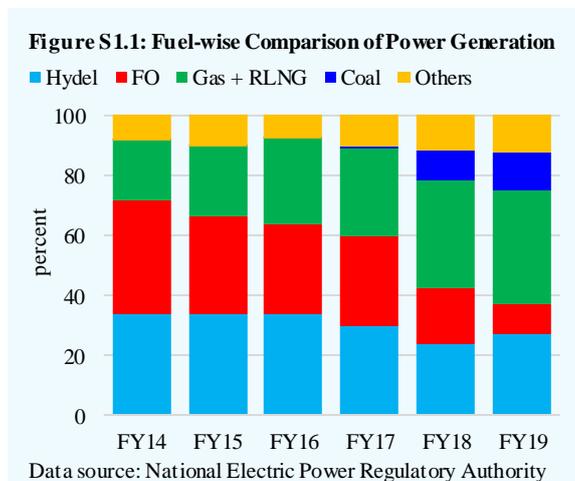


Special Section 1: Why are Power Tariffs in Pakistan Consistently High?

S1.1 Introduction

The power generation sector in Pakistan has undergone significant changes during the last 5 years. The overall electricity generation capacity increased by over 40 percent from June 2013, with a visible shift in fuel composition towards cheaper sources (**Figure S1.1**). The objective behind this transformation was to avoid power outages in the country and to make energy affordable. While a significant containment has occurred in load management over the past 5 years, the affordability issues persist. Instead of declining, power tariffs determined by Nepra remain stubbornly high, preventing the government from alleviating subsidy expenses meaningfully.



This section will look into detail the process of power tariff determination in the country and the reason why tariffs have not softened despite an apparent decline in fuel cost. The analysis suggests that capacity payments constitute the bulk of power tariffs in Pakistan, and a sharp increase in these payments in recent years has completely offset gains from declining fuel cost. It appears that until a significant amount of investment is done on transmission and distribution, the increase in generation capacities would keep electricity tariffs at escalated levels. Furthermore, if the government wants to do away with subsidies, it must carry out reforms in the entire power sector value-chain in order to ensure affordable electricity to households, exporters and other consumers.

S1.2 How are the power tariffs determined?

Before we dig deeper into the issue, it is important to understand how the power tariffs are determined. In accordance with the Nepra Tariff Standard & Procedure Rules, 1998, the authority determines the tariff for all the generation, transmission and distribution companies. Details are summarized in **Table S1.1**.

At the generation level, the tariff is determined based on power purchase agreements (PPA) between power producers (IPPs and public Gencos) and a

single buyer: Central Power Purchasing Agency (CPPA). The PPA allows calculating the revenue requirements for an individual power producer based on (i) a capacity charge, which includes costs pertaining to the design and construction of power units, the guaranteed return on equity, and debt financing charges, among others; and (ii) an energy charge, that covers variable costs, primarily fuel (which is based on a benchmark for fuel price by Nepra), and operation and maintenance (O&M) costs.¹

Table S1.1: Tariff Components at Various Stages of Power Supply-chain

| Generation | Transmission | Distribution (retail tariff) |
|---|--------------------------------|---|
| A. Capacity transfer charge Land purchase; design, procurement & construction; taxes & duties; fees and infrastructure; insurance; admin & utilities; financing fee; debt servicing charges; return on equity | | A. Power purchase price → Capacity transfer charge → Energy charge → Variable O&M → Use of system charge |
| B. Energy charge Price of fuel; thermal efficiency including of ageing and cleaning; output; heat rate; caloric value; and partial loading | A. Use of system charge | B. Distribution margin O&M cost; salaries, wages and other benefits; depreciation; other operating expenses; return on rate base; other income |
| C. Variable operation and maintenance (O&M) component | | C. Transmission and distribution losses (allowed) D. Prior year adjustments End-consumer tariff (A+B+C+D) |

Data source: National Electric Power Regulatory Authority (Nepra)

Importantly, the capacity charge is indexed periodically with multiple parameters including exchange rate, domestic interest rates, foreign interest rates, etc. Furthermore, power producers are allowed to impose this capacity charge irrespective of the amount of electricity (produced and) sold by them.² In contrast, their variable cost depends on the estimated amount of electricity produced and sold, reference fuel mix (e.g., furnace oil, RLNG, coal) and their prices. Fuel costs above or below the Nepra benchmark are passed onto consumers as fuel price adjustment (FPA); these appear on end-consumers' electricity bills separately based on units consumed in the previous month.³

