Tracking Distributed Generation Growth in Pakistan

Issue Brief

1. Introduction

Over the past few years, solar PV has emerged as one of the most competitive and versatile technology for power procurement. Geographically located in the solar belt, Pakistan has naturally high potential for renewable energy sources with long sunshine hours ranging between 8 and 8.5 hours per day[1] and solar irradiation exceeding 1500kWh/m^2 annually in most parts of the country.[2] Against this context, in a bid to promote renewable energy, net-metering regulations were introduced in 2015.[3] It allowed for self-consumption of renewable electricity to all category type of consumers of capacities up to 1 MW and sale of excess generation to distribution companies (DISCOs).

The objective of this issue brief is to present, track and interpret most recent developments in the distributed generation market in Pakistan. The brief provides a detailed picture on year-wise, distribution company-wise and sector-wise growth of DG solar up to December 2020. For the analysis carried out here, a detailed database on the solar PV installations under the net-metering regulations was assembled using relevant information from individual licenses. The licenses issued for DG in Pakistan are regularly uploaded by NEPRA on its official website. As Pakistan has 11 major DISCOs, these licenses are uploaded into categories divided on the basis of DISCOs and then further compiled into year-wise categories under each DISCO. This information was stored in MS Excel interpreted using R statistical software. [4]

2. Distributed Generation in Pakistan: Status and Outlook

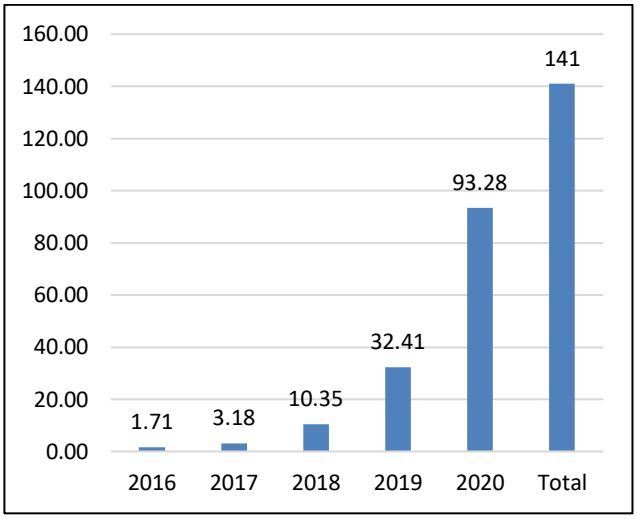
Before delving into the quantum of DG uptake, it is important to note that although net-metering regulations allow electricity generation from distributed solar and wind generators, all net-metered systems installed to date are rooftop solar PV systems. Pakistan has 11 major DISCOs/utilities.[5] These DISCOs/utilities have a significant role in the entire process of DG uptake since they are the key intermediaries responsible for connecting the consumers to the grid. Any reluctance or inertia on behalf of DISCOs in implementing the understated regulations might stifle or slow down the growth of DG in the country. Following section provides a comprehensive review of distributed generation installed capacity in Pakistan.

a. Total Installed Systems and Capacity

At the end of 2020, DG solar reached cumulative 8,006 installed systems. 93.8 MW of DG solar were installed in 2020 alone, bringing the total installed capacity to over 141 MW. **Fig. 1** illustrates year-wise growth of distributed generation.

[1] Shakeel, Shah Rukh, Josu Takala, and Waqas Shakeel. "Renewable energy sources in power generation in Pakistan." *Renewable and Sustainable Energy Reviews* 64 (2016): 421-434.
[2] Solargis, "Global Solar Atlas", World Bank. https://globalsolaratlas.info/map
[3] NEPRA. 'Distributed Generation and Net Metering Regulations', (2015).
[4] Despite the information on all licenses being publicly available online, the information is very scattered as each license has to be opened individually to check details on the system size, type of technology, category/sector of installation and so on.
[5] This brief does not take into account 2 small private utilities namely Bahria Town and DHA -XII.

