is made in 2–3 years. Nearby planetary group for petrol pumps is a main sample of such an application. IOCL is driving the race for solarization of petrol pumps with forceful targets. Sunlight based applications for petrol pumps by RelyOn Solar has been introduced in more than 150 IOCL petrol pumps crosswise over India and now other oil organizations are likewise looking to solarize their ROs. Sun based establishments for business structures, where the power rates are higher, are additionally turned out to be a distinct advantage for the proprietors of IT organization

Fig 2: INSTALLED SOLAR PV IN INDIA (IN MW):



Source: EIA

1.8. APPLICATIONS IN INDIA:

1.8.1. RURAL ELECTRIFICATIONS:

Absence of power framework is one of the principle jumps in the improvement of rustic India. India's matrix framework is extensively immature, with significant areas of its masses as yet making due off-network. Starting 2004 there are around 80,000 unelectrified towns in the nation. Of these towns, 18,000 couldn't be charged through expansion of the traditional network. A focus for jolting 5,000 such towns was situated for the Tenth National Five Year Plan (2002–2007). Starting 2004, more than 2,700 towns and villages had been energized, for the most part utilizing sun based photovoltaic frameworks. Advancements in shoddy

sun oriented innovation are considered as a potential option that permits a power base comprising of a system of nearby framework bunches with circulated power era. It could permit bypassing (or possibly soothing) the need to introduce lavish, lossy, long-separation, incorporated force conveyance frameworks but then convey shabby power to the masses. India as of now has around 1.2 million sun powered home lighting frameworks and 3.2 million sun based lamps sold/disseminated. Likewise, India has been positioned the most obvious market in Asia for sunlight based off-matrix products. Projects as of now arranged incorporate 3,000 towns of Orissa, which will be lit with sun powered power by 2014

1.8.2. **SOLAR LAMPS AND LIGHT:**

By 2012, an aggregate of 4,600,000 sun oriented lights and 861,654 sun powered controlled home lights had been introduced. These ordinarily supplant lamp fuel lights and can be bought for the expense of a couple of months worth of lamp fuel through a little advance. The Ministry of New and Renewable Energy is putting forth a 30% to 40% appropriation for the expense of lamps, home lights and little frameworks up to 210 Wp 20 million sun powered lights are normal by 2022.

1.8.3. **SOLAR WATER HEATERS:**

Bangalore has the biggest organization of rooftop top sun oriented water warmers in India. These radiators produce a energy likeness 200 MW. Bangalore is likewise the first city in the nation to put set up a motivation component by giving a refund of 50 on month to month power bills for occupants utilizing rooftop top warm frameworks. These frameworks are presently compulsory for all new structures. Pune has additionally as of late made establishment of sunlight based water radiators in new structures required

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1.8.4. AGRICULTURAL:

Sun powered PV water pumping frameworks are utilized for watering system and drinking water. Most of the pumps are fitted with a 200–3,000 watt engine that are fueled with 1,800 Wp PV exhibit which can convey around 140,000 liters (37,000 US gal) of water every day from an aggregate leader of 10 meters (33 ft). By 30 September 2006, an aggregate of 7,068 sun based PV water pumping frameworks had been introduced, and by March 2012, 7,771 had been installed. Solar driers are utilized to dry collects before storage

1.9. CHALLENGES AND OPPORTUNITY IN INDIA:

Area is a rare asset in India and every capita land accessibility is low. Devotion of area region for select establishment of sun powered exhibits may need to contend with different necessities that oblige land. The measure of area needed for utility-scale sunlight based force plants is presently pretty nearly 1 km² (250 sections of land) for each 20–60 MW produced which could represent a strain on India's accessible area asset. The construction modeling more suitable for the vast majority of India would be a very dispersed arrangement of individual roof power era frameworks, all associated through a neighborhood lattice. Then again, raising such a base, which hates the economies of scale conceivable in mass, utility-scale, sunlight based board organization, needs the business sector cost of sun oriented innovation arrangement to significantly decay, with the goal that it pulls in the individual and normal family measure family unit customer. That may be conceivable later on, on the grounds that PV is anticipated to proceed with its current expense decreases for the following decades and have the capacity to rival fossil fuel.

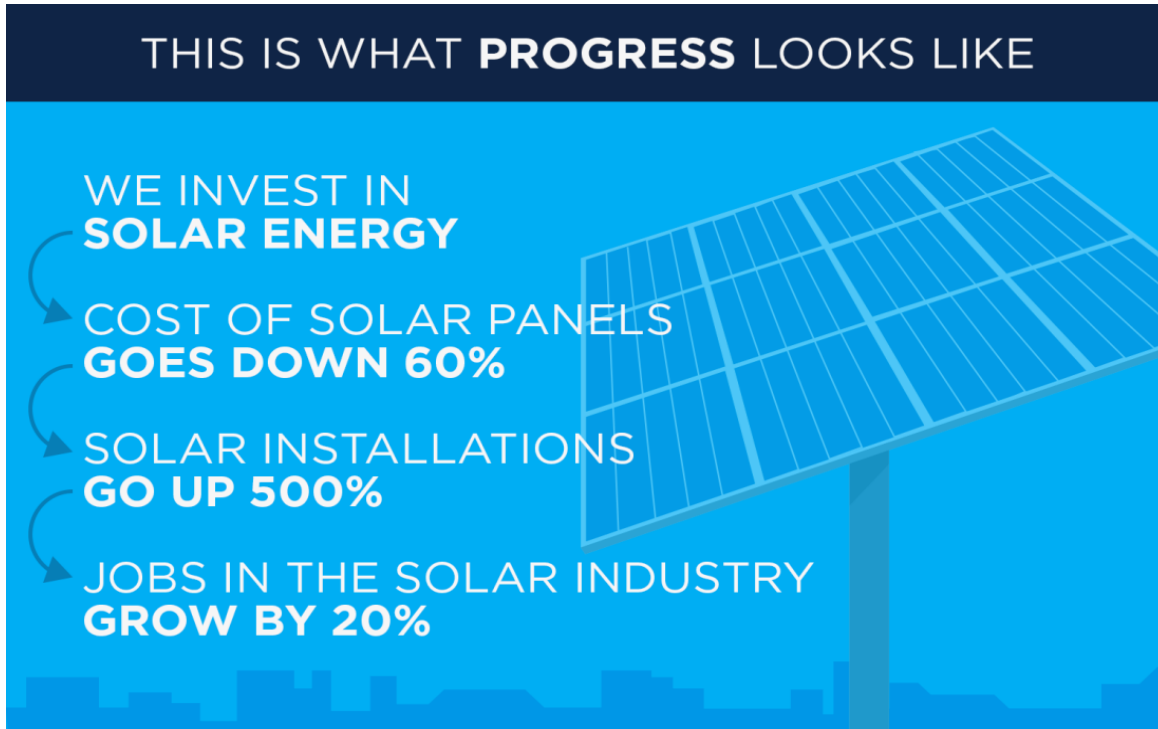
Government can give endowments to the generation of PV boards, in which there will be diminishment in the business sector cost and this can prompt more use of sunlight based power in India. In the previous three years, sun powered era costs here have dropped from around 18 a kWh to about 7 a kWh, though control from imported coal and locally

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created regular gas right now costs around 4.5 a kWh and it is expanding with time. Experts accept that ultra mega sun based power plants like the up and coming world's biggest 4,000 MW UMPP in Rajasthan, would have the capacity to deliver power for around 5 a kWh.

India can make renewable assets, for example, sun based the foundation of its economy by 2050, controlling its long haul carbon discharges without trading off its monetary development potential. India ought to receive an approach of creating sunlight based power as a prevailing segment of the renewable energy blend, since being densely populated district in the sunny tropical belt the subcontinent has the perfect mix of both high sun oriented insolation and in this manner a huge potential purchaser base thickness.

Chapter 2: LITERATURE REVIEW



Source:SEIA Report

India is confronting an intense energy lack which is hampering its mechanical development and financial advancement. Setting up of new power plants is unavoidably subject to import of profoundly unpredictable fossil fills. Consequently, it is fundamental to handle the energy emergency through sensible usage of plenteous the renewable energy assets, for example, Biomass Energy sun based Energy, Wind Energy and Geothermal Energy. Aside from enlarging the energy supply, renewable assets will help India in moderating environmental change. India is intensely reliant on fossil energizes for its energy needs. The majority of the force era is done by coal and mineral oil-based force plants which contribute intensely to nursery gasses discharge.

Sunlight based Power a clean renewable asset with zero outflow has got colossal capability of energy which can be bridled utilizing a mixture of gadgets. With late

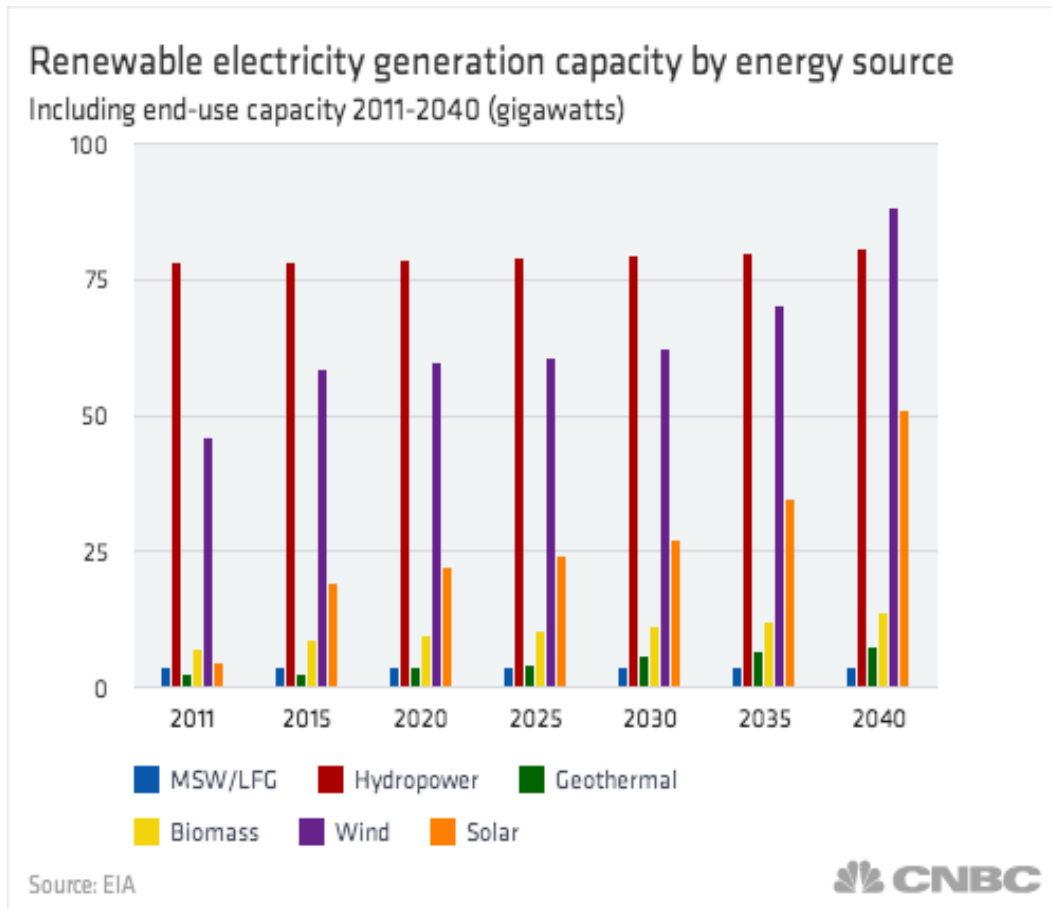
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advancements, sun oriented energy frameworks are effectively accessible for mechanical and residential utilization with the included playing point of least upkeep. Sun powered energy could be made fiscally practical with government charge impetuses and refunds. The majority of the created nations are changing over to sun powered energy as one of the prime renewable energy source. The current design plans make procurement for photovoltaic cells and important hardware while making building arrangements. Due to its area between the Tropic of Cancer and the Equator, India has a normal yearly temperature that ranges from 25°C – 27.5 °C. This implies that India has tremendous sun oriented potential. The sunniest parts are arranged in the south/east drift, from Calcutta to Madras.