¹ Here, it is important to mention that capacity payments serves as a means to ensure electricity adequacy at all the times. This concept implies that there should always be “enough supply available to match demand but it does not reduce the need for reserves in order to meet real-time demand”. Capacity payments are extensively used to encourage investment in power sector in a number of countries including UK, Chile, Argentina, Brazil, South Korea and Indonesia. However, mechanisms to determine these capacity payments differ across countries. Source: Report on Market Design for Capacity Markets in India, published by GIZ.

² The mechanism of capacity payments has been laid out in power purchase agreements with IPPs.

³ These can be driven by variation in the actual fuel mix versus Nepra's reference mix (e.g., gas shortages that force power plants to substitute gas with more costly high speed diesel); and/or

At the transmission level, the tariff includes the Use of System Charge (UoSC) payable to NTDC. This charge takes into account the revenue requirement of NTDC, which includes permissible expenses on administration, mark-up payments, corporate taxes, and repair and maintenance, as well as on the return on equity. Prior period adjustments are also allowed for any of these components. The UoSC in terms of kWh is then calculated by dividing the revenue requirement by the sum of maximum demand index of all distribution companies and bulk power consumers connected to the NTDC transmission network.

Finally, the retail tariff is determined at the distribution stage. Here, the estimated power purchase price (in terms of kw/hour) is calculated for each Disco, which includes capacity and energy charge paid to power producers as well as UoSC paid to the NTDC. On top of this, Nepra allows Discos to earn a permissible distribution margin, which is meant to cover a part of their costs pertaining to operation and maintenance, salaries, and depreciation as well as return on rate base. Nepra also allows Discos to take some of the distribution losses incurred by these entities to their tariff build-up. Prior year adjustments are also taken into consideration while determining the end-user tariff.

The above discussion leads to following important insights about power tariffs:

- (i) If a power producer does not sell even a single unit into the national grid, it will still be paid for the capacity charge (fuel charge will be zero in this case) that will eventually be included in the retail tariff;
- (ii) Depreciation of the Pak rupee and/or increase in domestic or foreign interest rate increase the capacity charge and the retail tariff;
- (iii) If a new generation plant is installed, the overall revenue requirement for the capacity charge will increase. If this new plant operates at 100 percent capacity and is able to sell every single unit it produces, the capacity charge in terms of Rs/kWh will remain unchanged. However, if it does not operate at full capacity, the capacity charge in terms of Rs/kWh will increase, and so will the end-user tariff.
- (iv) If the thermal power composition shifts in favor of expensive fuels, say due to shortage of cheaper fuels, the energy charge in terms of Rs/kWh will increase.
- (v) If the merit order list is not followed and inefficient plants are allowed to dispatch ahead of the efficient ones, the energy charge will increase.
- (vi) If Nepra allows Discos to include more transmission and distribution (T&D) losses as part of their tariff build-up, the end-user tariff will increase.
- (vii) Additional staff hiring, if allowed by Nepra, at any stage of the power sector

changes in fuel prices in the global market. Either of these can automatically increase (or decrease) the generation costs, and is passed on to consumers through FPAs.

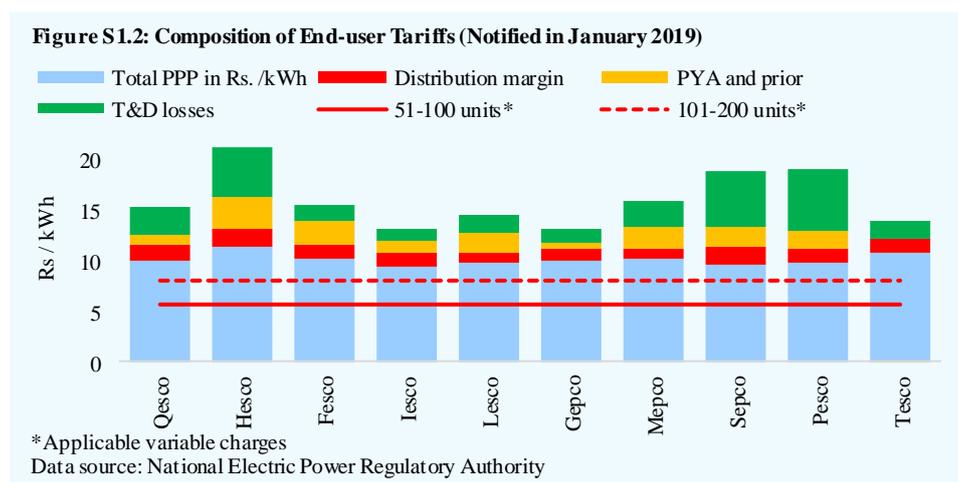
value chain, increases the retail tariff.

