State of Pakistan's Power Industry from NEPRA's Eyes

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NEPRA has recently issued its flagship annual State of Industry Report 2021 ("SIR21"). The purpose of such reports generally is to provide an overview of the regulated business, summarize the major developments during a specified period, state the regulator's position on key issues facing this business, and offer insight into its approach to regulating this business in the future. From this perspective, NEPRA has done a good job as SIR21 is much improved and comprehensive compared with this report's previous editions. However, we take exception to NEPRA's position on a few issues and in the second half of this article discuss as to why? But first let's have a snapshot of the state of affairs in the power industry in the previous fiscal year, as NEPRA has captured it.

In Fiscal Year 2020-21 ("FY21"), total installed generation capacity in the country (NTDC plus K-Electric systems) reached 39,772 MW of which roughly 25% was hydro-electric plants, 63% was thermal plants (gas, coal, and RLNG), 6.7% was nuclear, and 5.4% was renewable-based plants (bagasse, solar, and wind). Dependable total capacity in the country was estimated to be 37,271 MW or roughly 94% of the installed capacity. The maximum generating capability, due to operational limitations, was only around 31,243 MW.

NTDC's system in FY21 comprised of 8,059 km of 500-kV and 11,438 km of 220-kV lines. It was supported with sixteen 500-kV grid stations with cumulative transformation capacity of 30,610 MVA and forty-six 220-kV grid stations with 25,770 MVA capacity. The transmission system of K-Electric during FY21 consisted of 365 km of 220-kV and 833 km of 132-kV lines. It was supported with eleven 220-kV grid stations and sixty-nine 132-kV grid stations with transformation capacities of 4,580 MVA and 7,135 MVA, respectively. A hallmark of the country's transmission gird is the construction of its maiden ±660-kV high voltage direct current (HVDC) transmission system with design power transfer capacity of 4,000 MW over a length of about 886 km from Matiari (Sindh) to Lahore (Punjab).

As regards the distribution systems, during FY21, the ten DISCOs under the NTDC system had 29,495 km of 132-kV sub-transmission lines supported with 882 grid stations with cumulative transformation capacity of 55, 063 MVA and 349, 193 km of 11-kV feeders with 803,883 distribution transformers with cumulative capacity of 51, 555 MVA. The distribution networks of K-Electric comprised of 833 km of 132-kV lines supported with 69 grid stations with cumulative transformation capacity of 6,457 MVA and 10,283 km of 11-kV feeders with cumulative capacity of 8,153 MVA. The ten DISCOS under the NTDC system served around 31.5 million consumers while K-Electric served around 3.2 million.

The energy produced by the power generation plants in the country during FY21 totaled 143,090 GWh and was contributed roughly in a similar proportion as the capacity-mix (more precisely, 27% by hydroelectric plants, 61.76% by thermal plants, 7.72% by nuclear plants, and 3.15% by renewable energy plants. Just to complete the picture, imports from Iran amounted to 104 MW of capacity and 498 GWh of energy contribution (or 0.35% for each).

During FY21, electricity sales in the country by the ten DISCOs and K-Electric totaled 121,206 GWh of which 47% were consumed by residential consumers, 7% by commercial consumers, 25% by industrial consumers, and the rest was consumed by a variety of other consumers.

Peak demand in the country during FY21 was recorded as 28,179 MW on 17 August 2020 around 3 pm, reflecting a slight shift from its historic occurrence during Junes. The peak demand during winter was recoded as 16,774 MW on 29 December 2020 around 6 pm. The peak demand in the K-Electric system of 3,604 MW was recorded on 3rd July 2020. While the energy requirements in the system increased in FY21 by 7% from FY20, peak demand increase of 7.6% slightly outpaced the energy demand increase, reflecting a gradually worsening load factor or increasing "peakiness" of the system.

A total of 5,348 villages were electrified during FY21 increasing the cumulative total to 193,900 in the NTDC system bringing the proportion of electrified villages to 84% in the country. No new village was, however, electrified last year in the K-Electric system maintaining the proportion of electrified villages in its system at 98%. There were 484,138 applications still pending for connection to the grid in the DISCOs under the NTDC system and 17,705 under the K-Electric system. The SIR21 also notes that there is 2,500 to 3,000 MW of demand almost daily that had to be shed for a variety of reasons.

Against the PKR 1,799, 367 million billed for 99,372 GWh of sales, the DISCOs under the NTDC system were able to realize PKR 1,750,814 million in revenues, a recovery rate of 97.38%. K-Electric on the other hand was able to realize PKR 299, 672 million in revenues against its billed amount of PKR 315,872 million for its sales of 16,068 GWh, a recovery rate of 94.83%.

Losses in the NTDC system amounted to 2.78% while those in the distribution systems (in sub-transmission and distribution networks) amounted to 17.95%. HESCO, PESCO, SEPCO, and QESCO led the DISCOs in terms of higher losses in their systems while IESCO, LESCO, GEPCO, and FESCO maintained their good records during FY21 as well. Losses in the K-Electric system were around 17.54%.

The circular debt in the power grid, in which system losses and poor revenue recoveries figure prominently, increased to PKR 2,280 billion in FY21 as compared to PKR 2,150 billion for FY20, amounting to a 6% increase.