Fig. 1 Year-wise Distributed Generation Installed Capacity (MW)



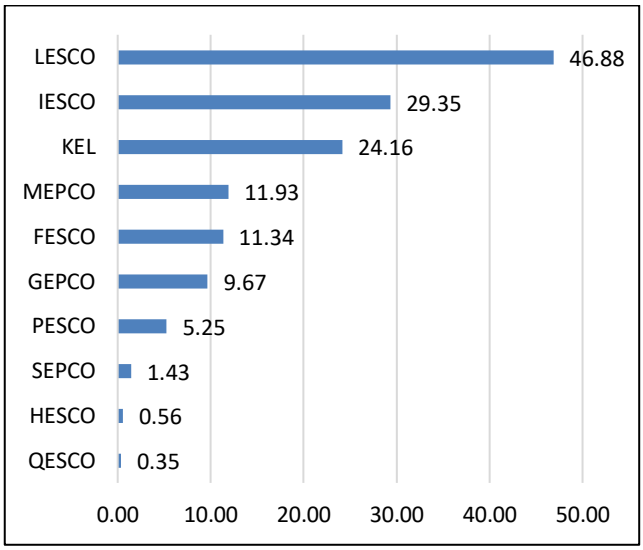
The overall year-wise DG growth data shows a positive trend line, registering positive growth with every subsequent year. The year-wise installations particularly illustrate big jumps in the years 2019 and 2020— registering 220% increase in 2019 and 187% in 2020. However, when it comes to the overall contribution of DG in the national energy mix, it remains negligible standing at less than 0.5% of both total installed energy capacity and generation mix.

Looking at the DISCO-wise distribution of DG, **Table 1** showcases the total no of connections under each utility, and the distribution of licenses issued by each DISCO till December 2020. In parallel **Fig. 2** illustrate the installed capacity (MW) under each DISCO during the same time period.

Table 1 DISCO-wise Licenses Issued to Distributed Generators

DISCOs	Total Connections	Net-Metering licenses/DG Systems
LESCO	4,598,784	2,492
IESCO	2,837,238	2,236
KEL	2,583,435	1,461
MEPCO	6,072,783	615
FESCO	3,953,132	459
GEPCO	3,326,274	381
PESCO	3,330,907	342
HESCO	1,080,714	8
SEPCO	745,308	6
QESCO	609,004	6
TESCO	442,401	0

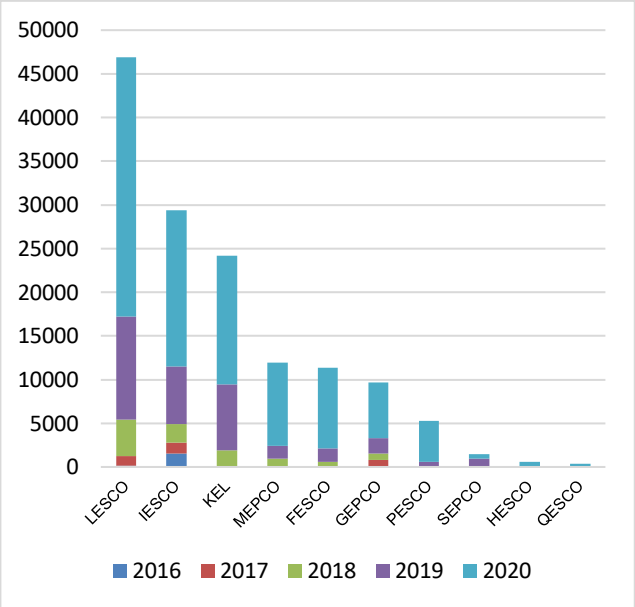
Fig. 2 DISCO-wise Distributed Generation Installed Capacity (MW)



The problem of uneven DG uptake continues. LESCO, IESCO and KEL continue to dominate the DG drive. These three DISCOs collectively account for more than 70 percent of the total installed capacity. Following these, MEPCO, FESCO, GEPCO, PESCO and SEPCO respectively have so far installed 11.93, 11.34, 9.67, 5.25 and 1.43 MW of capacity within their respective jurisdictions. The remaining three DISCOs however are still in the early phase of embracing DG—HESCO and SEPCO have so far issued eight and six licenses respectively. Finally, TESCO is the only utility which has yet not issued any license under the net-metering regulations for DG.

Fig. 3 shows the year-wise trend of DG installed capacity (kW) across the 11 DISCOs. As can be observed, IESCO and LESCO were the two pioneer utilities embracing DG in 2016, i.e. one year after the regulations were issued. GEPCO emerged as the third utility turning to the distributed generation. Following it, KEL, PESCO, MEPCO and FESCO also embraced DG uptake in 2018. The years 2019 and 2020 proved the paradigm point where except for TESCO, all DISCOs at least embraced the regulations and issued a couple of DG licenses to the end-users within their respective jurisdictions.