(viii) The overall cost of electricity generation from renewables (hydel, wind and solar) comprises primarily of the capacity charge, as the fuel charge is negligible (if any).

However, it must be noted that while the end-user tariff determined by Nepra changes with the developments mentioned above, the actual tariff is notified by the government to unify tariff across all Discos. This incorporates the element of subsidy to shield consumers from rising generation and/or distribution costs.

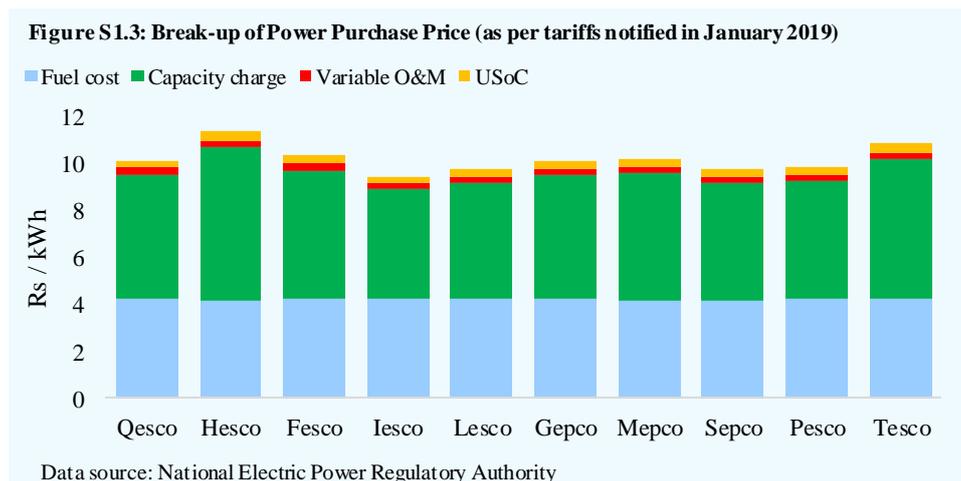
S1.3 The existing build-up of power tariffs

As shown in **Figure S1.2**, power purchase price constitutes on average 65 percent of the end-user tariff determined by Nepra. In case of some of the efficient Discos, such as Gepco and Iesco, the share of power purchase price in the end-user tariff determined by Nepra, is as high as 76 and 71 percent, respectively. It is also important to note that the tariff notified by the government to subsidize households consuming up to 200 units, is even lower than the price at which Discos procure electricity from the CPPA. This implies that while subsidizing power to end-consumers, the government pays not only for the inefficiencies at Discos level (especially those operating in Hyderabad, Sukkur and Peshawar regions), but also for the inefficiencies and excess capacities in the generation sector.



The latter can be explained by the fact that the strongest contribution to power purchase price comes from the capacity charge (**Figure S1.3**). In absolute terms, capacity payments are estimated to be around Rs 664 billion for FY19,

representing an increase of around 60 percent over the preceding year. This rise partially stemmed from an increase of approximately 729 MW capacity added into the system during the year; modest growth in power supply; the increase in net hydel profits (NHP) to provincial governments; and the associated arrears. As discussed in the following section, rising capacity payments recently have been the major contributing factor to the consistently high end-user tariffs (determined by Nepra). As things stand, these are likely to increase even further going ahead.



