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THE FUTURE OF RENEWABLE ENERGY: Can Solar PV be the right alternative for Pakistan?

Sufficient and secure energy is the main enabler for welfare and economic development of a society. As energy-related activities have significant environmental impacts, it is indispensable to provide an energy system which covers the needs of the economies and preserves the environment.

Fundamental structural changes in the energy sector, called energy transitions, occur worldwide. The past 15 years have seen unprecedented change in the consumption of energy resources. Unexpected high growth in the renewables market, in terms of investment, new capacity and high growth rates in developing countries have changed the landscape for the energy sector. We have seen the growth of unconventional resources and improvements in technology evolution for all forms of energy resources.

Global footprint of renewable energy

Renewable energy is a fundamental and growing part of the world's ongoing energy transformation. Governments all over the world are joining that consensus. The use of renewables is their prime choice for enhancing access to affordable, reliable and cleaner sources of modern energy services.

More than 170 countries have established renewable energy targets, and nearly 150 have enacted policies to catalyze investments in renewable energy technologies. Many are looking to partner with an increasingly active private sector. According to nearly every measure, renewable energy is gaining ground.

Today, one out of every five units of energy delivered to consumers comes from renewable sources. This is remarkably evident in the power sector, where renewables are growing at unprecedented rates, far outpacing growth in conventional technologies. At 154 gigawatts (GW), capacity from renewables represented 61% of all new power generating capacity added worldwide in 20151.

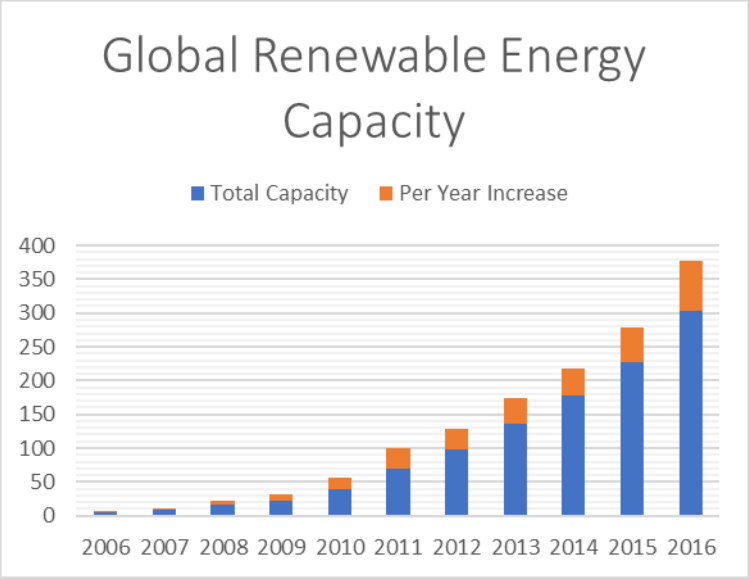

Figure 1: Global Renewable Energy Spike

Renewables are now the first-choice option for expanding, upgrading and modernizing power systems around the world (as depicted in Figure 1). Wind and solar power, which commanded about 90% of 2015 investments in renewable power, are now competitive with conventional sources of electricity, as their costs have plunged in recent years. Global investment in renewables has shown steady growth for more than a decade, rising from less than USD 50 billion in 2004 to a record USD 348 billion in 20152, including large-scale hydropower.

Solar PV Market: International Trends and Pakistan

During 2016, at least 75 GW of solar PV capacity was added worldwide – equivalent to the installation of more than 31,000 solar panels every hour[3]. More solar PV capacity was installed in 2016 (up 48% over 2015) than the cumulative world capacity five years earlier.

For the fourth consecutive year, Asia eclipsed all other markets, accounting for about two thirds of global additions. The top five markets – China, United States, Japan, India and the United Kingdom – accounted for about 85% of additions, others in the top 10 for additions were Germany, the republic of Korea, Australia, the Philippines and Chile[4].

Market expansion was due largely to the increasing competitiveness of solar PV, as well as rising demand for electricity and improving awareness of solar PV's potential as countries seek to alleviate pollution and reduce CO2 emissions. In many emerging markets, solar PV now is considered a cost competitive source for increasing electricity production for providing energy access. Nevertheless, markets in most locations continue to be driven largely by government incentives or regulations.