Fig. 3 DISCO-wise and Year-wise Distributed Generation Installed Capacity (kW)



b. Sector-wise Trend of Installed Capacity

Distributed generation offers a host of benefits to different categories of end-users. A major objective of this study was also to see which sectors in Pakistan are currently engaged in DG and so are driving the growth.[6]

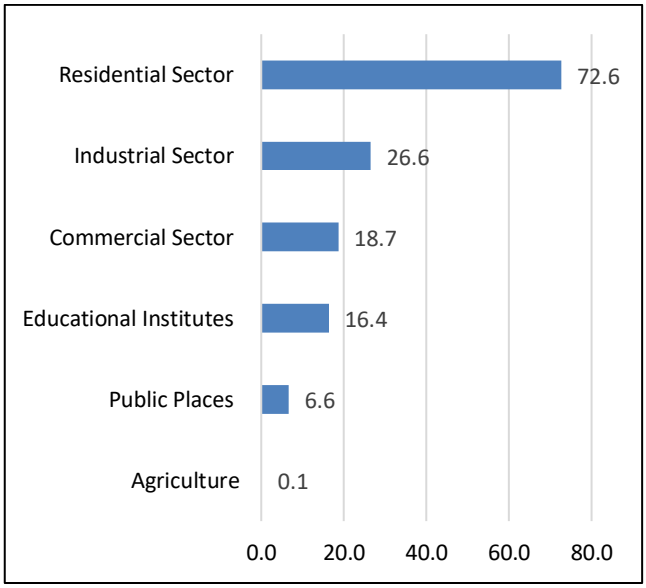
Based on the sample size and type of installed capacity, we constituted them into five broader categories (a) Households (HH)/Residential sector (b) Industrial sector (c) Commercial sector (d) Educational institutes both public and private including schools and universities (e) Public places (including offices, hospitals and mosques) and agriculture. **Table 2** showcases the overall sector-wise and category wise distribution of DG uptake in Pakistan.

As may be observed, the residential sector remains at the forefront of the DG drive and is the largest electricity consumer in Pakistan accounting for 72.6 MW of installed capacity. In terms of installed capacity, this accounts for 51% of the total DG. Industrial and commercial sectors are the second and third leading sectors accounting for 26.6 MW and 18.7 MW of installed capacity respectively. Further, public institutes and educational institutes have also installed an estimated capacity of 6.6 and 16.3 MW respectively. Table 2 shows the category-wise distribution of DG in the country in terms of number of licenses as well as installed capacity, whereas Fig. 5 shows the distribution of installed capacity (MW) in these different categories.[7]

Table 2 Category-wise Distributed Generation [8]

Type	Net-Metering licenses/DG Systems	Installed Capacity (MW)
Residential Sector	7,033	72.6
Industrial Sector	177	26.6
Commercial Sector	398	18.7
Educational Institutes	191	16.4
Public Places	144	6.6
Agriculture	1	0.1

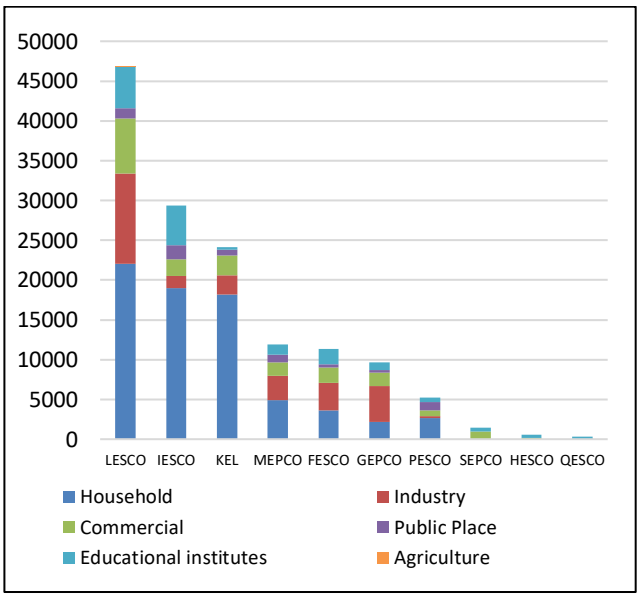
Fig. 4 Category-wise Distributed Generation (MW)



[6] It is important to note here that the licenses issued to the distributed generators did not explicitly mention the category/sector of the prosumers. However, for tracing it, multiple strategies were used such as taking an idea from the address, system size and in some complex cases—contacting the end-user and confirming the category/sector of the distributed generator.
[7] Out of 8,006, the information of 43 licenses was not found in data compiling process, information regarding their installed capacity and type of installation is not known.
[8] In terms of number of licenses, 53 observations were dropped owing to missing values on NEPRAs website.

Further probing this dimension, **Fig. 5** shows the breakdown analysis of sector-wise DG uptake in different DISCOs. Except in the case of two utilities, i.e. GEPCO and SEPCO, household sector continues to dominate the distributed generation installment across all DISCOs. In the case of GEPCO, installed capacity of the industrial sector is greater than the households sector. LESCO has the highest installation capacity in the industrial sector.