S1.4 Rising capacity payments offset the impact of declining fuel cost

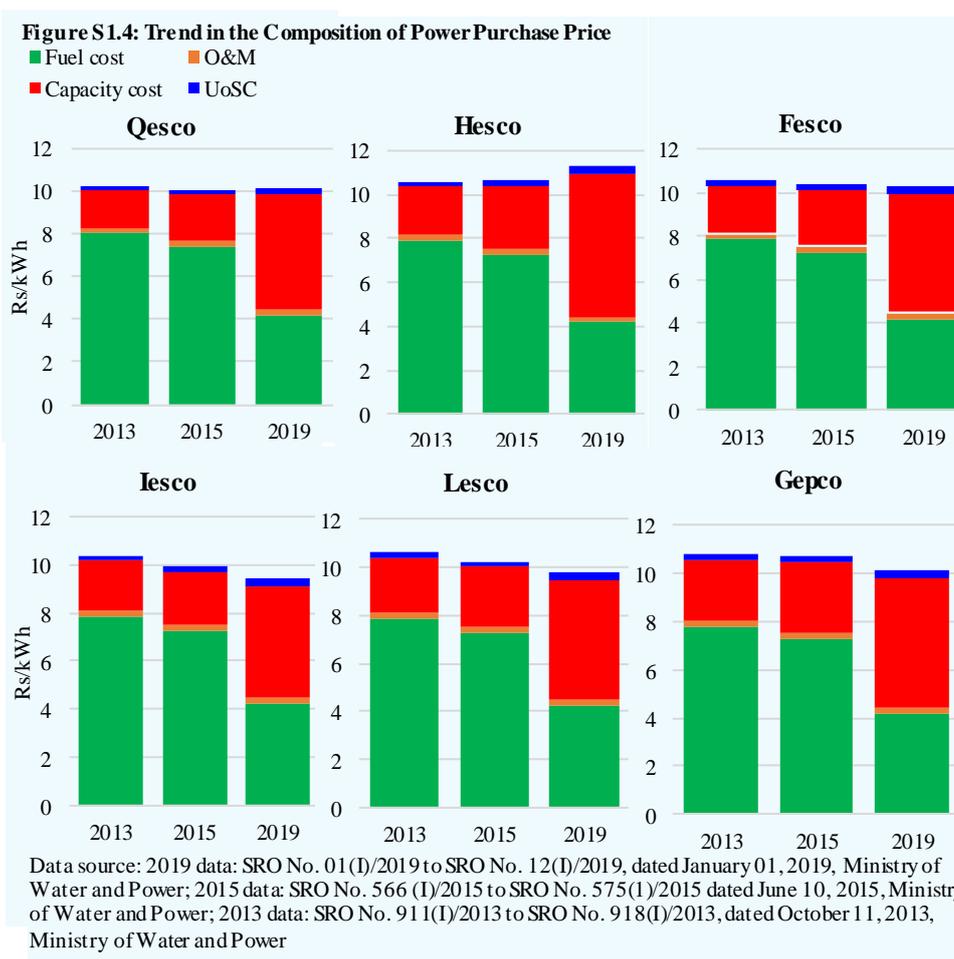
If we compare the tariffs between 2013 and 2018, it becomes clear that while the fuel charges have certainly softened due to lower oil prices and a shift in domestic fuel composition, capacity charges have actually increased. For nearly all the Discos, the increase in capacity charges have completely offset the fall in fuel charges (**Figure S1.4**). Reasons for this trend are discussed below:

(1) Dispatch remained weaker than capacity additions

Since June 2014, the country's power generation capacity has increased by 45.7 percent (7.8 percent CAGR) to reach 34,282 MW at end March 2019.⁴ This reflects the massive investment from the government in the power sector, as well as the completion of CPEC-related energy projects. Although power sold by generation companies also increased during this period, this has not been sufficient to keep the capacity cost unchanged. Here, Nepra's estimates are useful to put things in perspective: According to the regulatory authority, the energy sold was required to be increased by at least 30 percent between FY18 and FY19 in

⁴Source: Pakistan Economic Survey 2018-19.

order to keep the capacity cost component at the FY17 level, and by at least 57 percent to keep the capacity cost component at the FY16 level.⁵ In actual, the energy sold grew by only 12 percent during the year; therefore, the capacity cost per kWh continued to increase. Multiple factors explain a subdued growth in power dispatch including:



Constraints in transmission and distribution system

It is important to note here that the transmission and distribution capacity in the country falls significantly short of the installed generation capacity. At the

⁵ Nepra's State of Industry Report, 2017

transmission level, the available system can transfer only 25,339 MW (end- FY18) at 220 KV level (this level represents the interconnection voltage level between NTDC and the Discos – step down transformers) (**Table S1.2**). Therefore, NTDC has to execute planned outages to avoid overloading of its transformers. At the distribution level, situation is not different either: around 37 percent of the total power transformers and 29 percent of the 11kV feeders in the Discos are overloaded.