[1] http://www.irena.org/DocumentDownloads/Publications/IRENA_REmap_2016_edition_report.pdf
[2] https://www.coursehero.com/file/23666057/solar-89/
[3] http://www.solarcity.co.nz/blog/global-solar-stories/the-rise-of-global-solar-pv-electric-vehicles-sales-hit-new-high-in-nz/
[4] http://www.ren21.net/gsr-2017/pages/summary/summary/

In Pakistan, the use of solar energy is in still in its evolutionary stage. Pakistan mainly depends upon the conventional energy resources and there is not much effort for the utilization of RE resources for electricity generation. Due to over dependence on fossil fuel, presently more than 60% of the foreign exchange is spent for the import of energy. Currently Pakistan imports 308.9 thousand barrels per day and the indigenous production is less than 63,000 barrels per day[5].

It is estimated that load shedding is costing $2.5 billion/year to Pakistan's economy which is on average 2% dent to the country's GDP[6]. In addition, it has also caused a loss of employment to around 400,000 people annually within Pakistan. According to a survey by World Bank, 66.7% of the businesses in Pakistan identify shortage of electricity as the major business obstacle ahead of corruption and crime/terrorism which are 11.7% and 5.5%, respectively[7].

Pakistan has four main renewable energy solutions. These are wind, solar, hydro and biomass. The prospects of solar energy in Pakistan have also been widely investigated by many researchers. Alternative Energy Development Board has estimated that Pakistan has about 2900 GW of solar power potential[8].

Despite having enormous potential for solar power, generation capacity in Pakistan is almost non-existent. Germany, which receives almost one third less sun shine in a given year compared to Pakistan, generated almost 37,780 GW using solar power in 2013, which was equivalent to 43 percent of total power produced in Pakistan in FY15[9].

Pakistan's commercial and non-commercial sectors can benefit greatly by riding along the renewable energy bandwagon. Following are the case studies from different parts of the world which present success stories in solar PV installation through use of innovative ideas and technology.

[5] https://www.researchgate.net/publication/257548407_Technological_review_on_solar_PV_in_Pakistan_Scope_practices_and_recommendations_for_optimized_system_design?_sg=BCbyiIJMIrhLhP96AUfjhJdzQqM2OHcJWnCvN1EfKRD-UUznyPCzX0XyfAc5kxkCr0VjLbrbSk5TjvEn4ag_tal7opEf42og141Ud3FRKxFiKw

[6] https://www.dawn.com/news/1275116

[7] https://www.researchgate.net/figure/262764264_fig1_Fig-3-Solar-map-of-Pakistan-developed-by-NREL-and-USAID-23

[8] https://www.eniday.com/en/sparks_en/a-renewable-solution-to-pakistans-crisis/

[9] http://www.sbp.org.pk/reports/annual/arFY15/Energy.pdf

Case Study 1:

Solar Powered Irrigation System to facilitate the Sustainable Energy Access for the Off-Grid Area Population of Bangladesh

Agriculture is one of the major driving forces in Bangladesh's economy. Agriculture contributes 18.64% of its GDP, 48% of total labor force and 12% or export value[10]. During peak cultivation season 120 million acres of rice field is irrigated by 1.33 Million different types of water pumps, among which 87% are diesel operated.

Figure 2: Solar Powered Irrigation System

A commercial model of Solar Irrigation magically transformed the livelihood of farmers in the remotest Rangpur area of Bangladesh as shown in Figure 2. The first ever commercial solar irrigation system was installed at the remotest off-grid villages of Mamuderpara, Chengmari, Mithapukur in Rangpur region of Bangladesh. No modern irrigation facilities were available to help them grow crops round the year.

This installed solar pump is supplying irrigation water to a farmer's community comprising of 30 farmers. The successful introduction of the system helped farmers to shift from single crop to three crops in a year and irrigating 20 Acres BORO paddy in last season followed by 50 Acres vegetable field irrigation. Solar Array of 11.5 KWp with adjustable sun tracker system was set up on the aisle beside a lake that propels a 10HP solar submersible pump for irrigation. The panels utilize 8 hours of daily sunshine they receive with sun tracker to provide uninterrupted water supply.