Despite the fact that the certainties express that sun powered energy is considerably more alluring and has better future prospects considering all the money related, financial and ecological variables yet at the same time the noteworthiness of sun oriented energy in the Indian influence situation has not been given the accentuation it merits, there necessities to be more focused and solid endeavors towards tapping the capability of sunlight based energy in India.

As per the Energy Information Administration (EIA), development in renewable force era is required to surpass 858 billion kilowatt hours by 2040, with a main part of that development originating from sun based. Renewables produced 524 billion kilowatt hours in 2011

Fig 3: RENEWABLE ELECTRICITY GENERATION CAPACITY



To support the world meet its energy needs whilst diminishing the unfavorable effects of fossil fuel reliance, sun powered photovoltaic (PV) innovation is viewed as an actually suitable, practical renewable energy alternative. Recognizing this, large portions of the world's administrations have created exploration and money related motivators, (for example, Feed-in Tariffs (FITs), examination assignments and rustic charge commands) to enhance the arrangement and feasibility of sun based PV. However, absence of access to credit keeps on being an obstruction to sun oriented PV improvement, notwithstanding approach mandates. The issue of picking up credit to fund energy requests and battle environmental change is most extreme for the world's poorest who are generally subject

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to fossil fuels, for example, diesel, and will most antagonistically be influenced by environmental change. 66% of the world's population lives on less than US \$1,400 every year, with just a portion having entry to budgetary administrations, and 33% of a percent of these getting advances for energy. In either the created or creating world, poorer people experience both higher premium rates and grave advance terms from both customary and dark business monetary understandings. On the off chance that poorer people could get to sensible credits that would permit them to put resources into sun powered PV to enhance their energy security, and either exploit the pay of a FIT or enhance their micro-business, there would be financial development. Shared (P2P) loaning systems (where cash is loaned between individuals without the association of formal monetary foundations) give a potential answer for this issue. Under such a loaning system, little scale sun based PV generators, for example, singular property holders, could get entrance to extra capital in light of the speculation return for their venture under the FIT, or their business.

The Indian sun powered power industry, hitherto, has basically centered around brought together, read Big, energy era model, where expansive scale, private sun based force frameworks, have ended up common. We have attempted to take after the made model, of giving sun based energy to purchasers, transmitted from sun powered photovoltaic plants, situated far away. This methodology isn't fundamentally the best for India, where a vast piece of the populace is spread out, and has its own particular power and formative needs. Training, and comprehension of sun powered PV arrangements, is important to settle on an educated choice, which is best for us.

Brought together sun powered, alludes to vast scale sun oriented plant establishments, in generally remote areas. They are expansive sun based force era ranches, creating significant power that is bolstered into the network. Brought together sun oriented ranches need the same framework; electrical substations are needed, and transmission lines need to be run over long separations, to get that clean sunlight based force, into the matrix, and to the purchaser. Laws of material science direct that effectiveness and voltage are lost, when power needs to travel long separations. The dispersed hostage sun

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powered energy model is the inverse. Hostage sunlight based plants, allude to sun powered energy arrangements, that deliver energy on location, or close site; significance, less or no voltage misfortunes. A dispersed sun powered arrangement may be a photovoltaic framework on a customer's roof or at a close-by area, fueling the nearby purpose of utilization. The end client, frequently claims the sun based force framework, and specifically gets the advantages of the framework. These distributive sunlight based energy frameworks, deal with the energy needs of the proprietor themselves. Fundamentally, these are hostage sunlight based force plants. Thus, is it better to fabricate incorporated sun based force plants, as customary fossil fuel fueled plants, or if we get more astute, and make a disseminated sun powered force era framework, in which sun oriented photovoltaic boards, are sited as close as could be expected under the circumstances, to the clients of the power.

In dialect all the more nearly connected with green NGOs, the save money with resources of more than \$1.5tn says it expects a standard change far from huge scale ordinary influence plants. "Force is no more something that is only delivered by tremendous, brought together units claimed by expansive utilities. By 2025, everyone will have the capacity to create and store power. Also, it will be green and expense focused, ie, not more costly or much less expensive than purchasing force from utilities," say the creators, who desire their monetary customers to "join the unrest."

Sun oriented is at the edge of being an aggressive force era innovation. The greatest downside has been its irregularity. This is the place batteries and electric vehicles (EVs) become an integral factor. Battery expenses have declined quickly, and we expect a further decrease of more than 50% by 2020. By then, a mass [produced] electric vehicle will have just about the same cost as an ignition motor auto. Be that as it may it will set aside to €2,000 (£1,600) a year on fuel cost; henceforth, it will start to pay off very quickly with no important forthright 'venture'. This is the reason we expect a quickly developing entrance with EVs, specifically in nations with high fossil fuel costs."

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The normal 50% lessening in the expense of batteries by 2020 won't simply goad electric auto deals, however could likewise prompt exponential development sought after for stationary batteries to store abundance control in structures, says UBS. "Battery stockpiling ought to wind up fiscally alluring for family homes when consolidated with a nearby planetary group and an electric vehicle. As an outcome, we expect transformational changes in the utility and auto divisions," it says. "

By 2020 putting resources into a home nearby planetary group with a 20-year life compass, in addition to some little scale home battery innovation and an electric auto, will pay for itself in six to eight years for the normal purchaser in Germany, Italy, Spain, and a significant part of whatever is left of Europe.

In most sunny parts of the world it is less expensive to produce power from photovoltaic modules on your rooftop than to purchase it from your utility. The best recently constructed wind ranches are offering force at what might as well be called 3p/kWh before endowments, which neither gas, nor coal, nor atomic force can coordinate. Driven lights can be purchased for a couple of pounds, giving property holders a fast and shoddy method for cutting their service bills. What is much more essential is that the expense diminishment that have prompted this point are situated to proceed unyieldingly, far out into what's to come.

The sun is the wellspring of sun based energy, the energy hits the earth and is greatly effective. A little rate of sunlight hitting the earth is sufficient to meet the force and energy needs of the entire population on the planet. Every year, India is ready to receive well more than 4500 trillion KWH of immaculate sun oriented energy, adding more extensive degree to its geographical location. This is much higher than the yearly power consumption of India and even that of the United States which utilized lesser than four trillion KWH of energy in 2004. The utilization of sun powered energy by human civilization is nothing new. For some centuries, building strategies have made utilization of sun's developments to optimize its warmth and warmth. Numerous ancient South and

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North Americans, Indian tribes and Egyptians have also worshipped the sun. The industrial usage of solar force using curved mirrors to warmth water goes back to the late 15th century, when Leonardo Da Vinci conceived this idea.

With the assistance of sunlight based force innovation, we can tap sun energy in numerous ways. Solar cells, otherwise known as photovoltaic or photoelectric cells are the most mainstream devices that assistance to change over sunlight into electricity. In combination with modules, they are used to produce solar panels. Solar energy is also used in the functioning of solar water heaters, melting steel, creating hydrogen fuel and making electricity through solar furnaces.

Rural Electrification: Rural electrification is the procedure of conveying electrical energy to country and remote territories. Power is utilized for lighting and family purposes, as well as considers automation of numerous cultivating operations, for example, sifting, draining, and lifting grain for capacity. In regions confronting work deficiencies, this considers more prominent profit at diminished expense. One acclaimed project was the New Deal's Rural Electrification Administration in the United States, which spearheaded large portions of the plans still honed in different nations. As indicated by IEA (2009) overall 1.456 billion individuals (18% of the world's populace) don't have admittance to power, of which 83% live in rustic regions. In 1990 around 40 percent (2.2 billion) of the world's kin still needed force. A lot of this increment over the past quarter century has been in India, encouraged by mass relocation to slums in fueled metropolitan territories. India was just 43% zapped in 1990 instead of around 75% in 2012. In 1979 37% of China's country populace needed access to power totally. Almost 23% of individuals in East Java, Indonesia, a center district, likewise need power, as reviewed in 2013.

2.1. **BENEFITS:**

In ruined and undeveloped territories, little measures of power can free a lot of human time and work. In the poorest territories, individuals convey water and fuel by hand, their nourishment stockpiling may be restricted, and their action is constrained to sunlight

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hours. Including electric-controlled wells for clean water can counteract numerous water-borne infections, e.g. diarrhea, by diminishing or disposing of direct contact between individuals (hands) and the water supply. Iceboxes build the period of time that nourishment can be put away, possibly decreasing appetite, while nighttime lighting can protract a group's sunlight hours permitting of an opportunity time for profit.

2.2. TECHNOLOGY:

One of the minimum costly, most dependable, and best demonstrated power circulation frameworks for provincial jolt is single wire earth return. This framework is generally utilized as a part of nations, for example, Australia with low populace densities. There are some topographical necessities vital for its utilization.

Since current force circulation systems can efficiently incorporate optic strands in the inside of power exchange wires, phone and network access may get to be accessible with country zap.

Provincially created renewable energy is an option innovation, especially contrasted with jolt with diesel generators. The expansion of wires is lavish and generally don't keep going long in these situations, for example, amidst the wilderness, in this way smaller than usual frameworks are a decent option. Smaller than normal matrices (focal era and town wide dissemination system) can be a more intense distinct option for energy home frameworks since they can give ability to the gainful utilization of power (little organizations). Cross breed smaller than usual lattices (renewables joined with diesel generators) are a generally recognized innovation for country charge in creating countries. In a few nations (especially Bangladesh and India) a huge number of Solar Home Systems have been introduced lately. The organization of these frameworks is coupled with microfinance plans, for example, Grameen Shakti. The vast majority of these frameworks give power to lighting and some little machines (radio, TV).

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2.3. DRAWBACKS

Contingent upon the source, rustic jolt (and power as a rule) can bring issues and arrangements. New power plants may be manufactured, or existing plants' era limit expanded to meet the requests of the new country electrical clients. Among the primary issues that must be considered in rustic zap are the potential clashes with area utilization and the effect on the country situations. With respect to land use, directors will need to guarantee that sufficient arranging as to framework advancement and area use designation is placed set up. The financial expense connected to giving power in country regions is likewise of significant concern.

Ecological effect concerns on the impacts of producing and disseminating power in rustic territories is likewise of noteworthiness. The earth in rustic ranges will be influenced by the area of force plants. The energy source utilized as a part of this force era is the region that may have the most effect. The utilization of coal-based force is risky to nature as it discharges contaminations, for example, oxides of sulfur, nitric oxide, carbon dioxide among others. The utilization of hydro force is much cleaner with less toxins discharged into the air. However this system is more land serious and would along these lines a bigger money related responsibility to get property and to move local people who live in recognized zones. A designer may be slanted to utilize the least expensive era source, which may be profoundly contaminating, and find the force plant by helpless minorities or provincial ranges.