Feeders often need to be switched off to avoid power tripping and damages to transformers, and Discos are, hence, not able to ensure smooth power supply. Thus, if the state of transmission and distribution does not change significantly and if one goes by Nepra’s estimates, it is not possible to increase the power supply by 9 or 10 percent per annum in the coming years.⁶

| | No. of transformers | Percent overloaded |
|----------------------------|----------------------------|---------------------------|
| Transmission Level: | | |
| 550/220 kV | 33 | 39.0 |
| 220/132 kV | 143 | 55.0 |
| Distribution Level: | | |
| Power transformers | 1,828 | 36.8 |
| 11 kV feeders | 8,454 | 29.0 |
| Distribution transformers | 681,805 | 12.5 |

Data source: State of Industry Report 2017, National Electric Power Regulatory Authority

Mismatch between electricity generation and demand

The overall pace of economic activity is likely to grow modestly during FY20, especially in the industrial sector (only 2.3 percent). Resultantly, the GDP growth for the year has been targeted to be around 4.0 percent. The subdued growth environment, along with upward pressures on power tariffs, will make it challenging to generate power demand sufficient to compensate for the expected rise in capacity payments. This implies that if more generation capacity is added to the system – the planned increase as per NTDC is 65 percent between FY19 and FY25 –⁷ it will lead to further increases in capacity payments and the overall power tariffs in the country.

(2) A sharp rise in net hydel profits

Net hydel profits (NHP), which the federal government is legally bound to pay to provinces against the bulk hydropower generation, have posted a sharp rise in recent years.⁸ Up till 2015, this amount was capped at Rs 6.0 billion per annum,

⁶ Source: State of Industry Report 2017, Nepra

⁷ Source: State of Industry Report 2017, Nepra

⁸ Article 161(2) of the Constitution of Pakistan, 1973 states, “The net profits earned by the Federal Government or any undertaking established or administered by the Federal Government for the bulk

and that too only for the Khyber Pakhtunkhwa (KP) province. However, following the successful negotiations between the federal and KP governments and their concurrence by the Council of Common Interest (CCI), Nepra allowed the uncapping of these profits from FY16 onwards.

