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SOLAR ENERGY CONTRIBUTION IN DIGITAL INDIA & CHALLENGES OF CONSUMER AWARENESS TO SOLAR ENERGY.

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Abstract:-

Solar energy is not harmful as well as easier to use. But in India consumer awareness is the greatest challenge to solar energy. It is a great need to aware everyone about this technology so that uses of this resource of energy can be increased. Solar energy can contribute in Digital India dreams of Indian Government. It can complete electricity requirements of Digital India to spread internet up to villages & rural areas.

The increasing prices for petroleum products, projection that petroleum resources would be exhausted in a relatively short period of time and the use of fossil fuel resources for political purposes will adversely affecting worldwide economic and social development. In addition, global warming caused largely by greenhouse gas emission from fossil fuel generating systems is also a major concern. These problems can be overcome by alternative sources that are renewable, cheap, easily available, and sustainable. And the solar energy is best promising source. But unfortunately this source of energy has been get neglected.

In this paper researcher has aimed to find out the consumer aware of solar energy, solar energy systems and its uses as well as its contribution for digital India.

Keyword:-*CSP- Concentrated solar power SPV -Solar Photovoltaic CSC - common services center SWAN -state wide area networks*

1. INTRODUCTION:

Solar energy is the most readily available source of energy. It does not belong to anybody and is, therefore, free. It is also the most important of the non-conventional sources of energy because it is nonpolluting and, therefore, helps in lessening the greenhouse effect.

Solar energy has been used since prehistoric times, but in a most primitive manner. Before 1970, some research and development was carried out in a few countries to exploit solar energy more efficiently, but most of this work remained mainly academic. After the dramatic rise in oil prices in the 1970s, several countries began to formulate extensive research and development programs to exploit solar enery.

In the next few years it is expected that millions of households in the world will be using solar energy as the trends in USA and Japan show. In India too, the Indian Renewable Energy Development Agency and the Ministry of Non-Conventional Energy Sources are formulating a programs to have solar energy in more than a million households in the next few years. However, the people's initiative is essential if the program is to be successful.

India is one of the few countries with long days and plenty of sunshine, especially in the Thar Desert region. This zone, having abundant solar energy available, is suitable for harnessing solar energy for a number of applications. In areas with similar intensity of solar radiation, solar energy could be easily harnessed. Solar thermal energy is being used in India for heating water for both industrial and domestic purposes. A 140 MW integrated solar power plant is to be set up in Jodhpur but the initial expense incurred is still very high.
When we hang out our clothes to dry in the sun, we use the energy of the sun. In the same way, solar panels absorb the energy of the sun to provide heat for cooking and for heating water. Such systems are available in the market and are being used in homes and factories.
Solar energy can also be used to meet our electricity requirements. Through Solar Photovoltaic (SPV) cells, solar radiation gets converted into DC electricity directly. This electricity can either be used as it is or can be stored in the battery. This stored electrical energy then can be used at night. SPV can be used for a number of applications such as.
1. Domestic-lighting
2.Street-lighting
3.Village-electrification
4.Water-pumping
5.Desalination-of-salty-water
6. Powering of remote telecommunication repeater-station-sand 7. Railway signals.

2. Solar Energy Contribution in Digital India

In August 2014, the Narendra Modi government, aiming to connect billions of Indians, announced an ambitious Digital India vision. The program aims to deliver all government services to citizens electronically by connecting rural areas with highspeed internet network. The project has even attracted support from the likes of Facebook and Google to usher in this new era of connectivity in India. However, can India really bridge this digital divide? At a time when the country is reeling under power crisis, uninterrupted connectivity looks like a distant dream. Countrywide information and communication technology (ICT) infrastructure is a pre-requisite for comprehensive implementation of egovernance and more inclusive Digital India program. One of the key learning from the implementation of ongoing nationwide core and support e-Gov. infrastructure is the lack of uninterrupted and reliable basic electricity in the rural India, even at the block level. This experience has been evident in case of the 1,00,000 internet-enabled common services center (CSC) outlets for government and private service delivery, being established at the village/ panchayat level, or similarly, in implementation of the state wide area networks (SWAN), having more than 6,000 points of presence of electronic infrastructure in district towns and rural blocks. In apprehension of unreliable power in rural areas, these large projects had provided for alternative sources of power like UPS and diesel generator, having their inherent dependencies. In many cases the power situation happened to be so grave that the UPS systems remained ineffective due to non-availability of bare minimum continuous power necessary to charge the batteries.

