Prayas (Energy Group) comments on
"Guidelines for Medium and Long Term Demand Forecast"

May 10, 2023

Accurate demand estimation is a critical step to ensuring optimisation of investments while ensuring that the country is able to meet its energy requirements. Therefore, it is welcome that CEA has published draft guidelines for medium and long term demand forecast for use by utilities and states. However, demand estimation – particularly in a rapidly evolving sector such as electricity – is also a challenging task. Techniques than have been used in the past are unlikely to be sufficient and more sophisticated techniques are required. Prayas (Energy Group) provides the following comments in this spirit to encourage Indian electricity utilities to adopt richer and more sophisticated approaches to demand estimation which, in turn, can lead to a healthier sector. We will be happy to discuss this in greater detail with CEA, and will be happy to assist CEA in developing detailed guidelines backed by effective tools to aid in this process.

1. **Need for more sophisticated techniques for demand estimation:** The draft guidelines suggest least square method (LSM) and weighted average method (WAM) as the way to estimate future demand for each demand sector (consumer category). We believe both these methods are highly simplistic and inadequate. The LSM is a *linear* extrapolation method, when electricity demand is impacted by a host of multiple factors such as incomes, temperatures, aspirations, electricity tariffs, industrial growth, policy incentives, technology efficiency and so on – none of which probably has a linear relationship to electricity demand. Similarly, the WAM – as presented in Annexure II – is just a modified way of using past growth rates to project future demand. This cannot capture the impact of disruptive changes such as electrification of mobility or introduction of green hydrogen. It is also unlikely to capture the non-linear impact of increasing temperatures combined with increasing incomes and aspirations.

   Therefore, we believe that, given the multiple drivers of electricity demand, it is necessary to adopt a bottom-up consumer category by consumer category estimation of electricity demand by considering the demand drivers for each category separately. This will allow the unique features of each consumer category to be considered in the demand estimation. For example, the targets for share of e-vehicles in sales of different types of vehicles and the electrification plans of Indian Railways should inform electricity demand for transport. The impact of rising incomes, urbanisation, temperatures and BEE's efficiency standards on appliances such as fans and ACs will impact residential electricity demand. The pace of industrial electrification and adoption of green hydrogen will impact industrial demand. Therefore, sophisticated models – which already exist[1] – that enable making demand estimations considering such parameters should be used to estimate future demand.

2. **Demand forecast granularity:** While annual electrical energy demand forecasts may be sufficient at a broad level, given the increasing presence of intermittent RE in the grid, demand *profiles* are equally important. Currently, the draft guidelines only limit themselves to estimating peak demand based on load factor (Clause G). This will not be sufficient given the kinds of new demands (such as e-mobility and green hydrogen) that are likely to arise. Moreover, even past

[1] The PIER model developed by Prayas (Energy Group) is one such model which is available free of cost and in open-source form. See https://energy.prayaspune.org/our-work/data-model-and-tool/rumi-pier. An updated version is currently under development.

demand patterns for existing demands are likely to change due to policy drivers – for example solarisation of agriculture through schemes such as KUSUM and time-shifting of industrial and other demand due to introduction of time-of-day tariffs.

Therefore, we suggest that, in addition to estimating total energy demand, hourly (say) load profile estimation should be undertaken for each consumer category for at least one typical day in each season to capture seasonal and diurnal variations. This would require DISCOMs to undertake consumer category-wise load surveys. They could be mandated to undertake such surveys at a fixed periodicity (say, 5 years). Introduction of smart meters may make it easier to estimate consumer category-wise load profiles in future. To get the process underway, some initial surveys may be undertaken to estimate load profiles for each consumer category, which can be modified for future years with changes in technology and policies. Without such load profiles, it would be hard to plan power purchase or develop policies for demand response in a renewables-heavy grid. Having such load profile estimations also makes it easier to estimate demand and load profiles for larger areas, obviating the need to use techniques such as diversity factors. In addition to finer temporal granularity of demand estimation, it would also be desirable to have finer granularity of spatial demand estimation (e.g. at the zone/circle etc.) to the extent possible.