2.4. WORLDWIDE POWER SCENARIO

INDIA: Rural zones in India are zapped non-consistently, with wealthier states having the capacity to give a dominant part of the towns with influence while poorer states as yet attempting to do as such. The Rural Electrification Corporation Limited was shaped to explicitly address the issue of giving power in all the towns over the country. Poverty, absence of assets, absence of political will, lack of foresight and power burglary are a percentage of the significant reasons which has left numerous towns in India without power, while urban territories have delighted in development in power utilization and

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limit. The focal government is progressively attempting to enhance the earnest conditions by putting vigorously in bio-gas, sunlight based and in addition wind energy.

Projects, for example, The JNN sun oriented mission, Pradhan Mantri Gram Vidyut yojna to attach the pace of charge and differentiate the procedure. The work is likewise on-trying for decreasing wastage, giving better supplies and enhancing the general foundation for electrical transmissions in towns. As of now, exactly 60% of towns in India have been energized with a further objective of giving complete charge by 2025. Northern and North-Eastern states in India are lingering behind the national normal cutting the numbers down, basically because of wasteful state governments and absence of financial assets; these states are presently the center of numerous NGOs and in addition state programs. It is assessed that 1-2 GW of sun based force will be needed for the 1 lakh un-jolted towns in the nation, also the sun powered force prerequisites of un-energized family units of zapped towns.

CHINA: Over 99 percent of Chinese individuals now have entry to power, up from just 50% in 1976 and 90% in 1990.[1] China dispatched the China Township Electrification Program in 2001 to give renewable power to 1,000 townships, one of the biggest of such projects on the planet. This was trailed by the China Village Electrification Program, likewise utilizing renewable energy, went for the jolt of a further 3.5 million families in 10,000 towns by 2010, to be trailed by full rustic charge by 2015.

BRAZIL: In 1981, 74.9% of Brazilian family units were served by electric force, as indicated by the IBGE's PNAD overview. In 2000, the Federal legislature of Brazil, under the Fernando Henrique Cardoso organization, propelled the Luz no Campo project to extend the dispersion of power in Brazilian homes, with an attention on rustic family units. From 2003 on, the system was strengthened and renamed Luz para Todos by the Lula organization. The outcomes were that, as indicated by the PNAD, by 1996, 79.9% of all families had admittance to an electric power supply and that extent rose to 90.8% in 2002 and 98.9% in 2009.

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EUROPE: Big power stations in Europe could be excess inside 10-20 years as electric autos, less expensive batteries and new sun powered advances change the way power is created, put away and circulated, say examiners at the world's biggest private bank. In a preparation paper sent to customers and financial specialists this week, the Zurich-based UBS bank contends that vast scale, incorporated influence stations will soon get to be wiped out in light of the fact that they are too enormous and firm, and are "not significant" for future power era. Rather, the creators anticipate that it will be less expensive and more productive for families and organizations to create their own particular energy to power their autos and to store any surplus energy in their own particular structures even without endowments.

2.5. ACCESS TO ELECTRICITY

Energy alone is not sufficient for making the conditions for financial development, however it is absolutely essential. It is difficult to work a plant, run a shop, develop trims or convey merchandise to buyers without utilizing some manifestation of energy. Access to power is especially significant to human advancement as power seems to be, by and by, imperative for certain essential exercises, for example, lighting, refrigeration and the running of family unit apparatuses, and can't without much of a stretch be supplanted by different manifestations of energy. People's entrance to power is a standout amongst the most clear and un-misshaped evidence of a nation's energy destitution status.

Power access is progressively at the front line of governments' distractions, particularly in the poorest nations. As an outcome, a ton of provincial charge projects and national zap organizations have been made in these nations to screen all the more precisely the needs and the status of rustic improvement and jolt. We have fused the most recent accessible data to give the most exact picture to date of the power access on the planet, by locale and by nation.

A generous extent of the planets poor live in provincial regions which are geologically secluded and are frequently too inadequately populated or have a too low potential power interest to legitimize the expansion of the framework. Hence, it is important to give

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access to power through different means than the expansion of the lattice. Renewable energies are the most adaptable, adaptable and simple to utilize advancements for segregated provincial zones. Off network and scaled down lattice applications offer moderate decentralized renewable energy innovations, for example, Solar Home Systems, wind frameworks, biogas digesters, biogas gasifiers, and so forth.

As energy utilization ascends with increments in populace and expectations for everyday comforts, the ecological expenses of energy additionally raise primarily influencing creating nations. Along these lines, energy must be extended in new ways. Renewable energy sources are among the minimum expense and most attainable arrangements, since they are originating from boundless and open sources, they are maintainable (least upkeep needs) and will bring about no effect towards delicate environments. Further, renewable energies can help diminish CO₂ outflows, adding to environmental change moderation. Regularly, access to power is intended to give the support of low salary ranges where the occupants have insufficient intends to look after it. Hence, it is important to give a feasible access to power where the clients are likewise given the intends to bear the cost of the power they devour. It is basic to push and evaluate the profitable employments of energy so as to cultivate advancement. Immediate and aberrant monetary advantages stream from the utilization of power in beneficial applications inside provincial territories such as watering system, sustenance protection, yield handling, cooling and advancement of little business which would bring about an increment of job open doors for the rustic populace.

In any case, in spite of the good patterns of renewable energy sources, they are still seen as high cost choices and consequently constrain open and private interest in matrix associated and off network applications. The reasons can be found inside the advantages appreciated by the traditional energy frameworks, for example, good arrangement systems and open financing preferences, giving subsequently low capital expenses, thought leaving the proof of huge working expenses. Further, the high capital expenses of introducing renewable energy frameworks are frequently improperly contrasted with the capital expenses of routine energy innovations. In numerous cases, especially in remote areas, the low operation and support costs and additionally the inexistent fuel costs and

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the expanded unwavering quality and the more drawn out expected helpful existence of renewable energy advances, balance starting capital expenses, yet this sort of life cycle bookkeeping is not routinely utilized as a premise for correlation. Also, the externalities connected with energy frameworks, uncommonly the ecological expenses connected with fossil fuels, are frequently not completely accounted.

Sunlight based power in India will achieve network equality much before the matrix is augmented into country territories. Subsequently, sun based will be in a stage to convey power at a sensible cost as a distinct option for having a complete working lattice in India. It is evaluated that 1-2 GW of sun oriented force will be needed for the 1 lakh un-jolted towns in the nation, also the sun based force necessities of un-charged families of energized towns. Sun oriented PV plants in micro-network mode/neighborhood dissemination system, to meet unmet group requirement for force in unelectrified provincial territories, a capital endowment of Rs 150/Wp is given, and it is expressed that a capital appropriation of up to 90% of establishment expense can conceivably be benefitted.

- In Difficult-to-achieve regions, for example, Lakshadweep, Andaman and Nicobar Islands, and areas on India's outskirts, the appropriation benefitted will be 90%.
- For unique classification states viz. NE, Sikkim, Himachal Pradesh, and Uttarakhand, appropriation is altered at Rs. 90 every Wp (with battery stockpiling), and at around Rs. 70 every Wp (without battery stockpiling) for 2010.
- No take care of unmet group demand for power or in unelectrified rustic ranges, standalone country SPV force plants with battery stockpiling in a micro network mode/nearby appropriation system, would be given Rs.150/Wp of capital sponsorship AND delicate advance at 5%.

Monstrous red- tape in the nation is ruining greatest usage of assets. Given the current state of matrices in open regions, stretching out them to country populaces is a costly suggestion. Because of bounteous sunlight based energy accessible in many parts of the nation, a superior alternative for a long haul versatile and low upkeep arrangement

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would be conveyed, group level, renewable energy based sun powered photovoltaic (PV) little lattices. Consolidated with biomass gasifier, clean cooking gas can be made accessible bringing about a flexible biological system. What is required is a battle to compel arrangement creators to highlight renewable innovation energy and underscore the basic part it would play in our nation's energy future.

About one-third of India's populace – 80 million family units representing more than 300 million individuals – don't have admittance to power. More than 77 million family units, for the most part in towns, rely on upon lamp oil for lighting. Nearly one-sixth of India's 6 lakh towns and villages are not energized. Further, just 10 percent families need to have associations for a town to have 'zapped status' and numerous towns announced charged by Rural Electrification of India (REI) not all families have entry to power. Fuel lack, wasteful gear and upkeep shutdown prompts almost 25% of India's energy era limit going unutilised declined by gigantic misfortunes in transmission and appropriation. Imported high cost fuel is the chief fuel for influence era in the nation adding to high cost of influence from routine and contaminating sources. India's sun oriented energy generation is just 1 percent of its aggregate energy request. China which is creating 10% power through renewable, primarily sun based, energy is going for full country charge through renewable energy by 2015.

Current framework joined introduced limit for sun based force is 1,700 MW. Toward the end of the 13th five-year arrange (2017-22), the focus of Jawaharlal Nehru National Solar Mission (JNNSM) is to produce 20,000 MW of sunlight based force. Urging for most extreme confidence in force and energy needs the report calls for taking after the Japan illustration where innovation organizations and private speculators are introducing sun powered boards on tops of production lines, shopping centers, office edifices and private structures and the force so created is sold to electric force organizations or decentralized scaled down lattices.

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The force service to acknowledge off-lattice sun based force plants as long haul arrangement against considering it as temporary " till the network arrives', the report says that interest in sun oriented little matrices incorporates expenses of supply of force for a long time, ie, life of boards, is non contaminating and advances decentralized advancement.

2.6. CHALLENGES ON DEVELOPMENT OF MINI GRID IN RURAL AREAS

- Coherence of a village or cluster of villages.
- Availability of skilled manpower to install and operate these mini grids is a major roadblock to scale up these systems across lakhs of villages.
- On the technical side battery maintenance and replacement is a challenge for solar systems and one needs creative load optimisation as well as innovations in financing to tackle this cost.
- Appropriate metering, pricing and payment collection systems.
- Operational challenges include overheads of reaching remote places, last mile logistics, laying down a localised grid.
- Lack of infrastructure and difficult access to remote areas.
- High prices for energy access in rural areas require supplementing of current subsidy regime to reduce tariffs.
- Confusion over applicability of subsidies. Present subsidy regimes and processes are either insufficient or too tedious. Appropriate capital grant or subsidy a must to make installation of mini-grids feasible even as a social business.
- Access to capital as solar mini grid is an expensive proposition and banks are not inclined to finance these small scale projects particularly local entrepreneurs who lack credit history and collateral.

Villages and remote hamlets that are off the main grid can leapfrog into sustainable power access via solar PV mini grids as a long term solution rather than a stop gap till 'the time the grid comes'. These mini grids will provide 'Electricity beyond Lighting' which is critical for achieving livelihood enhancement. In a country like India where land

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is scarce resource and per capita land availability is low, technological innovation in solar power must receive a strong policy and investment push.