3. Go Solar for Digital India

Though environment-unfriendly fossil fuels currently contribute 80 percent of the world's primary energy, the changing pattern of the pricing model for solar power among many other renewable and sustainable energy alternatives predicts that solar electricity would soon be cost-effective to the fossil fuel electricity, having a potential to become the future energy source. As per an Ernst & Young report on renewable energy country attractiveness indices, ranking countries based on regulatory environment, fiscal support, unexploited resources, suitability to different technologies and other factors determining renewable energy growth in a country, India maintains a ranking within the top five countries in the world. It ranks third in terms of biomass and fourth in hydropower and in concentrated solar power (CSP) capacity. It is stated that India's potential for total renewable energy production can reach 220 GW by 2032, which is the current installed total energy capacity in India. India's landmass is endowed with one of the highest global solar radiations, with potential energy content of about 5,000 trillion kWh per year, considering most parts receiving 4-7 kWh per square metre per day for 300 clear sunny days. While 8 percent of India's total area is barren, 1 percent of land has the potential to produce 2,000 billion Kwh of solar electricity with no need of supply of any raw material. In this context, the current Solar Mission plans to cover 20 million square meters by 2020, to generate up to 20 GW gridbased solar powers and 2

GW of off-grid solar power. Advantage of solar energy is that it is available throughout the peak load demand time of the day and therefore it would substantially bring down the peak energy costs, obviating the need to build additional generation and transmission capacity. Solar energy conversion equipment systems have longer life and need lesser maintenance with low running costs and hence provide higher energy infrastructure security. Unlike conventional thermal power generation from coal, solar energy generation does not cause pollution and generate clean power. The multi-tier digital infrastructure is the cornerstone of implementation of Digital India, which has the focus on delivery of services to citizens located in the remote corners of the country. These are the locations, which suffer most from lack of uninterrupted quality power. Many e-governance initiatives rolled out in rural India experience worse power and bandwidth conditions. Intended benefits from those schemes cannot be derived for these reasons. For remote locations where easy, convenient and cost-effective grid connections are not available and pollution free and environmentally safe power generation is a priority, standalone local captive solar energy generation is highly suitable. Off-grid local generation also provides with transmission loss and fault free uninterrupted reliable power connection leading to energy independence to local community, as this power can be used for lighting, internetenabled communication systems and other usual purposes like, heating, pumping, small scale industry utilization, and so on. Further, solar energy, as a substitute of conventional sources of energy with current pricing system, works economical in those areas that are using diesel generators as a primary source of electricity. There are a few examples of petrol pumps being run using solar energy and commercial buildings where solar energy are providing a very cost-efficient proposition against prevailing high electricity rates.

4. Benefits of Solar PanelElectric Power Systems for Homes

If you like the thought of contributing to the efforts of making the earth a better place to live, or if you like money, you'll love solar energy. There are a myriad of great reasons to install a photovoltaic solar power generation system in your home or commercial building, here are a few.

- A solar energy system adds to your property value without adding any tax liability.
- Home based solar power is a quiet, nearly maintenance free, continuous source of electricity.
- Solar electric systems reduce pollution and CO2 emissions by generating electrical power using radiant Sun light that can replace electricity that comes from coal fired electrical plants.
- Many states including California, Massachusetts, New Jersey, Maryland, Texas and Arizona offer $0 down installation plans that immediately lower your electric bill and cost nothing to install or maintain.

5. Modern Solar Power Technology

We are constantly seeing new breakthrough technology in photovoltaic solar power systems as scientist and manufacturers continue to create cheaper and more efficient panels and supporting components. However, even with all the research and development in the solar industry, one thing is for certain, solar panels are the best way for homeowners to create electricity simply and efficiently. Regardless of the myriad of technological advances, solar panels will remain the primary component of home solar energy production systems for the foreseeable future. There will always be various different types of photovoltaic cells being developed in an effort to improve efficiency and production costs, but the modern solar panels are amazing. Today's solar photovoltaic systems are light years ahead of the early designs with often haphazard set-ups. Modern solar power systems use a method of sun exposure to generate electricity via semiconductors. Simple, direct exposure to the sun and its heat generates electrons that are then captured into the solar system and transformed into usable electricity. This same basic design is used for tasks as small as charging your mobile phone to as large the system needed to entirely power all of the appliances in your home.