FY21 was not a good year in terms of safety as 189 fatalities were reported in the power grid of the country. These fatalities included 47 employees and 142 people from general public. Highest number of fatalities (46) were reported in K-Electric system followed by HESCO with 32 fatalities, PESCO with 23 and IESCO with 22 fatal accidents.

All in all, NEPRA's SIR21 is an excellent document as it provides a comprehensive insight into the state of Pakistan's power supply industry. It is structured and written nicely as well as professionally. Exposition is smooth as well as lucid. The main body of the report is supplemented with a set of statistical tables which contain a treasure of useful data, almost to the extent of making it exhaustive. NEPRA must be commended for bringing out a report that will be extremely useful for the industry participants, stakeholders, potential investors, academia and researchers as well as the general public. There are, however, a few issues discussed in the SIR21 on which NEPRA's stance does not appear correct or can be

disputed. Since the space does not permit covering all such issues, below we discuss only a few of these, and leave the rest for another time.

Strangely, the very reason for which the whole power industry exists—consumer demand—is absent from the main body of the SIR21. Readers' first encounter with consumer demand is in section 4.5 on page 44 and even there only a passing reference. The SIR21 does provide some tables in its statistical supplement on the peak demand recorded in the NTDC and K-Electric systems and various DISCOs, but these are no substitute for a proper chapter to provide analysis of consumers' demand for electricity in the country and how its magnitude and temporal and spatial patterns are impacting the generation, transmission, and distribution systems. NEPRA must accord this aspect of the industry the seriousness it deserves at least to the same extent as it treats generation, transmission, and distribution systems.

Reading the SIR21, one gets the impression that on most issues facing the power industry in Pakistan today, NEPRA has taken an entirely hands-off approach. "Arm's length" or "light-handed" regulation is arguably more desirable than a "command and control" approach to dealing with the regulated industry, but not to the extent of making it just an annual ritual of lamenting that "we ordered them but they did not comply". If the NTDC, DISCOs, or GENCOs were not delivering on its requirements and targets, NEPRA should have engaged these entities more actively to understand their constraints and difficulties and helped them in overcoming their genuine problems. In the future editions of this report, it would be nice if NEPRA can provide a summary of the efforts it made to engage these entities actively to assist them in resolving some critical issues they face.

In the SIR21, NEPRA characterizes hydroelectric and bagasse-based plants "intermittent" and in later parts asserts that their addition into the grid necessitates an equal amount of backup from conventional plants. We take exception to both of these assertions. Solar and wind power plants are characterized intermittent because power from these can drop from full capacity to almost zero in a matter of moments if a thick cloud blocks the sun over the solar panels or wind stops blowing across the wind turbines. The available water resource for hydroelectric plants and biomass for bagasse-based plants may be limited in magnitude but these limitations are of a different nature and planners can predict the extent and pattern of their availabilities with some analytic effort. Even run-of-the-river type hydro plants cannot be characterized as intermittent.

The assertion that renewable (solar or wind) plants invariably require an equal amount of backup is also not correct. First, at low shares like the 4 to 5% in Pakistan, no extra backup is required to manage their intermittency and variability. The energy production from these plants is generally treated as a "negative load" at these levels, and the conventional grid is quite capable of handling some extra fluctuations in consumer demand. As the share of these plants in the grid increase beyond certain levels, these plants start to impose additional demands on the grid to cover their intermittency and variability. However, even at such higher shares, the assertion that these plants necessitate 100% backup from the conventional power plants is not true. Numerous options exist (not just restricted to backup generation) to develop and deploy these plants in the grid to minimize their negative impacts and maximize their contributions to the system.

Another issue the SIR21 raises multiple times and to which we take exception, is NTDC's not strictly adhering to Merit Order in the dispatch of generators as if this were the sole criteria for their dispatch. In reality, many factors compel system operators to deviate from the Merit Order, when scheduling as well as during dispatch. This fact is clearly established in the Grid Code. Section SDC 1.4.3 which specifies the scheduling process is quite clear on this issue. Clause SDC 1.4.3.2 specifies Merit Order as a starting point for scheduling and the very next clause lists 14 additional factors that can influence the tentative schedule. In fact, SDC 1.4.3.4 concludes by noting that "*Due to taking into account of and the application of the factors stated in SDC 1.4.3.3 shall mean that, in general, that the strict Merit Order as stated in SDC 1.4.3.2 may not necessarily be the final outcome in the shape of "Final Generation Schedule*". NTDC may have deviated from the Merit Order during its scheduling and dispatch and NEPRA has every right to verify that these deviations were for genuine reasons, but declaring such deviations as "violation of the Merit Order" is a bit too harsh and unjustified.

The SIR21 goes in considerable detail on the Authority's activities on Health, Safety, and Environment (HSE) and Corporate Social Responsibility (CSR), and in particular its new initiative under the banner "Power with Prosperity". It's worth reiterating that NEPRA's primary duty is to ensure affordable and reliable electric power to people and economy of this country. Poverty is considered the biggest polluter as it compels people to compromise on their health, safety, education, and quality of life. Therefore, all NEPRA efforts must focus on accomplishing these twin objectives, and not on tangential issues like HSE or CSR. The best way NEPRA can contribute to country's prosperity is by ensuring affordable and reliable electricity supply which is gradually slipping out of the reach of most citizens, businesses, and industries.

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