2.7. SCOPE

Establishment of scaled down matrix administrators or dissemination operators that prepares nearby nationals at the front of the system where

(a) Large players give scale in organizations through various establishments by tapping their current supply chains and utilizing their image name in provincial territories and

(b) Local business visionaries can get to be franchisees of these organizations and work at different levels of BOOM (construct, own, work, keep up)

- Enabling a biological community for encouraging collaboration among all partners to develop facilitative environment for aggregators and neighborhood business visionaries to end up main thrust and states and focal governments get to be empowering influences and facilitators

- Joint strategy by the force service and new and renewable energy service in an empowering association with industry, business visionaries, NGOs and the account service to forcefully handle jolt through sun powered PV (or half and half) smaller than normal lattice

- Launch across the nation limit building and provincial enterprise preparing system to prepare thousand of youth who can be utilized – particularly business visionaries notwithstanding a large number of professionals being tried to be instructed under the JNNSM

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•Provide monetary impetuses like

(a) Capital appropriation, where the administration needs to direct and make a straightforward and checking structure,

(b) Setting aside a corpus for interest appropriation to make these ventures financially doable.

(c) Directing government credit waiver plans to an advance assurance corpus so banks have the certainty to loan.

(d) Separating country energy credits from force part for guaranteeing stream of trusts.

Aadhaar implementation across the country in three phases:

Phase I- LEARN (up to 2015): Here a joint approach ought to be encircled, techniques streamlined, preparing given to business visionaries, experts, brokers, make open mindfulness, distinguishing streets for sourcing sponsorship and stipend subsidizing, incentivise extensive organizations and bring them on board, urge them to channel CSR reserves for these ventures to set huge scale arrangement of smaller than expected lattices. This stage ought to distinguish possible on ground models which could then be prepared for fast execution.

Phase II- SCALE (up to 2018): This will push endeavors in greatness to see substantial number of smaller than usual matrix administrators as by now practicality will have demonstrated. Expansive organizations too will set up small network establishments. Preparing of labor will be ventured up and the pace will would now need to bolster six thousand towns every year.

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Phase III- DELIVER (2018 onwards): With the experience of introducing a huge number of small networks, the whole country goes full steam to make progress. The strategy for network intelligence could be finished and actualized. A grouped town approach other than accelerating environment would give more prominent potential to introducing Solar PV -biogas or Solar PV and micro-wind half breed plants.

One of the essential inquiries affecting improvement of the sun oriented rustic charge business is whether this business will become essentially through: 1) the offer of family-sized, customer oversight home frameworks (single modules with joined battery stockpiling), or 2) 1MW to 5MW scaled down lattices with expert administration of clusters and stockpiling.

In the purchaser power showcase in the created world, a professionally-oversaw power framework has been the standard. Indeed, even a straightforward home sunlight based in addition to battery framework obliges support and a touch of specialized ability. While sun powered modules are normally solid and enduring, batteries corrupt in limit and oblige upkeep. Given current innovation, batteries need to be swapped out intermittently to keep on delivering sufficient measures of power. Moreover, in tropical and sub-tropical atmospheres, conditions are brutal for metallic and electrical gadgets, with frequently high stickiness levels, rainstorm precipitation, and bottomless bug life.

By difference, an utility-scale exhibit with a multi-megawatt-hour battery bank would offer, as a rule, more solid, predictable force for various reasons: A small power-plant will oblige one or all the more full-time specialists whose employment it is to guarantee the smooth working of the smaller than expected framework and dependable conveyance of power. Economies of scale will keep on empowering generous investment funds on an every watt premise in capital expenses, more than adjusting for the expanded support spending plan needed to pay proficient staff.

Different vast scale energy stockpiling advancements have preferences now and may later on have extra points of interest over family unit size battery banks.

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Justify residential tax structures to enhance focusing on and decrease the monetary weight. A precise arrangement of recognizing families underneath the neediness line can better target appropriations to poor people. Until such a framework is utilitarian, it would be valuable to move in the direction of supporting tax structures through:

- Volume-separated duties rather than incremental piece taxes. In volumedifferentiated levies, family units are gathered by aggregate month to month utilization, and every family in a gathering pays the same (consistent) levy for each unit of force it devours.
- Tariff piece shorts that better match the power utilization examples of family units at distinctive salaries.
- Charging above expense recuperation levies to higher expending families. States with genuinely low financial expenses of endowments attain to this by constraining the appropriation, confining what number of family units get the sponsorship, and charging a crosssubsidy to a few families.

In July 2009, India uncovered a USD 19 billion arrangement to deliver 20,000 MW of sunlight based power by 2022. The primary Indian sunlight based warm power extend (2 X 50 MW) is in advancement in Phalodi in the condition of Rajasthan. As per MNRE, the offer of renewable-based limit is 10.9% (barring expansive hydro) of the aggregate introduced limit of 170 GW in the nation, up from 2% toward the begin of the 10th arrangement period (2002–07). This incorporates 13,065.78 MW of wind, 2,939 MW of little hydro power, 1,562 MW of (bagasse-based) cogeneration, 997 MW of biomass, 73.46 MW of waste-to-power and 17.80 MW of sun powered PV for lattice joined renewables

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2.8. POLICY AND PROMOTIONS

Foreign direct investment (FDI) up to 100% is allowed under the programmed course for:

- Generation and transmission of electric energy created in hydroelectric coal/lignite-based warm, and oil- and gas-based warm power plants
- Non-traditional energy era and appropriation
- Distribution of electric energy to family units, mechanical, business and different clients
- Power exchanging

There is no necessity of licenses to set up new power plants, however FDI is not permitted in the atomic section. The force division got FDI worth USD 6,545 million between April 2000 and July 2011, which was 5% of the aggregate FDI inflows attained to, as per the Department of Industrial Policy and Promotion, which plans the nation's FDI strategy and is a piece of the Ministry of Commerce and Industry. A wage assessment occasion for a long time in the initial 15 years of operation and waiver of capital merchandise's import obligations on uber force ventures, over 1,000 MW era limit, is given as impetus to putting resources into the part. Power acquirement is allowed through a straightforward offering methodology. There is no traditions obligation on the import of capital products for uber force ventures. The state power sheets (SEBs) create, transmit and circulate power as a team with private/Centrally-possessed producing organizations

49% FDI & FII:

Under the Power Sector's venture arrangement, 49 % FDI & FII is allowable for Power Exchanges. FDI venture will be liable to the administration regard.

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Other conditions:

- (i) Such remote speculation would be liable to a FDI breaking point of 26% and a FII utmost of 23% of the paid-up capital;
- (ii) FII ventures would be allowed under the programmed course and FDI would be allowed under the administration support course;
- (iii) FII buys should be confined to optional market just
- (iv) No non-inhabitant financial specialist/substance, incorporating persons acting in show, will strong more than 5% of the value in these organizations; and
- (v) The remote speculation would be in consistence with SEBI Regulations; other pertinent laws/regulations; security and other contingency

India was the first nation on the planet to set up a service of non-traditional energy assets, in mid 1980s. India as of now turns into a pioneer in wind power creation. In the field of sunlight based energy creation, some huge scale activities have been proposed, and a 35,000 km² zone of the Thar Desert has been put aside for sun powered force ventures, sufficient to create 700 GW to 2,100 GW. Likewise India's Ministry of New and Renewable Energy has discharged the JNNSM Phase 2 Draft Policy, by which the Government intends to introduce 10GW of Solar Power and of this 10 GW focus on, 4 GW would fall under the focal plan and the remaining 6 GW under different State particular plans. As indicated by a 2011 report by BRIDGE TO INDIA and GTM Research, India is confronting a flawless tempest of variables that will drive sun based photovoltaic (PV) reception at an "angry pace through the following five years and past". From August 2011 to July 2012, India went from 2.5 MW of lattice associated photovoltaics to more than 1,000 MW. India's hypothetical sun powered force gathering, with around 300 reasonable, sunny days in a year, on just its property territory, is around 5000 Petawatt-hours every year (PWh/yr) (i.e. 5000 trillion kWh/yr. The every day

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normal sun oriented energy occurrence over India fluctuates from 4 to 7 kWh/m² with around 1500– 2000 daylight hours every year (contingent on area), which is much more than current aggregate energy utilization. Nonetheless, India is positioned number one regarding sunlight based energy generation every watt introduced, with an insolation of 1,700 to 1,900 kilowatt hours every kilowatt top (kWh/KWp) additionally 25.1 MW was included 2010 and 468.3 MW in 2011

2.9. CAPTIVE SOLAR PLANTS

2.9.1. CAPTIVE SOLAR PLANTS ARE MORE ENERGY EFFICIENT:

More than 30 percent of our power is lost in transmission in our current framework, in a few spots; misfortunes are as high as 60 percent because of robbery, and circulation wastefulness. A unified sun oriented plant is the same than the current framework thusly. A hostage framework can supply energy to where it is required specifically, frequently inside the grounds, or on the housetops significance better security and less misfortunes

2.9.2. CAPTIVE SOLAR PLANTS ARE MORE SPACE EFFICIENT:

Most circulated hostage sun based plants, produce power, on or near to load destinations, though a substantial concentrated frameworks need improvement of new land, given the measure of unused rooftop space power toward oneself era is an easy decision. Schools for instance regularly have huge open housetops that can produce generous sun based force, for their hostage utilization. However its a jump that the norm content associations, and people, are timid to make. Likewise consider that introducing sun oriented boards on open conduits, similar to the Gujarat analysis, could decrease dissipation and produce power; wherever water goes, so can sun powered force. Such sun powered resourcefulness has an enormous social monetary case, in creating countries like India.

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2.9.3. CAPTIVE SOLAR PLANTS ARE RESILIENT TO GRID BLACKOUTS:

In 2001, for all intents and purposes all of northern India was passed out, after the disappointment of a substation, set off the breakdown of the nation's northern lattice. Fundamental administrations, organizations, transport and key supplies came to a standstill, influencing 250 million individuals and creating 107.1 million dollars misfortune to business in only 12 hours. In the 2012 power outage for 2 days, influenced 700 million individuals, in 20 states, in India. The monetary misfortunes, were so expansive it would have been impossible certainly compute, and excessively serious, making it impossible to distribute. The more appropriated hostage heavenly bodies there are, the less effect such debacles can have. There will be no single purposes of disappointment that can cut down the entire network, as there is with concentrated force era. The effect of purposefully made fiascos, will likewise be minimized.

2.9.4. CAPTIVE SOLAR PLANTS ARE MORE EMPLOYMENT FRIENDLY:

Envision when a sun powered force framework will get to be as normal as a family unit apparatus, similar to a toaster or microwave broilers. However, we are not there yet, decentralized hostage sunlight based is the initial move towards the future, where vocation will be made to keep up, and administration the dependable arrangements. As individuals begin producing their own energy, the investment funds will be diverted, into more occupation era exercises. Little and medium organizations, utilizing experts to keep up and introduce frameworks, wherever they are required, is an enormous in addition to point.