Table S1.3: Hydel Levies Tariff Determined by Nepra for FY18, FY19 and FY20

| Rs/kWh | Province | FY18 | | | | Total NHP Payments | FY19** | FY20 |
|----------------|----------|-------------|--------------------|-------|-------------------|--------------------|-------------|-------------|
| | | NHP Arrears | Current Year's NHP | Irsa | 12-month arrears* | | NHP Arrears | NHP Arrears |
| | | (a) | (b) | (c) | (d) | (a+b+c+d) | | |
| Mangla | AJK | - | 0.15 | 0.005 | - | 0.155 | - | - |
| Gomalzam | FATA | - | - | 0.005 | - | 0.005 | - | - |
| Tarbela | KP | 0.419 | 1.155 | 0.005 | 0.2595 | 1.838 | 0.4186 | - |
| Warsak | KP | 0.419 | 1.155 | 0.005 | 0.2595 | 1.838 | 0.4186 | - |
| Chitral | KP | 0.419 | 1.155 | 0.005 | 0.2595 | 1.838 | 0.4186 | - |
| K. Garhi | KP | 0.419 | 1.155 | 0.005 | 0.2595 | 1.838 | 0.4186 | - |
| Dargai | KP | 0.419 | 1.155 | 0.005 | 0.2595 | 1.838 | 0.4186 | - |
| Jabban | KP | 0.419 | 1.155 | 0.005 | 0.2595 | 1.838 | 0.4186 | - |
| Khan Khwar | KP | 0.419 | 1.155 | 0.005 | 0.2595 | 1.838 | 0.4186 | - |
| Allai Khwar | KP | 0.419 | 1.155 | 0.005 | 0.2595 | 1.838 | 0.4186 | - |
| Dubair Khwar | KP | 0.419 | 1.155 | 0.005 | 0.2595 | 1.838 | 0.4186 | - |
| Tarbela 4 | KP | - | 1.155 | 0.005 | - | 1.160 | - | - |
| Golen Gol | KP | - | 1.155 | 0.005 | - | 1.160 | - | - |
| Ghazi Bharotha | Punjab | - | 1.155 | 0.005 | 3.9429 | 5.103 | 0.9456 | 0.9456 |
| Chashma | Punjab | - | 1.155 | 0.005 | 3.9429 | 5.103 | 0.9456 | 0.9456 |
| Jinnah | Punjab | - | 1.155 | 0.005 | 3.9429 | 5.103 | 0.9456 | 0.9456 |
| Rasull | Punjab | - | 1.155 | 0.005 | 3.9429 | 5.103 | 0.9456 | 0.9456 |
| Shadiwal | Punjab | - | 1.155 | 0.005 | 3.9429 | 5.103 | 0.9456 | 0.9456 |
| Nandipur | Punjab | - | 1.155 | 0.005 | 3.9429 | 5.103 | 0.9456 | 0.9456 |
| Chichoki | Punjab | - | 1.155 | 0.005 | 3.9429 | 5.103 | 0.9456 | 0.9456 |
| Renala | Punjab | - | 1.155 | 0.005 | 3.9429 | 5.103 | 0.9456 | 0.9456 |

* Since the notification was issued on December 14, 2017, half of the year FY18 was passed. This column refers to those arrears that account for months of FY18 prior the issuance of this notification.

**Total NHP for the year FY19 will be calculated as Rs 1.155/kw/hr + 5 percent indexation + NHP arrears to be collected in FY19. Moreover, if additional capacities come online, their NHP will be included as well.

Data source: National Electric Power Regulatory Authority (Nepra)

Specifically, Wapda was allowed to charge from CPPA the net hydel profit of Rs 18.7 billion for FY16 against the purchase of hydro-electric power – this amount

generation of power at a hydro-electric station shall be paid to the province in which the hydro-electric station is situated.”

was to be included in the capacity charge.⁹ In 2016, the CCI approved NHP payment of Rs 83 billion to the government of Punjab for Ghazi-Barotha Hydropower Project on the grounds similar to those in case of the KP government.

In 2017, Nepra issued a detailed ruling on the subject and determined the hydel levies (including NHP, Irsa charges and water use charge) for all the provinces for the year FY18. For KP and Punjab, the regulator also allowed 5 percent indexation every year for the computation of NHP. Moreover, it also determined the values of NHP arrears for the years FY19 and FY20 (**Table S1.3**).

However, there are certain caveats to this decision which need to be addressed jointly by Wapda and CCI:

- (i) First, the Constitution stipulates transfer of NHP incurred by the federal government to provinces. However, the current arrangement applies a pre-determined fixed rate of NHP uniformly to all hydel power stations, instead of transferring actual profits earned by them. Since actual profitability differs across various hydel generation plants, applying a notional fixed NHP rate (currently @ Rs1.155 / kWh) does not seem justified, as this would potentially turn even the loss-making units into profitable ones.
- (ii) Second, even before the imposition of NHP, consumers were paying hydel profits (retail price minus the cost of generation). However, instead of transferring these profits to relevant provincial governments, the federal government had been using these for subsidizing the overall electricity in the country (by compensating for expensive power generating units).
- (iii) Third, it is important to note that hydel generation plants are given a must-run status in the country, because they incur no fuel cost and thus produce the cheapest electricity. However, if NHP is continuously passed on to the end-users, and is indexed every year at 5 percent, a few hydel plants will eventually become more expensive compared to some of the non-hydel plants.

The existing distortions in hydel tariffs need to be addressed. The NHP payments will likely increase going forward not just because of indexation, but also on account of planned additions in hydel capacity.