5. Consumer Awareness is the Greatest Challenge to Solar Energy

Consumers are optimistic about solar energy despite having some serious misconceptions about the solar industry--this according to Applied Materials' international survey carried out by Ketchum Global Research & Analytics and Ipsos, In an attempt to better understand global consumers' outlook on solar power, the survey interviewed 1000 people from countries with high potential growth in solar energy. The chosen nations were China, Japan, India and the United States. The results can be separated into four sections: cost of solar energy, solar job prospects, rate of solar adoption and global solar leaders

- **Cost of Solar Energy.**

PV Magazine reports that while Applied Materials' 2011 survey showed that solar technology would reach grid-parity at the end of the decade, this year's data indicate that it will be reached by the end of the year. In fact, a recent post on Applied Materials' blog reported that solar power has already reached grid-parity in over 100 countries. The blog notes that "105 countries make up 98% of the world's population, account for 99.7% of the world's GDP and consume 99.2% of the world's energy related to CO2 emissions" (See image here.). It is clear that solar energy prices are dropping fast. Dr. Charlie Gay, president of the solar branch of Applied Materials, recently explained to Reuters that this trend is "due to the dramatic and accelerated rate of cost reductions in the supply chain." He adds that "a continued focus on technology innovation will further drive down the total cost of solar electric power plants."

Respondents to the survey were overly optimistic in their perception of solar power prices. Overall 55% of those surveyed said that solar power is cheaper than other sources of energy such as natural gas and coal. Indian consumers were most likely to believe that solar electricity was the least expensive at 68%. Meanwhile, Japanese respondents had the most pessimistic outlook on solar energy's cost as 51% believe that it is more expensive than traditional sources of electricity.

- **Solar Job Prospects.**

Applied Materials' survey was also intended to evaluate whether the public thought a growing solar energy sector would generate jobs. Of the one thousand consumers interviewed, slightly less than half (46%) answered that solar energy growth would create jobs while exactly a quarter said that it would decrease employment. Japan and the U.S. ended up on opposite ends of this spectrum. The U.S. had the brightest outlook with 58% agreeing that the solar industry would have a positive effect on employment. On the other hand, 40% of Japanese believe that solar will have no effect. This is surprising considering that Japan just put huge subsidies on solar power, placing prices on solar electricity that are "triple what industrial users pay for conventional power", Bloomberg reports.

- **Rate of Solar Power Adoption**

In both China and India consumers express concerns that the adoption of solar power is "too slow" in their nation. Reuters writes that the Indian Ministry of New and Renewable Energy plans to increase "the contribution of renewable energy to six percent of India's total energy mix by 2022." Meanwhile China aims to raise its solar energy capacity to 15 giga watthours by 2015. 58% of Chinese and 51% of Indian respondents think that their respective country should accelerate **the rate of installations of solar technology**

- **Global Solar Leadership**

Interestingly, each country's respondents are convinced that their country leads the world in solar panel installations. Applied Materials reports that "Almost six in 10 (57%) Americans say the U.S. has installed the most solar panels, 43 percent of Chinese think it is China, and half (52%) of India thinks it is their country". Despite each countries conviction, Solar Buzz finds that the current global solar leaders are in descending order: Germany, Italy, Japan, U.S.A., Spain and China. However, in terms of awareness Japan came out on top: 35% of interviewed Japanese correctly placed Germany as the country with the most solar installations. It is important to note that the majority of Chinese and Indian citizens believe that their country is the world leader in solar energy and that their nation should increase the rate of adoption. This is a sign of very strong support for renewable energy. Furthermore, even in countries such as Japan, where respondents were skeptical about solar energy's ability to create jobs, governments are committed to promoting the solar industry.

Applied Materials survey demonstrates that the public has a high regard for solar power as an alternative energy source, but is not well aware of the current state of the industry. Despite this, consumers clearly believe that solar power has an important role to play in supplying global energy needs. This support is a good sign as we are in a pivotal point for global energy supply. Dr. Gay explained to Reuters that "since the planning horizon for utilities extends over time periods of 30 to 40 years, the opportunity to influence the world's long-term energy supply is now".

6. Challenges Faced by Solar Energy Sector in India

The solar industry in India is still in its nascent stage and faces many challenges such as high costs of solar power generation. In India, cost of solar electricity produced on-grid is Rs. 18.44/unit. This high cost is mainly due to dependence on imports for silicon and solar wafers used for the manufacture of solar cells – about 80% of which comes through imports. Solar projects are capital intensive, and the lack of an effective financing infrastructure for these projects is another major factor impeding growth in this sector. Another challenge faced today is the disparity in solar potential across states, which is evident from the irradiance map given in Exhibit 2.

