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SOLAR ENERGY :HERALDING FUTURE OF ENERGY ON GLOBAL MAP

Ranjitkumar Parmar

Lecturer in Electrical Engineering,
Government Polytechnic, Junagadh, Gujarat-362 001

ABSTRACT

Mother Nature had bestowed us with a very clean and pure water, air and food. But due to excessive hunger of energy due to varieties of reasons like higher living standard, urbanization etc, we are day by day making it a worst place..! This is due to the methods of obtaining energy, which makes pollution. Conventional methods are emitting much pollution where as renewable methods are harmless as well as they are not going to be exhausted. These factors have leaned human attention towards these sources. Out of many renewable resources, this paper discusses the impact of solar energy on a global energy map for the future. Sun is an ultimate source of energy for our life and earth. In future solar energy is going to be the only best solution for our energy needs. There are different ways of harnessing solar energy like PV cells and CSP. Both concepts are having own merits according to the applications. In PV cells, an array of photovoltaic material is laid on land or roof, which converts directly solar radiation in to electricity, whereas in CSP, low temperature radiation of sun is used to heat a vessel filled with heat exchanging media, transmitting the radiation after concentration. Much research is going on in this field, hitherto unploughed. Cost per unit is also coming down, whereas price of energy generated thorough non renewable sources is soaring high due to diminishing sources. Days aren't away when solar energy will no longer require subsidies from the governments to survive. Instead, it will be the best solution.

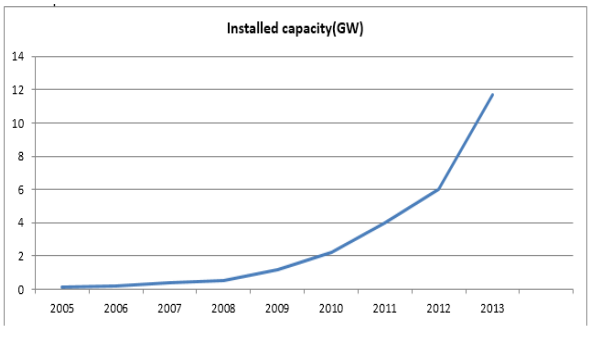
KEYWORDS : Solar Energy, Roof top, CSP, Photo voltaic generation, Renewable energy sources

Introduction

No doubt at all regarding this fact that solar energy is the cleanest alternative of energy to coal and natural gas. This source has sufficient potential to feed the demand of entire globe. There are various ways of harnessing the solar energy as discussed in abstract. Till few years back, solar energy was only used for cooking via solar cooker or heating water via solar heater fitted on the roofs. Apart from these conventional uses now the concept of power generation through is gaining popularity. Prominent ways are PV based and CSP based. People may be motivated to install roof top plants. By this way they will not be just able to decrease their light bills but also may earn income by selling excessive power. Main grid may not be always reliable say in case of disaster, however Solar Micro grid helps in such case. Community with in the periphery of solar micro grid generally remains unaffected from power cut outs or blackouts. Matter of pleasure is that during last decade electricity generation via PV cells has crossed growth of over 60 percent.

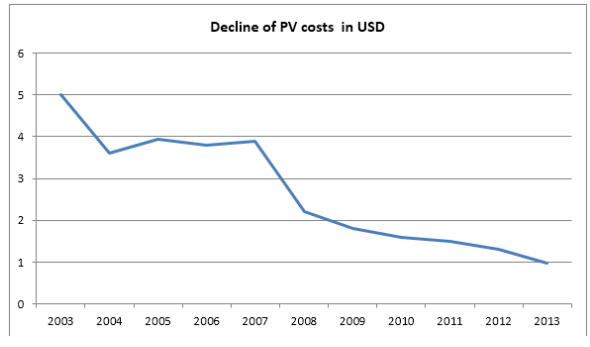
Recent Growth in Solar Energy

As mentioned in introduction, in recent years, the concept of generating energy through solar energy is gearing for faster speed This has resulted due to sharp decrease in price of solar cells, which ultimately leads to reduction in per unit cost of generated unit. Additionally, due to lower initial cost more and more people may be provoked for solar energy generation. Following figure depicts the saga.