(3) Quarterly indexation of capacity payments against macroeconomic variables

As mentioned earlier, the government has put in place an indexation mechanism

⁹ However, in the absence of a clear interpretation of the term “net hydel profit”, Nepra termed this an “interim arrangement” and emphasized on the need for increased consultation with CCI for the distribution formula.

for the capacity charge against changes in exchange rate, interest rates, fuel prices, US and domestic inflation, O&M costs, and other factors. Nepra is authorized to decide in the matter of indexation/adjustment of capacity purchase price and O&M on a quarterly basis.

With a sharp depreciation of the Pak rupee from FY18 onwards, and an increase in the interest rates, capacity payments of all the power producers have increased during the last couple of years. It is important to mention here that the returns guaranteed to IPPs via power purchase agreements, and their dollar-based indexation, is allowed on both foreign as well as domestic investments. Therefore, the government and the regulator are finding it legally challenging to make any adjustments in the granted incentives.

S1.5 Going forward

With pressures building on the country's balance of payments as well as fiscal resources, it has become imperative for the government to cut down its expenditures and reduce (among others) the significant level of power subsidies. However, chronic governance issues in state-owned Discos and rising capacity payments mean that with the reduction in power subsidies, it will be challenging for the government to achieve the objective of providing cheap electricity to domestic users.

Table S1.4: Fuel related Expected Additions in Power Generation Capacity (Megawatt)

| | Additions every year | | | | | |
|--------------------------------|----------------------|---------------|---------------|---------------|---------------|---------------|
| | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | 2024-25 |
| Oil | 0 | 0 | 0 | 0 | 0 | 0 |
| Coal | 823 | 3,300 | 2,610 | 1,320 | 0 | 0 |
| Gas/RLNG | 420 | 0 | 0 | 0 | 0 | 0 |
| Wind | 0 | 1,224 | 0 | 0 | 0 | 0 |
| Solar | 600 | 0 | 0 | 0 | 0 | 0 |
| Bagasse | 144 | 0 | 0 | 0 | 0 | 0 |
| Hydro | 201 | 177 | 824 | 3,080 | 4,325 | 2,203 |
| Nuclear | 0 | 1,100 | 1,100 | 0 | 0 | 1,100 |
| Year-wise addition | 2,188 | 5,801 | 4,534 | 4,400 | 4,325 | 3,303 |
| Capacity post additions | 39,822 | 45,623 | 50,157 | 54,557 | 58,882 | 62,185 |

Data source: State of Industry Report 2017, National Electric Power Regulatory Authority

Here, the investment in transmission and distribution infrastructure that is currently underway would be crucial going forward in terms of reducing T&D losses. However, the capacity payments are likely to grow over the next 5-6 years, as a number of ongoing power projects (mostly coal and renewables) come online and, in the absence of a commensurate growth in demand amidst a challenging macroeconomic environment, augment the capacity surplus situation in the

country (**Table S1.4**). As mentioned above, the resultant costs would eventually be borne by the end-users.

In this regard, the practice of keeping government-notified tariffs below even the levels of procurement costs for most of the Discos, is proving as a major disincentive for such institutions to carry out the necessary investments at an adequate scale. Hence, there is an urgent need for the government to review this practice to ensure that the power sector is able to channel forward the coming additions in generation to the industrial, domestic and other end-users.

Similarly, it is pertinent to note that the power purchase agreements – which allow for guaranteed returns along with the indexation of capacity payments – of some IPPs are going to expire in a 4-5 year period. It is vital now that for the renewal of these agreements as well as for selection of new projects, the government takes a long-term holistic view of the economy.

Finally yet importantly, the government must realize that if the capacity payment structure remains unchanged, the desired effects of providing affordable energy to the public by increasing the share of cheaper power sources in the generation mix are unlikely to materialize. Here it is important to mention that the issue of transfer of net hydel profits to provinces should be addressed in a more technical manner. To this end, Nepra has repeatedly advised Wapda to take the matter to CCI, so that CCI may issue policy guidelines to Nepra for NHP determination, in compliance with the provisions of the Constitution and Nepra Act, 1997. As things stand, the rate of Rs 1.1 per kWh, indexed at 5 percent per annum, is only an interim arrangement between Federal and KP governments, which may not be used as a final settlement of the NHP computation.

All these challenges warrant a policy overhaul and rationalization strategy to be implemented at the earliest. The entire sector needs to become more efficient and financially sustainable in order to ensure smooth and affordable electricity to end-users.