The project is now irrigating 20 Acres of rice fields, along with round the year irrigation solution for other cash crops optimizing irrigation cost for the farmer group for the lifetime. The farmers at the project are getting irrigation at the expense equivalent to current diesel run irrigation systems with payback within 8 years and the initial expenditure is going to be recovered within 5-7 years. This project saves nearly 26-ton carbon dioxide emission per year. Solar pumps also help in ground water conservation.

[10] http://www.wame2015.org/case-study/1132/

Case Study 2:

Business Opportunities with Solar Systems in Somaliland

Somaliland is situated in the northern part of Somalia, where the electricity grid is poorly developed. It is estimated that 75% of the population have mobile phones, which are mostly used for communication, but also for banking. Thus, the need for recharge is huge for private households and businesses. The commercial sector in rural areas is often poorly developed. The main activities in coastal areas is fishing. Due to the lack of cooling opportunities, fishermen were unable to preserve their catch.

Figure 3

Off-grid solar power systems (shown in Figure 3) can be an important factor to support rural development in areas that are not connected to the electricity grid. The Phaesun Business Opportunities with Solar Systems (BOSS) solutions target specifically the commercial sector in unelectrified areas.

Since 2012 the project partners have been developing and implementing entire BOSS solutions for the business needs of the users.

• Solar charging stations were developed and set-up in different locations in Somaliland. Besides the charging of mobile phones, LED lamps with integrated battery (Ulitium lamps) were rented to be charged again at the charging station.

• Refrigeration kits were also introduced so that fishermen could produce ice to cool their fish and subsequently transport them in cooling boxes to the cities. As a result, the fishermen achieved higher margins because they were now able to sell fresh fish in the cities

Since the first introduction of BOSS solutions in Somaliland in 2012, the number of interested entrepreneurs has grown steadily. Until mid of 2015, more than 30 solar charging stations for cell phones and lamps have been opened. Furthermore, 30[11] solar cooling kits have been installed at fishermen places, shops and restaurants.

Customers of kiosks and restaurants were able to experience even more services with solar-powered equipment like fans and TVs. By combining many different off-grid solar systems in the village square and as the quotidian life of the locals is mainly concentrated around village squares, a potential solar market place is in the pipeline. Such a place will have a major influence on the daily life interactions and prosperity of communities.

[11] http://www.energyafrica.de/fileadmin/user_upload/Energy_Africa_16/EA16_Phaesun_Boss.pdf

Future of Solar in Pakistan and the Way Forward

Pakistan faces lingering energy crisis due to the poor generation capacity, rising demand for oil and gas, system losses, untargeted subsidies, and lack of an overarching integrated energy policy. Currently, the country is not able to produce the required energy demand. With 22,158 MW installed capacity averaging almost 18,000MW, the short fall stands at 5000-7000 MW per day (NEPRA). It may be mentioned that 30[12] per cent of Pakistan's population has no access to the formally supplied power. If this segment of the population has to be serviced, the officially estimated demand will actually be a number greater than 7,000MW.