2.9.5. CAPTIVE SOLAR PLANTS ARE MORE GOVERNMENT EFFICIENT:

While, most substantial brought together sun oriented plants, flourish with particular taxes, creating extra misfortunes to effectively ruined service organizations, conveyed hostage sunlight based plants bode well; with no administration help, by giving power, at much lower Leveled Cost of Energy. Any organization that wishes to capacity over a

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drawn out stretch of time can't disregard this. In the event that notwithstanding, the administration must get included, it could be as proceeding with duty motivating forces, to hostage sun oriented plants, which are more successful path, of allotting open trusts

2.9.6. CAPTIVE SOLAR PLANTS ARE MORE SECONDARY COSTS EFFICIENT:

The fundamental expenses for incorporated sunlight based force frameworks, as new transmission lines, huge transformer stations must be ascertained into the expense of concentrating bunches of sun powered megawatts in one spot. This must be paid for and returns must be normal. This, even from private endeavor, leaves the field open to arrangement, between substantial players, and at last thrashings the extremely objective, that renewable sun powered force, must be utilized to attain to. The issues with our present, deficient and rotting electrical network will need to be settled, obliging tremendous ventures, which are better directed by spending on conveyed hostage sun oriented plants. In India, there is a chance to utilize appropriated hostage sun based plants, and fabricate another flexible and limited power framework, to supplant our insufficient and coming up short matrix huge unified undertakings.

Creating nations like India, must take this opportunity, for a reasonable redoing utilizing sun powered force era, for confined utilization. Brought together sun based is a poor substandard option, to the best conceivable arrangement, and we have to move center, to appropriated hostage sun oriented now, so that equitable power, is a funnel dream, as well as an advancement cultivating reality .According to the Ministry of New and Renewable Energy (MNRE), the aggregate network associated sun powered force introduced limit toward the end of the money related year 2013-2014, which finished in March, remained at 2,632 MW. Of this, just 26 percent (688 MW) was included under the JNNSM, though around 50 percent (1,323 MW) was included under different state strategy activities. Regardless of this, Mercom is determining that 2015 establishments will dramatically multiply, coming to roughly 1,800 MW in the year as the business sector balances out after the race of Prime Minister Narendra Modi and in the wake of an

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August choice not to force hostile to dumping obligations. The Indian sun oriented industry is unmistakably playful since the races and particularly in the wake of moving beyond the opposition to dumping case," clarifies Raj Prabhu, CEO and Co-author of Mercom Capital Group. "Late undoings of coal mining licenses by the Supreme Court in the midst of rising coal imports and expanding expenses, and proceeding with force deficiencies have all added to the positive energy in the sun oriented area," included Prabhu.

The MNRE in the interim refers to Gujarat as the pioneer, having authorized 860.4 MW under state-upheld motivating forces, near to 33% of the country's aggregate introduced limit. Madhya Pradesh and Maharashtra took after with 2013-2014 state-sponsored establishments of 175 MW and 150 MW, individually. Alternately, Rajasthan, which has the second most astounding aggregate limit, introduced the greater part of this under the JNNSM, with just 22 MW going under the state sun oriented arrangement support. As indicated by MNRE, the state is additionally during the time spent distributing 50 ventures, each of 1 MW limit.

Central Government Stands Up for Solar

While the development of India's sunlight based division might so far have depended all the more on extensive — as opposed to national — activities, there is no deficiency of encouraging feedback from focal government.

In an offer to drive the JNNSM program forward, In the most recent year MNRE discharged another establishment objective of 15 GW by 2019 that is to be created through three tranches of immense 500-MW to 1-GW utility-scale sunlight based parks. In the interim, MNRE additionally has as of late uncovered 12 areas in seven states where supposed ultra-mega sun based activities could be set up. Grown through the following five years as a team with state governments, the ventures would have a consolidated limit of nearly 20 GW. Andhra Pradesh alone has evidently recognized locales that could bolster 2,500 MW of these supposed mega PV establishments while the biggest

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undertaking will be created in the condition of Jammu & Kashmir with a limit of 7.5 GW. Rajasthan will have three 1-GW tasks while Madhya Pradesh and Punjab will every host two vast activities with an aggregate joined limit of 3.5 GW.

Then again, without a doubt the most striking advancement is another 100 GW focus for sunlight based PV by 2022. As per remarks ascribed to India's energy clergyman, Piyush Goyal, the JNNSM target is to be reproduced by an element of five with the administration working particularly towards accomplishing lattice equality.

"On the sun powered front, we accept there is huge potential to take it to 100,000 MW in next five to seven years," Goyal told journalists as of late, including: "Renewable energy may appear to be lavish, yet over the long haul, it scores over routine energy. The appropriation administration needs to be more hearty, focused on and feasible. The legislature of India stands resolved to lead the upset in the renewable energy division. Straightforwardness, genuineness, world-class innovation will be the way to managing key difficulties."

Also, maybe its no occurrence that the new government is completely grasping sun oriented, given that in its race declaration, the now-administering government gathering known as BJP vowed to grow the JNNSM. Furthermore, maybe all the more essentially, Modi was once boss priest for the uniquely beating — as far as Indian sun powered establishments — Gujarat. On the off chance that there is a question mark over the focal government-supported mega sun oriented task (500 MW+) methodology it concerns the long haul supportability of such a system. Mercom Capital's investigators contend that by solely growing expansive scale and mega sun powered tasks, India is going in the other way to numerous different markets which have seen a movement to private and business housetop ventures. Transmission and conveyance misfortunes are assessed at around 25% in parts of India and area accessibility

Chapter3: OBJECTIVE AND HYPOTHESIS

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Chapter 4: METHODOLOGY

During the preparation of my paper report, I get ready some steps like

- To survey the present status of sun powered ventures in the nation through writing audit.
- To analyze the sun powered improvement of fruitful nations and that of India through study and investigation of arrangements and measures received.
- To translate the purposes behind lesser development of sun powered energy in India and find supportable courses for its future development by directing meetings of industry experts. Then in the following step I analysis all the information gathered systematically.

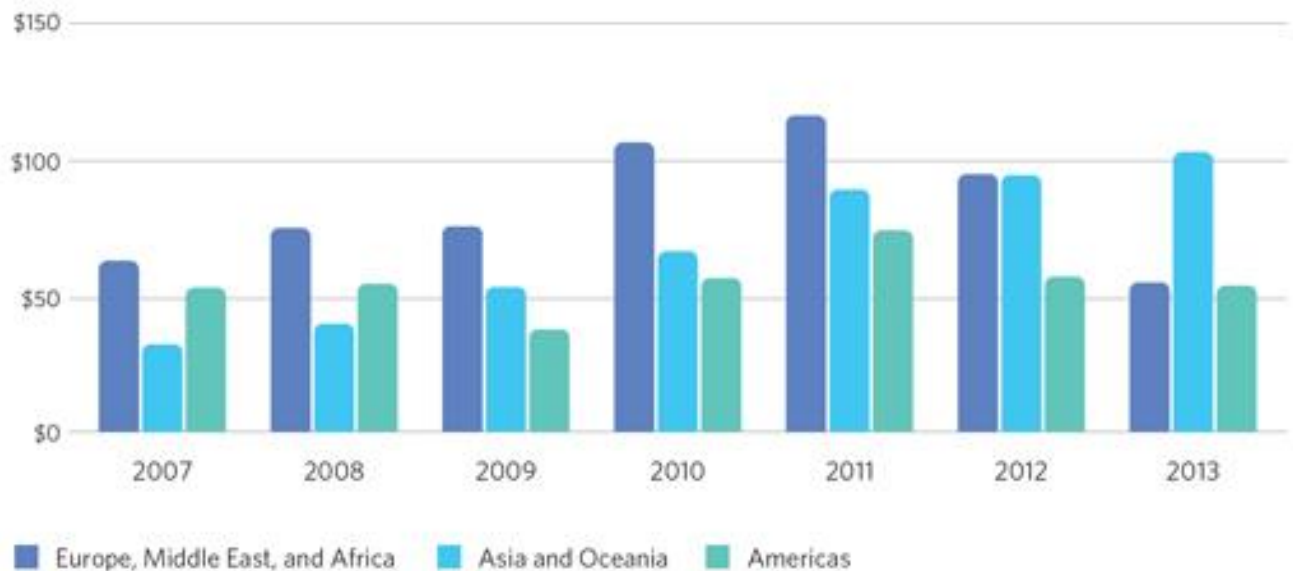
Chapter 5: DATA ANALYSIS

5.1. INVESTMENT IN CLEAN ENERGY BY REGION

The diagram underneath demonstrated that interest in Asian nations is expanding as China and India monetary development is expanding though the created contries like Americas and Europe has lessened their interest in clean energy.

Fig 4: TOTAL INVESTMENT IN CLEAN ENERGY

Total Investment in Clean Energy by Region, 2007-13
(in US\$ billions)
Asia continues uninterrupted investment growth, Europe falls back



Source: Bloomberg New Energy Finance

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5.2. STATE WISE INSTALLED CAPACITY OF SOLAR ENERGY IN INDIA

Fig 5: STATE WISE INSTALLED CAPACITY OF SOLAR ENERGY IN INDIA

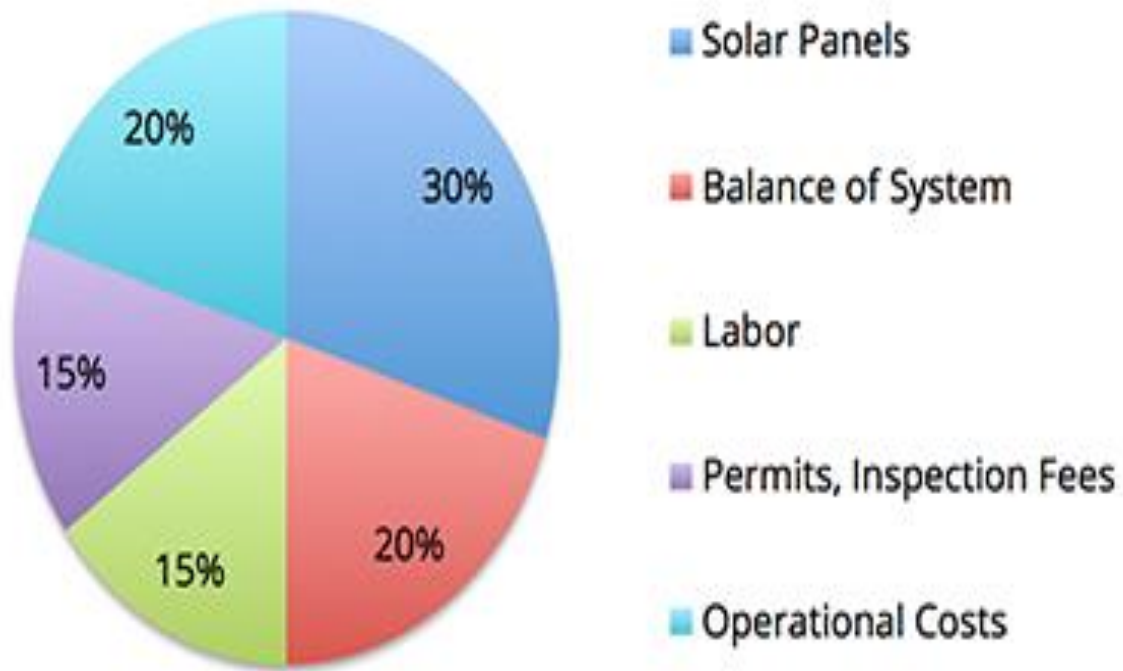
State wise Installed Capacity of Solar Energy in India:

