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Power Sector Solutions Brief - 4

c. Long Term Measures aim is to Optimize Electricity Tariff to 8-9 cents

- *PPIB*
- Base load maximized on nuclear/indigenous gas/coal for generation
 - Deliver Energy mix of 20% percentage RE (hydel, wind solar)
 - Imported gas/coal plants with efficiency beyond 60% only be installed
- *NTDC*
- Reduce interlink/interconnection constraints
 - Increase HVDC utilization as part of regional play with UAE, Iran and Afghanistan
 - Deliver surplus capacity to KE
 - The transmission and distribution system capacity be 5-10% higher than peak demand load
- Cater for renewables intermittency and navigate transition to a sustainable energy future
 - Energy Storage: Storing excess solar energy for evening use e.g pump storage using hydel and battery
 - Grid Flexibility: Enhance infrastructure for rapid demand changes.
 - Demand Response: Strategies to shift electricity use patterns
- *DISCOs*
- Listing of DISCOs and GENCOs on PSX (5% thru book building initially with option of additional 5%)
 - Merge DISCOs with 2 per Provinces and operate under public private public partnership with ownership of Federal, Provincial, Generation Companies, Consumers of the area
- *NEPRA*
- Competitive generation necessitates CTBM be implemented with sincerity in stages, as we build knowledge, gain confidence and experience, initiate with generation capacity of expired PPAs and RE traded on PMEX
 - Consider developing real two-way “contracts for differences” where the generators get money from the public entity when prices are low, and pay back the difference between spot prices and their agreed price, when spot prices are high.
 - In France and UK, this is providing a natural hedge to power prices and helps keep retail prices down.

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- *MoIndustries*
- Pilot project for hydrogen not as a fuel but for producing green ammonia to replace indigenous gas utilization in fertilizer industry without any subsidies but with policy incentives under a 3P initiative to encourage production of green hydrogen and ammonia
- Encourage small hydel and vertical axial wind turbine manufacturing from E&P royalty
- *MoE*
- Focus on coal with expansion of Thar and rail link connectivity
- The new gold and new "secret" for investors to make money" is world's dirtiest fuel and a disturbingly safe investment.
- "The Dawn of the New Solar Age" is creating opportunity
 - Literally every smelter for solar panels has its own dedicated coal plant in China and that not one single panel is possible without carbon (the chemical element), heat, and electricity from coal (produced to over 80% in China) and in 2023 (again), coal's electricity generation increase was double that of solar in India and China... despite their dramatic solar capacity build out
 - Headlines elude to that there is no way to make "honest" money with wind and solar driven by their low energy density + intermittency + short lifetime and the resulting high input energy and raw material requirement to make up for the total system to make solar and wind power "useful" for the customer i.e.
 - Provide electricity on demand 24/7/365 despite drastic overbuild, short duration energy storage (batteries?), long duration energy storage (hydrogen?) backup power stations (gas or coal?) and more complex and larger network integration and transmission infrastructure
- Increase of variable renewable energy to 56% (46% of hydropower and 10% of variable renewable energy) vs 6.5% of total current installed base requires evaluation of
 - a. Battery vs pump hydel and green hydrogen needs understanding given due different costing, subsidy need and environmental considerations.
 - i. "Green hydrogen" throws away 70% of the electricity in production whereas in an electric vehicle only 20% of the electricity is wasted. That hydrogen as a fuel is incredibly complex with cost approximately x10 more than electric vehicles.
 - ii. Clarity that most battery technologies are dirty and wasteful. Solar and wind turbines disposal is a challenge
 - b. Maximum value of solar generation does not occur when solar production is at its peak; needs consideration of vertical panels

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- c. The total installed capacity of renewable energy sources including hydropower, wind, solar, and bagasse/ biomass, in Pakistan's power system exceeds 13,000 MW.
 - As of June 30, 2023, the total number of net-metering consumers in the CPPA-G system was 56,427, compared to 37,769 as of June 30, 2022.
- d. Accumulated generation by net-metering connections during FY 2022-23 amounted to 481,863,365 kWh, in contrast to 150,669,148 kWh during FY 2021-22.
 - i. In the FY 2022-23, 1,596 Net-Metering Licenses represented installed capacity of 221.05 MW.
 - ii. KE Net-Metering Import: 102 MW in FY23 vs 60MW in FY22
 - iii. Current projects show addition of 1.1TWH of Solar Energy through Solar IPPs for next FY at PKR 37 per unit. Why?
 - iv. EPP for FY25 is at Pkr 9.69per unit (USc 3.49 per unit) and KE will add large scale solar above 4 cents per bids received
- e. Many countries are encouraging batteries to allow people to self generate and consume while opening up ancillary services market to manage variations through utility scale BESS and other existing plants.
 - Effective energy storage solutions are essential to capture and store surplus energy for later use, especially when demand is high and supply is low.
 - Developing or making available cost-effective and efficient energy storage technologies is crucial for maximizing the benefits of intermittent power sources.
 - Unlike traditional power plants, intermittent sources cannot provide a continuous output, which means that excess energy generated during periods of high availability may go unused
- f. Facilitating microgrids in rural areas and building a robust, transmission infrastructure to transport energy from where it is generated to where it is needed and an interconnected grid is crucial for harnessing potential of intermittent power sources.
 - Geographical location of these sources can pose logistical challenges given land requirement e.g solar power is most abundant in regions with ample sunlight, while wind energy is more prevalent in specific geographic locations.