3. **Scope of demand estimation:** It is not entirely clear whether the proposed guidelines are only for utilities (DISCOMs) or for states and the Central Government also. It would be good to clarify this. Moreover, given the increasing viability of alternative options and policy support such as Green Open Access Rules, migration of industrial and commercial consumers away from DISCOMs is likely to increase in future. Demand estimation for DISCOMs needs to specifically factor this in to optimise power purchase planning. Network planning may need to consider the entire demand of the region – thus different kinds of demand may have to be estimated. It is necessary to project utility demand, captive demand and open-access demand in a given area separately, based on which total demand can be estimated for different purposes such as power purchase and network planning. The consumer categories for which demand is to be estimated should also be expanded: the Irrigation category can be expanded to HT Irrigation and LT Irrigation, while a new “Behind the Meter” category may be added. Estimating demand for any of these categories should be based on past trends as well as emerging future trends based on policies/regulations, technology changes and consumer preferences. In addition, estimates of injection into the grid of captive and open access generation, and reliance of those consumers on the grid supply would be important in estimating actual utility demand.

4. **Scenarios:** The current definition of suggested scenarios does not seem to be consistent or appropriate. For example, a scenario representing high temperature and low rainfall is not really an “Optimistic Scenario”. It may lead to an increase in electricity demand due to these factors but these conditions may also lead to lower economic growth and thus lead to lower electricity demand. Instead, it would be better to specify internally consistent scenario definitions with well-defined changes to the different demand drivers, based on which demand estimation can be done. Examples of such drivers could include national consumption trends, load share changes, extent of achievement of policy goals, weather patterns, technology evolution, price trends, etc. CEA could define these scenarios and the impact of each scenario on the relevant set of variables. These can be further customised as per each state/DISCOM's situation such as state level policies, consumer trends and local weather patterns.

5. **Role of efficiency:** Energy efficiency changes can have a huge impact on energy demand. For example, the recently notified standards for efficiency of ceiling fans – the appliance that consumes the highest amount of electricity on aggregate in buildings – can significantly lower the trend of growth of residential electricity demand, particularly in conjunction with the continued tightening of AC standards. The same is true with PAT for industrial energy consumption. Therefore, it is not really correct to say (para C.4) that the impact of energy efficiency should not be considered additionally as it would be captured in past trends. Instead, future electricity demand should be estimated after explicitly considering the impact of existing and proposed efficiency measures.

6. **Adoption of demand estimations:** The demand estimates that are projected by each DISCOM should be formally adopted subject to regulatory approval based on a public consultative process. For this, DISCOMs should publish all the important assumptions regarding the drivers of electricity demand and its profile for each scenario, and the methodology by which they estimated the demand. Such a process will help make the demand estimation more robust, and can perhaps be synchronised with the multi-year tariff process adopted by most regulatory commissions. Thus, DISCOMs can be mandated to undertake a detailed demand estimation exercise using suitable sophisticated models every 5 years leading up to the multi-year tariff process. For the intermediate years, an annual review as suggested in para A.3 may be sufficient, wherein input parameters are tweaked to adjust for any changes – though such tweaks and resultant demand changes should also be subject to regulatory approval and made public.

7. **Specific comments:**
    a. Para A.14: An "Econometric method" is mentioned but such an econometric method is not explained anywhere.
    b. Para E.2: Estimating distribution losses based on "total energy billed" is not correct as many consumers (e.g. agricultural consumers or even some residential consumers in some states) may not be billed at all. Hence, "total energy accounted" may be a better term, where "total energy accounted" can be estimated based on feeder or other level metering.
    c. Box E.2: It is not clear why the open access consumption should be subtracted to estimate T&D losses. Instead, T&D losses should be computed as the difference between the net input energy at the DISCOM periphery and the total energy consumed by the DISCOM consumers and the energy consumed by third parties and wheeled through the DISCOM wires.
    d. Para G.2: The formulas for calculating load factor are not correct because the numerator is in MUs while the denominator is in MWh. The numerator has to be multiplied by 1000 to correct the formulas.
    e. Annexure III: Agencies such as RBI do not usually project GDP for more than a year or two – hence may not be useful for medium to long term projections.
    f. Annexure IV: The calculation of CDD is not clear. In particular, the variable Tt is not defined. It is not clear if 21 C is being considered as the threshold temperature to calculate CDDs. If so, it is very low. BEE norms for ACs require the set-point temperature to be 24 C.

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