State	MWp	%	State	MWp	%
Andhra Pradesh	21.8	2.2	Orissa	13.0	1.3
Chhattisgarh	4.0	0.4	Punjab	9.0	0.9
Delhi	2.5	0.3	Rajasthan	510.2	20.2
Gujarat	654.8	66.9	Tamil Nadu	15.0	1.5
Haryana	7.8	0.8	Uttar Pradesh	12.0	1.2
Jharkhand	4.0	0.4	Uttarakhand	5.0	0.5
Karnataka	9.0	0.9	West Bengal	2.0	0.2
Madhya Pradesh	2.0	0.2	Maharashtra	20.0	2.0
			Total	1686.44	100

Source:SEIA

5.3. SOLAR SYSTEM COST

Fig 6: BREAK UP COST OF SOLAR SYSTEM



5.4. RURAL ELECTRIFICATION: TECHNOLOGIES AND SERVICE LEVELS

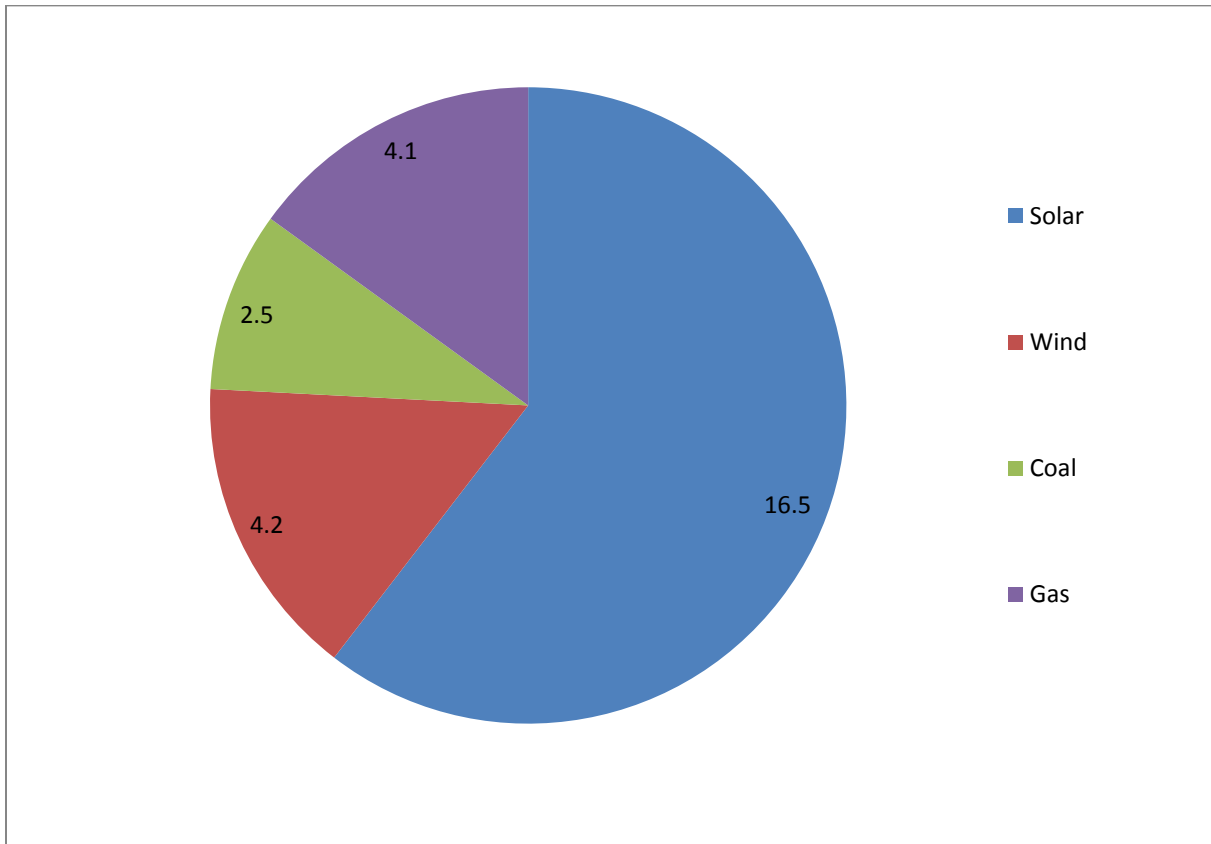
Rural Electrification Technologies and Service Levels

<i>Electricity Source</i>	<i>Household Capacity</i>	<i>Possible Benefits of Electricity Service</i>
Main grid electricity	1 kilowatt and above	Lighting, color TVs, B & W TVs, cell phones, small appliances, fans, Refrigerators, air conditioners, motors, electric pumps
Isolated grid electricity	500 kilowatt and above	Lighting, color TVs, B & W TVs, cell phones, small appliances, fans, Refrigerators, air conditioners, small motors, electric pumps
Photovoltaic HH System	15+ watt peak coupled with 700 watt hours battery storage (60 Ah)	Lighting, color TVs, B & W TVs, cell phones, low wattage small appliances,
Car Battery	700 watt hours battery storage capacity (60 Ah)	Lighting, color TVs, B & W TVs, cell phones, low wattage small appliances,
Small/Pico Lighting System	5-15 watt peak coupled with various small batteries	Lighting, cell phone charging, radios
Battery powered Flashlight	D Cell batteries have between 2 and 6 watt hour storage capacity	Lighting, cell phone charging, radios

Source: Solarbuzz

5.5. TARIFF FOR POWER GENERATION

Fig 7: COST OF POWER GENERATION IN KWH



5.6. BENEFITS OF SOLAR INITIATIVES

THE BENEFITS OF A SOLAR INITIATIVE

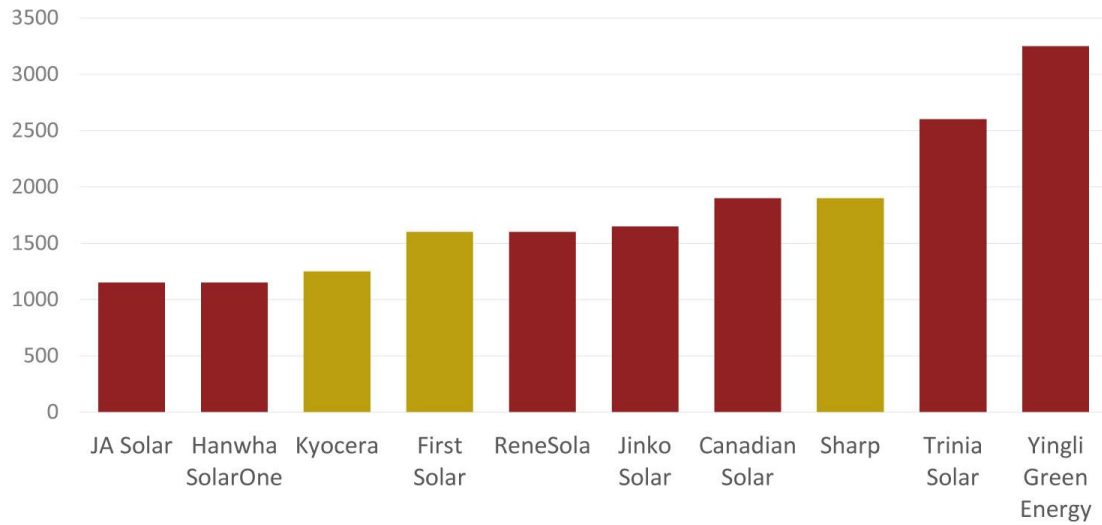
	% substitution of diesel for power generation by solar			
	50%	60%	70%	100%
Annual Savings for End Consumer (<i>Rs '000 Cr</i>)	7.8	9.3	10.9	15.5
Reduction in Petroleum Imports (<i>Rs '000 Cr</i>)	17.3	20.7	24.2	34.6
As % of Current Account Deficit	4.6%	5.5%	6.4%	9.2%
Reduction in Under Recovery (<i>Rs '000 Cr</i>)	2.8	3.3	3.9	5.5
Implied Solar Capacity in India (<i>MW</i>)	6,792	8,151	9,509	13,584

Source: SEIA

5.7. SOLAR MANUFACTURER

Fig 8: BIGGEST SOLAR MANUFACTURER

World's Biggest Solar Manufacturers (MW in 2013)



China based manufacturers in red, others in green

Source: IHS

shrinkthatfootprint.com

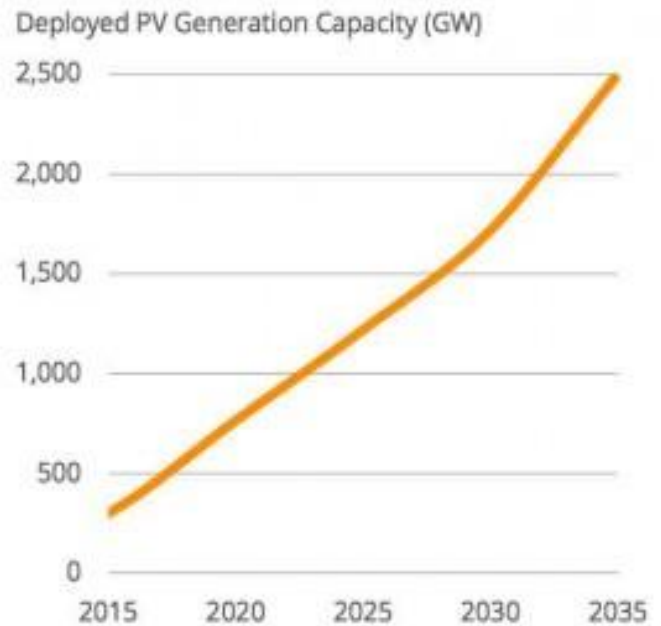
5.8. SOLAR GROWTH

Fig 9: EXPECTED SOLAR GROWTH

Expected Solar Power Industry Growth – Next Two Decades

By 2035

- Global electricity sales double to \$4 trillion / year
- PV deployment increases by > 10X
- PV supplies > 10% of total electricity demand
- Cumulative PV systems deployment > \$5 trillion
- Global business, largely non-incentivized



SOURCE:SEIA

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Fig 10: U.S. POWER PLANT CAPACITY ADDITIONS