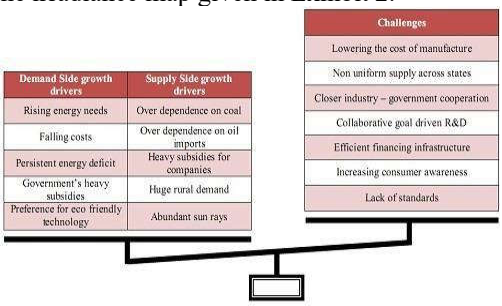

Exhibit 4: Solar Energy: Drivers of demand and supply and major challenges

Active growth of the Indian solar energy industry calls for immediate implementation of the following steps. These measures will not only boost the growth of solar energy sector, but also reduce the usage of non-renewable sources of energy and carbon footprint

Faster and Efficient Implementation of Renewable Energy Certificates (RECs)

RECs are interstate tradable certificates issued for every unit of renewable energy produced. Mechanisms such as these are essential to achieve NAPCC's goal of increasing the mandatory RE usage for states from 5% today to approximately 15% in the next 10 years. Instead of producing RE by their own, states can purchase RECs from each other to increase their RE content in total energy. This mechanism will enable low RE potential states to purchase RECs from high potential states, enabling them to meet

NAPCC's increased demands. Moreover, these purchases will incentivize high RE potential states to produce more RE than required currently, enabling overall increase in RE production.

Carbon Trading as a Source of Revenue
Solar power generation emits lesser amount of CO2 compared to conventional sources of energy such as coal. Trading this reduction in the emissions trading market can be another source of income for the Solar Energy manufacturers. We estimate that on an average – considering the current rate of emissions trading – savings of anywhere between Rs 0.9-1.5 can be achieved per unit of electricity produced. This will partially help in offsetting the high cost of solar production.

Selective Implementation of On-Grid Application
From today's technology standpoint, solar power generation works at 15-20% efficiency. Under this scenario, large-scale on-grid applications are more feasible in areas where there is plenty of barren land and high rate of irradiance such as Gujarat and Rajasthan. It is very important to concentrate the efforts in these areas to realize solar potential there before moving onto other parts where the irradiance is low or there is scarcity of barren land. The RE produced in these regions can be transferred to other states through RECs, enabling uniform distribution.

Development of Off-Grid Application
More than 80, 000 villages in India suffer major electricity supply shortages throughout the year, which provides tremendous opportunity for off-grid solar applications deployment. Some of the possible applications are lighting and electrification systems, solar powered cellular towers, irrigation pumps and street lighting. Exhibit 5 gives an estimate of the diesel savings and carbon emission reduction possible through deployment of solar cellular towers.

Total Towers	250,000
Diesel / month	2008.7 Mn litres
Diesel carbon emissions	5.85 pounds/litre
Total carbon emissions from towers / year	11.76 billion pounds
Cost of diesel for towers / year	Rs 8000 Cr.

Exhibit 5 Solar cellular towers: Cost estimate of diesel savings
Establishment of Localized Mini-Grids
More than 80, 000 villages in India suffer major electricity supply shortages throughout the year, which provides tremendous opportunity for off-grid solar applications deployment. Some of the possible applications are lighting and electrification systems, solar powered cellular towers, irrigation pumps and street lighting. Exhibit 5 gives an estimate of the diesel savings and carbon emission reduction possible through deployment of solar cellular towers.

7. Conclusion
Solar Energy possesses tremendous potential in bridging India's energy demand-supply gap in the future. Solar Energy can be a boon for Digital India. India Government has a dream to provide internet & online services to all the villages & rural areas but for that the lack of electricity has to remove from villages or rural areas. Only solar Energy can provide cheapest electricity in these areas. There are various challenges for this industry, including lowering cost of production, increasing R&D, consumer awareness and financing infrastructure. It is important to overcome these challenges for fast growth and mass adoption of the technology. Some of the immediate actions to enable growth are efficient implementation of renewable energy certificates, usage of carbon trading as a source of revenue, immediate implementation of grid powered energy in regions of Rajasthan and Gujarat, development of off-grid usage in various applications such as cellular towers and encouraging localized mini grids in areas that lack connectivity today. If these initiative work as planned, it is only a matter before India becomes one of the world leaders in Solar Energy.

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