Fig. 5 Category-wise distribution of Installed Capacity (KW)



Another important dimension of analysis is to check the average, maximum as well as minimum installed capacity in each category. In this context, **Table 3** illustrates important information on the stated dimensions of installed capacity under different categories. The mean household installed capacity was the lowest among all category types standing at 10.32 kW whereas mean DG capacity for the industrial sector was found to be the largest observed mean, standing at 150 kW. In parallel, the maximum installed capacity for the residential, commercial and industrial sector stood at 410, 998.4 and 1000 kW of installed capacity respectively. In case of public places and educational institutes, it was recorded at 1000 kW respectively. Likewise, minimum installed capacity of commercial sector was found to be the highest (4.5 kW); whereas it was the lowest in case of households (1.06 kW). For the remaining two sectors namely industrial and educational institutes, it stands at 3 kW and for public places it stands at 2.38 kW.

Table 3 Summary of Category-wise Installed Distributed Generation Capacity (KW)

	Mean	Median	Minimum	Maximum
Residential Sector	10.32	9.75	1.06	410
Industrial Sector	150.0	71.28	3	1000
Commercial Sector	46.89	20.2	4.5	998.4
Public Places	45.68	15.4	2.38	1000
Educational Institutes	85.60	45.5	3	1000

3. Concluding Remarks

During the past few decades, Pakistan's electric utility system has faced immense challenges. Despite multiple reform initiatives, the electricity sector continues to face many of the same problems that existed earlier including heavy reliance on imported fuels, inefficiency of transmission and distribution networks, rising energy prices and growing vulnerability related to environmental implications of energy use. Expanding renewable base and tapping the huge indigenous renewable resources stands out as the most important and viable pillar for sustainable growth in energy sector. In this regard, decentralised energy generation has opened a universe of opportunities. DG drive could help fully harness the immense rooftop PV potential, bringing paradigm change in the existing fossil-fuel dominated power sector. Extended scale self-generation could also help simultaneously in achieving Sustainable Development Goals 7, 11, and 13 and address the prevailing intertwined challenges of energy security and energy deprivation.

The year-wise DG solar growth in Pakistan is clearly increasing overtime, which is an encouraging sign. However, as a percentage of generation mix, overall distributed generation in the country is still in its infancy. Further, mostly this growth tends to be concentrated in few DISCOs and most utilities are still in the transition phase of embracing it fully. Finally, although all sectors are engaged in distributed

generation yet residential sector continues to be at the forefront of this drive.

With a more supportive and enabling environment, DG solar could certainly become a powerful tool to unlock the drive toward indigenous renewable resources. It is very important to understand here that for Pakistan, net-metering does not offer an 'irresistible alternative' for advancing renewable energy but a 'necessary prescription for the ailing power sector', a much overlooked discourse. DG solar could simultaneously play a crucial role in meeting the renewable energy targets as set under Alternative Renewable Energy Policy (2019) while kickstarting the country's nascent renewable energy market, gradual phase out of subsidies in power sector, devolution of capacity payments to end-users, and adding low-cost power production capacity to the country's installed generation base. In conjunction, the context/country-specific conditions in terms of ideal solar irradiance in most parts of the region, physical landscape and free rooftop spaces, huge number of end-users, and strong demand forces, further align with the desirability of solar energy adoption among general populace.

To conclude, DG solar is increasingly driven by the natural competitiveness of solar technology, strong supplementary forces including strong demand and favourable architectural landscape in several segments. While the future of the PV sector is bright given the technological and price developments, the real challenge remains to catalyze the DG drive. All that is needed is an enabling environment and strong state-level enthusiasm to promote and advance the decentralized solar PV uptake. As a first step, the existing administrative, contractual, and financing challenges need to be addressed on priority basis. In parallel, explicit targets shall be set for rooftop solar and overall distributed generation. For reaching the set targets, a combination of approaches encompassing, but not restricted to facilitating the DISCOS, business model innovation, supportive policies and awareness programs should be introduced. If distributed generation is to become widely adopted, then the government should pull itself together and undertake a more proactive approach toward its diffusion. The sooner an intervention framework is designed and implemented, the more likely it is going to catalyze the prosumage drive.

***For an in-depth overview of challenges and barriers restricting DG Growth in Pakistan, please check IPS' published report.**

https://www.ips.org.pk/barriers-and-drivers-of-solar-prosumage-a-case-study-of-pakistan/

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