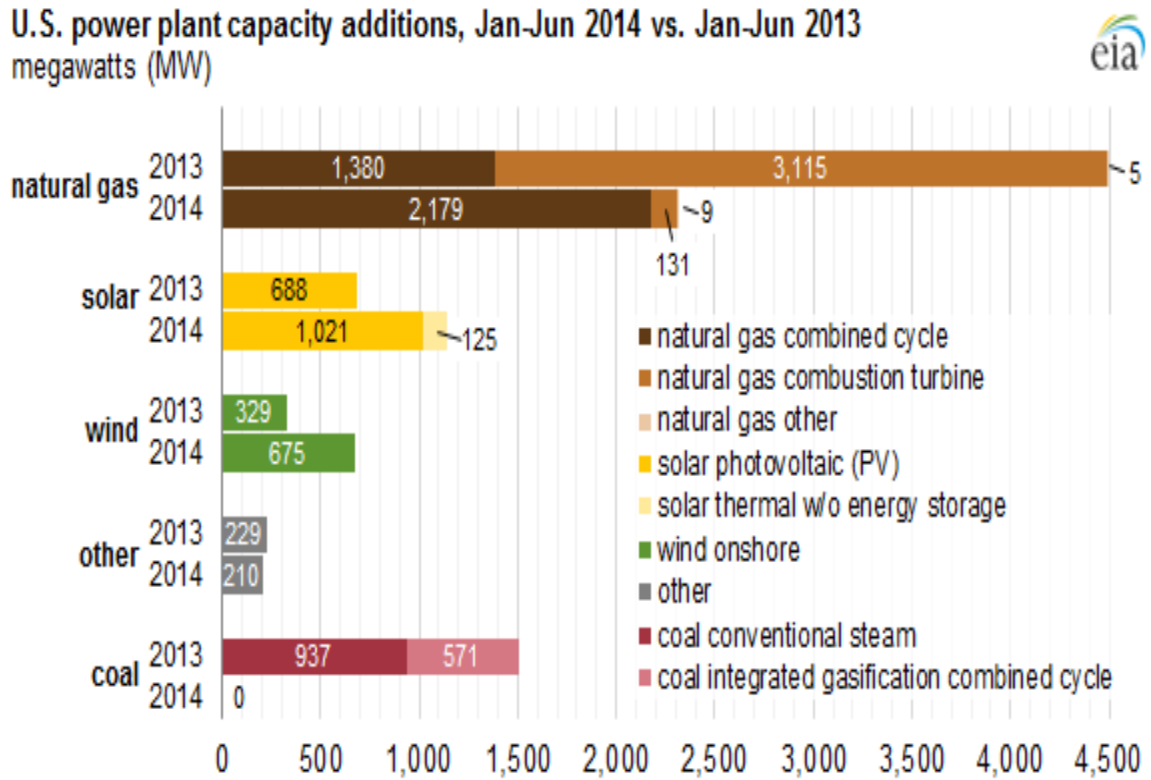
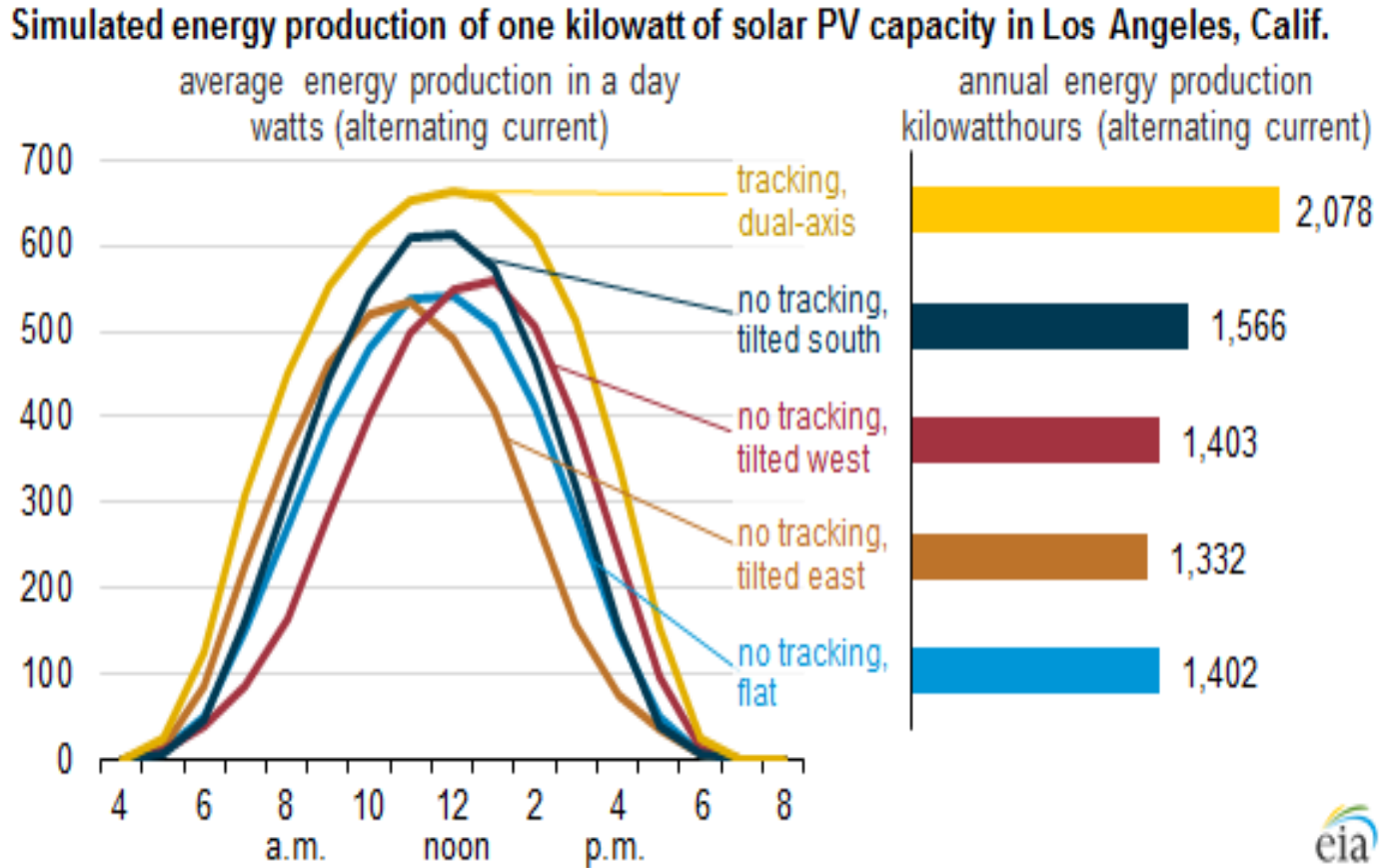


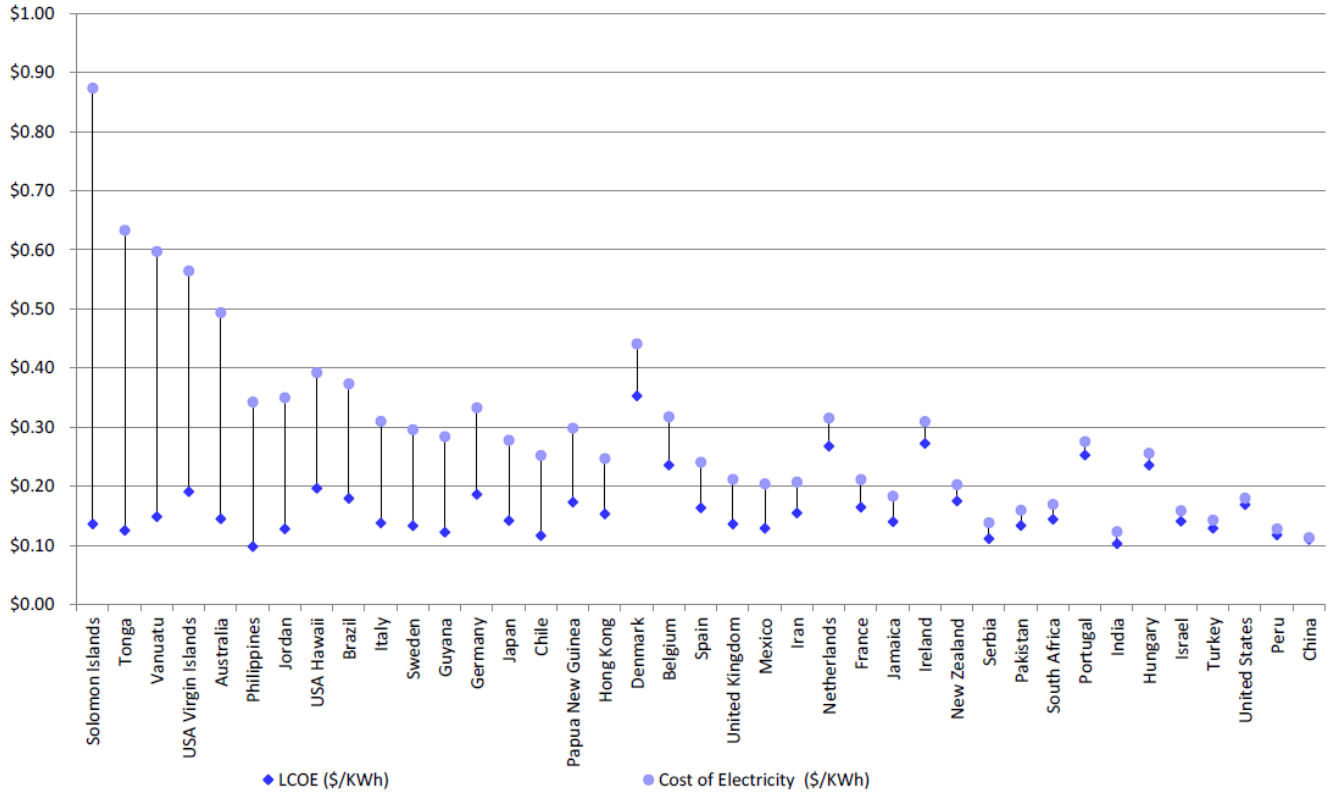
Fig 11: LOS ANGELES SOLAR PV CAPACITY



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Fig 12: COUNTRIES WITH REGIONS OF GRID PARITY

Figure 20: Countries With Regions of Grid Parity



Source: Deutsche Bank Estimates

5.9. ROLE OF GOVERNMENT

In June 2008, the prime minister launched the national action plan for climate change (NAPCC), which categorically targets an increase in solarbased generation in the nation. As part of the plan, the government has approved the creation of a national solar mission on the lines of the atomic commission. The mission has a target of adding 1,000 MW of concentrated solar power in the next 10 years. Till date, the union government has made various concessions for solar energy development in India. The MNRE, in a effort to promote large sized gridinteractive solar power generation projects, recently introduced a generation based incentive (GBI) of Rs 15 per kWh for solar PV and Rs 13 per kWh for solar thermal power projects.

Solar PV power generation plants with a minimum installed capacity of 1 MW per plant are eligible for the incentive. However the incentive is available only for a maximum cumulative capacity of 10 MW of gridinteractive solar PV power generation projects in a single state, with the overall project size being limited to 50 MW. Further, no single entity can receive the GBI for projects of more than 5 MW. The industry has been demanding the removal of the total capacity and per plant limits but, so far , no steps have been taken in this regard.

The government has also sanctioned the development of solar cities programme for the Eleventh Plan period. The programme will extend support to municipal corporations for preparing and implementing the plan to set up 60 solar cities. In June 2008, the prime minister launched the national action plan for climate change (NAPCC), which categorically targets an increase in solarbased generation in the country. As part of the plan, the government has approved the creation of a national solar mission on the lines of the atomic commission. The mission has a target of adding 1,000 MW of concentrated solar power in the next 10 years. Till date, the union government has made various concessions for solar energy development in India. The MNRE, in a effort to promote largesized gridinteractive solar power generation

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The government has also sanctioned the development of solar cities programme for the Eleventh Plan period. The programme will extend support to municipal corporations for preparing and implementing the plan to set up 60 solar cities at an investment of Rs 5 million, which will enable a minimum 10 percent reduction in total demand of conventional energy at the end of 2012.

5.10. NATIONAL SOLAR MISSION

The National Solar Mission is a major initiative of the Government of India and State Governments to advance ecologically sustainable development while addressing India's energy security challenge. It will also constitute a significant commitment by India to the worldwide push to meet the challenges of environmental change.