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- Intelligent tackling of issues related to variability, energy storage, and transmission infrastructure will be key to realizing the full potential of hydropower, wind, and solar energy in pursuit of a sustainable energy future.
- Unlike conventional power plants that provide a constant output, availability of energy from hydropower, wind, and solar depends on weather conditions and water flow.
- This variability can lead to fluctuations in energy supply, making it challenging to match supply with demand in real-time.
 - Wind and solar generators MUST be required to be able to provide 99.98pct reliable 24/7/365 power ... then a) the true total cost comes out b) common sense energy policy decision can return
 - As unpopular as it may be but the uncontrolled build out of wind and solar power has to stop ... very fast... to avoid grid disaster. Only dispatch able capacity belongs on the grid
 - “Smart” grids or meters or batteries are also NOT the solution. They may help optimize the grid a little but clearly cannot overcome the underlying issues of intermittent low energy density wind and solar
- As a result, grid operators need to implement sophisticated forecasting and balancing mechanisms to ensure a stable and reliable power supply.
- g. In June 2021, Council of Common Interests approved the National Electricity Policy and PPMC was declared as designated entity to implement the benchmarks envisaged under NEP
 - Power Planning and Monitoring Company replaces PAPCO established in October 2021, and is providing support to the Ministry of Energy (Power Division) in coordination, pertaining to Discos, Transmission & System Operations, Market Operations, Generation and leveraging IT for greater efficiency and sustainability; and on policy, technical and performance monitoring.
 - Endorsement of Clean Air Act with imposition of Green Tax immediately to control emissions and penalize the power plants, which emit excessive CO₂, SO_x and NO_x than permitted under the Act is necessary
 - It is important to establish CDM process to adjust/net off carbon emissions could offset some of the expenses related

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to power tariff by providing an alternate revenue source and PPMC needs to lead the initiative

- Power generation
 - Based on imported fuel is planned to be reduced to 13%, RFO has no contribution in the energy mix in IGCEP. Imported coal (due contractual binding) and RLNG contribute 9% and 4% in the total energy requirements, respectively. Share of indigenous fuels stand at 31%, i.e. 9% of local coal, 5% of local gas and 17% of nuclear in the overall energy mix
- 2023-2024, indigenization ratio of energy is 74.2%, is to increase to 76.5% by 2027 and to 87.13% by 2034 due to RE
 - Provided we invest funds per IGCEP 2024, to meet demand and installed capacity of 37,224 MW and 56,046 MW, respectively by 2034 of 63.31 bn US\$ NPV (2019 June USD Rate Rs 156.7 vs IGCEP 2023-24 is based on Rs. 289.1 of Oct 2023) in terms of CAPEX and OPEX of power generation by 2034
- Load duration curves reflect base, intermediary and peaking loads. Our load Factor is 44% and by reducing industrial tariff from September to April (8 months), this LF can potentially jump to 74%, thus reducing overall tariff. Still there will be a few plants that will operate from 0 to 10%. Extensive study of NEPRA publications, hearings, PSS NTDC would help in planning
- Background
 - The power purchase price (PPP) includes (Energy Purchase Price (EPP) fuel and variable O&M (operation and maintenance) costs and Capacity Purchase Price (CPP) capacity charges including the use of service charges, market operator fee, impact of T&D losses, Distribution & Supplier Margin, and Prior Year Adjustment) needs detailed understanding in revised IGCEP/TSEP given that percentage of CPP in the overall tariff is an increasing trend.
 - In FY 2022, EPP constituted around 60% of the tariff, while CPP accounted for about 40%. During FY 2023, the percentage of EPP and CPP was around 50% each, while for FY 2024, it was projected to be around 67% and 33%, respectively.
 - Capacity charges work out as around 65pc of the total projected PPP whereas energy cost is around 35pc in FY25. The increase in CPP percentage is due also to the augmented capacity of power generation plants and the addition of the HVDC line in the system besides devaluation