Sources: EIA (2008, 2009, 2010, 2011, 2012, 2013a, 2013b)

Figure 1: Installed PV capacity



Source: REN21 report, Renewable energy for the 21st century

Figure 2. Falling price of PV cells year wise in US Dollar

Above figure sows trend of falling cost of PV cells, which has boosted up the PV generation. Till last decade, even when solar energy was considered to be an innocent source of energy, yet due to higher prices, it could not penetrate the market. It can be seen that price have reduced by as good as 85 percentage during the course of last decade. Even when there are huge opportunities available for the dollar generation yet only meagre amount of electrical energy is harnessed as compared to other conventional sources. Nevertheless, the difference of costs between solar and conventional sources is remarkably decreasing.

Trend of renewable in coming years

Globally renewable energy share is approximately 20 % as of today, and its track is expected to grow more in coming years. Classifying above data in detail, reveals, approximately 10 % is coming from modern whereas rest coming from conventional renewable sources like biomass. As its growth is catching up new opportunities as well as challenges are increasing. Growth of renewable was little hampered due to subsidies to conventional sources but yet overall growth is satisfactory according to experts. Business has seen new horizons in this growing market. Huge opportunities are seen in particularly developing nations. Reduction in subsidies by governments clearly indicates that the industry is growing on its own. World wide acceptance of renewable is thankful to advancements in technology sup-

port of governments, novel financial methods and falling price. It is expected renewable energy sources like wind and solar will lead the energy sources in future to meet energy demand. Initially investments in solar and wind industries were seen as a risk but now scenario has totally changed. Industries are making profit in the market of renewable. Advancements in technology leading to falling price are increasing profit margin.

This may be seen in the light of increasing demand of energy. Global power generation crossed the mark of 1500 GW by 2013. It was for the first time in history of renewable that, globally solar PV crossed wind power. Viewing the record of merely last five years, it has been seen that solar PV is expanding at very high rate. Its average growth is 55% annually. Many countries are making policies in this regard for example, signing pacts or MoUs with renewable energy suppliers for the purchase of energy. This motivates the industrialist for setting a target of generation without worrying about consumers. At the end of 2013, China, US, Brazil, Canada and Germany are leading the world with reference to total installed capacity. However, without considering hydro power, China, US, Germany, Spain, Italy and India. Countries like Costa Rica, Urugway, Mauritius were leading countries in investment in renewable energy. Few more indicators at glance : Compared to 2012, global solar investment has declined by 22% but installed capacity rose by nearly 32%. For the first time China surpassed the power generation by renewable to power generation by fossil fuels. In 2013, solar met 8% of total annual power demand. Countries like Denmark are banning fossil fuels for building heating aiming 40% share by 2020 through renewable resources. It suitability can be seen from the fact that, wind power was kept away in power auction as it was putting out others from the competition itself due to lower pricing of wind generation. Awareness increase can be realized by the fact that Cities like Djibouti, Scotland and island of Tuvalu are planning to generate its total energy demand by renewable. Approximately 6.5 million people are connected directly or indirectly to this sector. Following table through the light on ever increasing investments in renewable field.