Objectives and Targets

- To make an empowering approach structure for the sending of 20,000 MW of solar power by 2020
- To increase limit of matrix joined solar power era to 1000 MW inside three years – by 2013; an extra 3000 MW by 2017 through the required utilization of the renewable purchase obligation by utilities upheld with a preferential tariff. This capacity can be dramatically multiplied – reaching 10,000 MW installed power by 2017 or more, based on

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the upgraded and empowered international finance and innovation transfer. The ambitious focus for 2022 of 20,000 MW or more, will be subject to the "learning" of the first two phases, which if successful, could prompt conditions of grid-competitive solar power. The transition could be appropriately up scaled, based on availability of international finance and innovation.

- To make positive conditions for solar manufacturing capability, particularly solar warm for indigenous production and market leadership.
- To advance projects for off grid applications, reaching 1000 MW by 2017 and 2000 MW by 2022 .
- To achieve 15 million sq. meters solar lightning systems

5.11. POLICY AND REGULATORY FRAMEWORK

- The objective of the Mission is to make a policy and administrative environment which provides a predictable incentive structure that enables rapid and extensive scale capital investment in solar energy applications and encourages technical innovation and lowering of costs Although in the long run, the Mission would seek to establish a sector-specific lawful and administrative structure for the advancement of solar force, in the shorter time outline, it would be necessary to install the activities of the Mission within the existing system of the Electricity Act 2003. The Electricity Act as of now provides a part for renewable however given the magnitude and importance of the activities under the Mission, it would be necessary to make specific amendments.
- The National Tariff Policy 2006 command the State Electricity Regulatory Commissions (SERC) to fix a minimum rate of energy purchase from renewable sources of energy taking into account availability of such resources in the region and its impact on retail tariff. National Tariff Policy, 2006 would be modified to

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order that the State electricity regulators fix a rate for purchase of sun based force. The solar power purchase obligation for States might start with 0.25% in the phase I and to go up to 3% by 2022.

- This could be supplemented with a solar specific Renewable Energy Certificate (REC) mechanism to permit utilities and solar power generation companies to purchase and sell certificates to meet their solar power purchase obligations. The Central Electricity Regulatory Commission has as of late issued guidelines for fixing feedtariff for purchase of Solar force considering current cost and innovation trends. These will be revised on a yearly basis. The CERC has also stipulated that Power Purchase Agreement that utilities will close with Solar power promoters, should be for a period of 25 years. In request to empower the early dispatch of "Solar India" and energize rapid scale up, a scheme is being introduced in cooperation with the Ministry of Power, the NTPC and the Central
- Electricity Authority, which would simplify the off-take of solar force and minimize the financial weight on Government. Numerous investors are willing to set up solar based force plants. Nonetheless, sale of
- Power by the IPPs may be a issue because of the high cost of force and realization of tariff for the same from the distribution companies. In request to incentives setting up of an expansive number of Solar Power Projects, while minimizing the impact on tariff various alternatives were investigated. One of the options is to package solar control alongside force out of the less expensive unallocated quantity of Central stations and selling this packaged energy to state distribution utilities at the CERC directed price.

5.12. SOLAR MANUFACTURING IN INDIA

One of the Mission objectives is to take a worldwide leadership part in solar manufacturing (across the worth chain) of leading edge solar technologies and focus on a

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4-5 GW equivalent of installed capacity by 2020, including setting up of dedicated manufacturing capacities for poly silicon material to every year make around 2 GW capacity of solar cells. India as of now has PV module manufacturing capacity of around 700 MW, which is anticipated that would increase in the following few years. The present indigenous capacity to make silicon material is low, nonetheless, a few plants are likely to be situated up soon in public and private part. As of now, there is no indigenous capacity/capability for sun powered warm power ventures; in this manner new facilities will be required to fabricate concentrator authorities, receivers and different parts to take care of the demand for sun oriented warm power plants. To achieve the installed capacity focus on, the Mission prescribes the following:

(i). Local interest creation: The 20 GW arrangement supported with right level of incentives for solar generation coupled with substantial government pilot/demonstration programs will make the Indian market attractive for solar manufacturers

(ii). Financing & Incentives: SEZ like incentives to be provided to the manufacturing parks which might include:

- Zero import obligations on capital equipment, crude materials and excise obligation exemption
- Low interest rate loans, priority sector lending
- Incentives under Special Incentive Package (SIPs) policy to set up integrated manufacturing plants; (i) from poly silicon material to solar modules; and (ii) dainty film based module fabricating plants. . Under the SIP scheme of the Department of Information Technology, there are 15 applications in the domain of solar photovoltaic, which includes cell manufacturing, (both crystalline and thin film) and poly-silicon manufacturing among others. The combined capacity anticipated by these 15 companies could result in the production of 8-10 GW solar control by the year 2022 which would be sufficient for meeting the Mission targets even after accounting for exports.

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- It is also prescribed that sun powered segments be secured under the Bureau of Energy Efficiency's star rating system to guarantee high gauges. Similar incentives will be required for production of CSP frameworks and their parts. A Committee may be set up to form a policy for promotion of sun powered warm fabricate in the nation.
- Ease of doing business: In consultation with States, make a single window freedom mechanism for all related permissions.
- Infrastructure & ecosystem enablers: Create 2-3 extensive solar manufacturing tech parks consisting of manufacturing units (across the solar esteem chain), housing, offices

5.13. ISSUES AND CHALLENGES

Despite various efforts, the solar industry still faces a lot of issues including high era costs, unlucky deficiency of region, insufficient financing options and rising environmental concerns. Furthermore, despite the governmentsto be commercially viable.

- Policy Hurdles: According to wander planners, furtherpolicy action is required on the sun arranged essentialness front. There is still a surge of conjusion incorporating the procedure framework. Originators have refered to issues, for instance, nonattendance of clarity regarding the clearances expected to set up operations. Others cry that it takes preposterous time to get the different clearances required.

- Many creators have moreover gone up against issues as the later have not held quick to the power purchase assentions. There is also strong enthusiasm for evacuating the top on MNRE's GBI.

- High Costs: Despite costs sliding over the years, power period from solar PV is still four to five times more expensive than fossil fuel-based time. The estimated cost of time from sola PV and solar warm sources in India is Rs 12-20 each kWh and Rs 10-15 each kWh

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respectively. Of course, control from conventional sources can cost as little as Rs 3-Rs 4 each kWh. According to industry estimates, the current tariffs for the initial 10 years period are not sufficient to make solar projects viable. This, combined with wander financing at 12-14 percent with a development residency of seven-eight years, results in IRR of 6-10 percent. Attractive IRRs have been the single most important variable for the advancement of the sun controlled PV industry in Europe, with engineers receiving in any occasion a incremental return of 4-6 percent over the capital/financing cost. At the same time, it is important to note that capital costs have declined substantially over the past two decades and a fall in solar PV costs is foreseen, which would make it competitive vis-à-vis fossil fuels. With economies of scale and new technologies, the industry is targeting to continuously improve efficiencies and decrease costs to the Rs 6-8 each kWh range within the accompanying five years.

- **Manufacturing Process:** Solar PV cell manufacturing is a development intensive process requiring sophisticated expertise and ability. The technological landscape is changing quite rapidly. Plus, as it is challenging for new entrants to replicate the success of companies having a long standing in the solar PV market, competition is decreased to a degree.

- **Environmental Concerns:** Some of the rough materials used for producing solar PV cells, like cadmium, are hazardous. Other unrefined materials, like plastics, are nonbiodegradable. Disregarding the way that some of the waste made during the manufacturing process is recyclable (for eg. Silicon), not all materials are recyclable. As a result, disposal is a test.

- **Low Land Availability:** Solar power plants require tremendous areas of region 35-40 acres for a 5 MWp installation. Regardless, suitable tracts of zone are not always available and land acquisition is sometimes subject to close-by resistance.

- **Power Evacuation:** In the past, it has been often seen that a transmission line is required to be drawn from the solar power plant site to the nearest substation, which is usually 4-5

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km away. The concerned power utilities generally insist that the line should be drawn by the promoter of the sun controlled endeavor. Setting up a transmission line is not simply unfamiliar work for the daylight based wander's promoter or engineering, acquisition and construction foreman, it also adds substantially to the capital cost incurred. For conventional power plants, the respective T&D companies set up the line and purchase power from the premises of the generating station. This is because T&D companies have the experience and legitimate support required to handle the socio-political issues that arise while setting up transmission lines across range guaranteed by multiple landowners.

Chapter 6: CONCLUSION

The eventual fate of the solar warm industry is looking promising however the main challenge is regarding the initial set-up cost, to meet this obstacle government is adopting various instruments to adapt up this situation.

Solar Thermal Industry is seeing a lot of changes in the late years. There are various participants entering the business sector at different stages of force era. This is because of the increased awareness of utility of solar warm in distinctive countries. There is strong change in viewpoint of the industry along with major changes in the technological scenario. There are various projects going in as mentioned in the report and new and emerging technologies are promising cost competitiveness with the traditional methods of electric generation.

Sunlight based is demonstrated to convey predictable, practical energy to villagers and occupants in creating markets, especially in country settings. There are examples of overcoming adversity all around. For instance, with simply a 10% appropriation and the utilization of previous microfinance establishments, families in Bangladesh can at present appreciate electric light and PDA charging by means of off-framework, 50W sun oriented PV and battery frameworks.

The sunlight based limit in India crossed the 2 GW turning point in the second from last quarter of 2013 with the expansion of around 900 MW (as of October 2013) determined fundamentally through the limit increments under the Batch II of Phase 1 of the National Solar Mission. Notwithstanding this, a couple of expansive scale force plants were included states, for example, Madhya Pradesh and Maharashtra as a feature of the states' drive to fullfil their sunlight based RPO quantity.

Regarding arrangement declarations, 2013 was a memorable year for sun based. The sunlight based industry was kept occupied with some huge declarations including the

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offerings booked to come up under the Tamil Nadu and Andhra Pradesh sun powered approach. The turnout of the arrangements however was not what the business had anticipated. That being said, the sunlight based approaches in these states did not end up being an aggregate bust with fundamentally expansive assignments being made under the TN sun oriented approach and fruitful distributions under the Rajasthan and Karnataka sun powered arrangements.

The Andhra Pradesh sun powered arrangement however left an astringent taste in different engineers' mouths. Sunlight based organizations, effectively profiting from blasting offer costs, are swinging to progressively imaginative approaches to raise capital, including security issues, bank credits and even group subsidizing. Sun oriented City—Wall Street's most current renewable energy sweetheart a week ago reported that it will offer obligation speculations sponsored by pools of sun powered resources this year. A year ago, Solar City, which is upheld by Tesla Motors originator Elon Musk, issued about \$54.4 million in the first-ever sun oriented bonds. They secured a venture evaluation rating from

Standard & Poor's. Since sun oriented force can be produced at the neighborhood level, and in light of the fact that its base can be assembled effectively without the politically-tinged issues that go with unrefined, it makes for a nearly appealing venture

Chapter 7: SUGGESTION FOR POWER INDUSTRY

According to the study carried out I went to the following suggestion for the promising sun based force industry:

- The request and supply hole can be met by using the inconceivable potential of sun based energy.
- The village electrification could be possible by using off-grid solar PV power plants of small capacity.
- The awareness about efficient power energy should be spread among the population.
- The government should urge the private players to come in this field.
- The special emphasis should be on reducing the cost of the innovation.
- The fitting campaigning should be carried in request to make the renewable sources more prevalent by appropriately demonstrating the innovation.

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