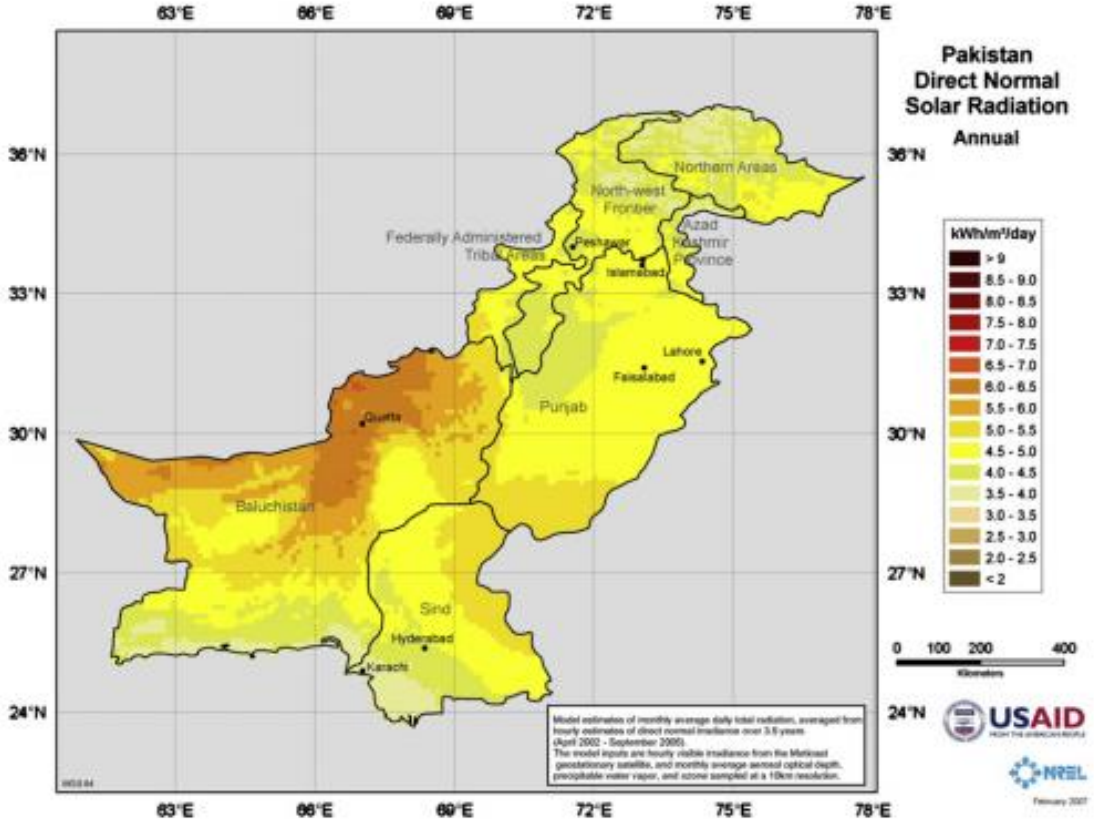

Figure 4: Solar Potential in Pakistan

[13]Solar energy is a viable option for Pakistan and the government has taken concrete steps in the right direction with projects such as Quaid e Azam Solar Power Project. To support the common belief that solar energy is the way forward, a research study found that If 0.25%[14] of Balochistan was covered with solar panels with an efficiency of 20%, enough electricity would be generated to cover all of Pakistani demand. As depicted in Figure 4, a USAID Study shows that Pakistan's solar potential is immense throughout the country, especially in Balochistan.

[12] https://www.sdpi.org/publications/files/Fund-raising-for-Energy-Projects-in-Pakistan(W%20-%20149).pdf
[13]https://www.researchgate.net/publication/257548407_Technological_review_on_solar_PV_in_Pakistan_Scope_practices_and_recommendations_for_optimized_system_design?_sg=BCbyiIJMIrhLhP96AUfjhJdzQqM2OHcJWnCvN1EfKRD-UUznyPCzX0XyfAc5kxkCr0VjLbrbSk5TjvEn4ag_tal7opEf42og141Ud3FRKxFiKw
[14] http://www.tbl.com.pk/the-feasibility-of-renewable-energy-in-pakistan/

Furthermore, solar energy makes much sense for Pakistan: 70%[15] of the population lives in 50,000 villages that are very far away from the national grid, according to a report by the Solar Energy Research Centre (SERC). Connecting these villages to the national grid would be very costly, thus giving each house, a solar panel would be cost efficient and would empower people both economically and socially.

Conclusion

In this paper, we have shown that over the past decade, solar energy has experienced one of the most remarkable growth curves and cost reduction trends in renewable energy technology sector. Solar PV solutions are a potential way forward strategy for Pakistan's energy sector as well. Given the solar radiation intensity being favorable as per multiple research studies and technology options becoming more and more affordable, industries and corporations need to increase their focus on this alternative. The case studies highlighted in this paper show distinct examples which have helped entities both at commercial and non-commercial level. Clearly a new age for solar has arrived for Pakistan to consider – which needs to be pushed forward by support of the federal government but also driven by momentum from private partners.

[15] http://www.tbl.com.pk/the-feasibility-of-renewable-energy-in-pakistan/