Table 1. Ever increasing investment in renewable energy

	START 20041	END 2012	END 2013	
INVESTMENT				
New investment (annual) in renewable power and fuels2	billion USD	39.5	249.5	214.4 (249.4)
POWER				
Renewable power capacity (total, not including hydro)	GW	85	480	560
Renewable power capacity (total, including hydro)	GW	800	1,440	1,560
Hydropower capacity (total)3	GW	715	960	1,000
Bio-power capacity	GW	<36	83	88
Bio-power generation	TWh	227	350	405
Geothermal power capacity	GW	8.9	11.5	12
Solar PV capacity (total)	GW	2.6	100	139
Concentrating solar thermal power (total)	GW	0.4	2.5	3.4
Wind power capacity (total)	GW	48	283	318
HEAT				
Solar hot water capacity (total)4	GWth	98	282	326
TRANSPORT				
Ethanol production (annual)	billion litres	28.5	82.6	87.2
Biodiesel production (annual)	billion litres	2.4	23.6	26.3
POLICIES				
Countries with policy targets	#	48	138	144
Feed-in Number of states / provinces / countries	#	34	97	98
RPS / quota policies Number of states / provinces / countries	#	11	79	79
Tendering Number of states / provinces / countries	#	8	45	55
Heat obligations / mandates Number of countries	#	n/a	19	19
Bio fuel obligations / mandates5 Number of countries	#	10	52	63

Source: Renewable 2014 Global status report of REN21, Renewable energy policy network for 21st Century

Solar PV Market worldwide

Among all renewable, after hydro power, solar PV industries are installing more capacity than others. More than s half capacity has been added in last couple of years only. China has surpassed Europe in this regard. Developing nations of Asia are also emerging at a very rapid rate. Asia added 22.7 GW by end of 2013. Other than Asia, 16.7 GW was added worldwide. Globally falling from first to fourth, Germany remained at top position in EU adding 3.3 GW. Australia emphasized on roof top system adding 3.3 GW. This reduced electricity bills of almost one quarter of South Australia.

South American continent has yet joined the race except few countries like Brazil and Chile. Many other countries have projects in pipeline. Even oil rich countries like Kuwait, Saudi Arabia etc are also joining hands in the growth of solar PV energy. It is expected that by 2014 , global combined PV generation will rise to 5.1 GW

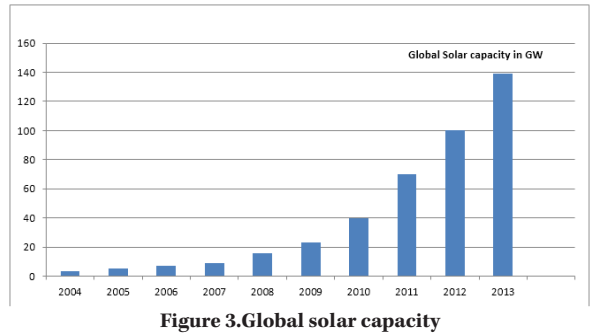


Figure 3.Global solar capacity

Concentrated solar Thermal power

Even when net power generation using PV cells has surpassed many renewable, yet the significance of CSP cannot be ignored due to its simplicity and capacity to generate power even after sun set. US and

Spain are leading the world in csp domain by sharing more than 80% generation. The solar tower of Nevada dessert in US had become very famous worldwide in last decade reveals its attraction. Mainly parabolic trough technology is used to concentrate the solar radiation. United states added 375 MW at the end of 2013, leading the world, where as Spain added 350 MW. Other many countries have projects in pipeline.

Conclusion

World is racing fast with itself with reference to solar energy. Now the importance of renewable resource is understood due to its innocence and demerits of conventional resources. Initially the per unit price of electricity generated through PV cells was higher, but due to advancements in technology,

price is decreasing. This has motivated people to lean towards non conventional resources. Governments are also motivating industries as well as people by tax concession and subsidies. The future of solar energy is bright as conventional sources are diminishing and polluting the Earth. There are two prominent methods to harness solar energy, viz, CSP and PV. CSP technology concentrates the solar radiation in a big ground. This radiation is reflected to high tower containing element having low melting temperature, which is used to exchange the heat. Which generates steam which in turn used for rotating turbine for generation of electricity. Second method, uses PV cells , which directly converts solar radiation energy in to electricity using photo voltaic effect. This second method requires less space as compared to former. Sooner or later world will have to lean towards renewable resources like solar and wind for the future sources of energy.

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