

## kVAh Billing - Frequently Asked Questions (FAQs)

1. What is kVAh billing?
  - a. Electrical Energy has two components viz. Active Energy (kWh) and Reactive Energy (kVArh). Vector sum of these two components is called as Apparent Energy & is measured in terms of kVAh.
  - b. In kVAh based billing, fixed/ demand charges are levied on apparent power (kVA) and energy charges are levied on apparent energy (kVAh). In future, energy charges will be levied based on this apparent energy (kVAh) consumption which eliminates requirement of charging active and reactive energy separately.
2. What are Active, Reactive & Apparent Power and Power Factor?
  - a. The electrical power in normal condition consists of two components; Active power (P) and Reactive power (Q).
  - b. The active or real power (P) is actually consumed and converted into useful work for creating heat, light and motion and is measured in (kW) and is totalized by the energy meter as kWh.
  - c. The reactive power (Q) is used to provide the electromagnetic field in inductive equipment and drawn from grid. Also reactive power is supplied by consumer to grid in case of excessive capacitive load. It is measured in kVAr (Lag / Lead) and is totalized by the energy meter as kVArh (Lag / Lead).
  - d. Apparent Power (S) measured in kVA is the product of the Root Mean Square (RMS) values of voltage and current. The Vector sum of active power and reactive power is called apparent power.
  - e. The ratio of active power to apparent power is called the power factor.
3. What is the existing billing method?
  - a. At present, Consumers are billed on Active Energy Consumption measured in kWh along with the fixed charges and other charges. kWh consumption

when multiplied by the applicable tariff for the consumer will give energy charges payable by the consumer. The effect of reactive energy is considered through Power Factor penalty / incentive mechanism. Penalty is levied to consumers for Power Factor (PF) below 0.90 (for Lead as well as Lag PF) and incentive is provided for P.F. above 0.95 (for Lead as well as Lag PF).

4. Why is kVAh billing necessary?

*a.* Both Active (kWh) and Reactive (kVArh) energies are consumed simultaneously. Reactive Energy (kVArh) occupies the capacity of electricity network and reduces the useful capacity of system for generation and distribution & hence its consumption also needs to be billed. kWh based billing is associated with PF incentive /penalty mechanism. Considering that the kVAh based billing has an inbuilt incentive /penalty mechanism and separate mechanism for the same is no more required; instead of billing two energies separately, billing of kVAh energy is preferred as a commercial inducement.

5. When will kVAh billing be implemented?

*a.* As per MERC Order in Case no. 195 of 2017 dated September 12, 2018, The Commission intends to implement kVAh billing to all HT consumer and LT consumers having load above 20 kW from 1<sup>st</sup> April, 2020.

6. How kVAh billing is different from existing billing & what are its benefits?

*a.* kVAh billing has an inherent mechanism to incentivize or penalize consumers according to their power factor. The Prime Objective of the kVAh based billing is to encourage the consumers to maintain near unity Power factor to achieve loss reduction, improve system stability, power quality and improve voltage profile. At the national level, emphasis is being given to Energy Conservation, Energy Efficiency and Demand Side Management (DSM) to optimize the energy usage. Through kVAh billing, the consumers will be encouraged to adopt energy efficiency programs and will be benefited by reduced electricity bills.

7. Explain more about reactive Power & its effects on system?
- In case of inductive loads like motors, electrical energy can't directly be converted into useful work (rotation of motor shaft in this particular case). This is because, to convert electrical energy into rotational energy, magnetic field has to be created in between the gaps of stator and rotor of Motor. Hence, some amount of energy has to be used in creating magnetic field. The portion of power that contributes in creating magnetic field is known as Reactive Power.
  - Though reactive power is needed to run many electrical devices, it can cause harmful effects on your appliances and other motorized loads, as well as electrical infrastructure. Since the current flowing through your electrical system is higher than that necessary to do the required work, excess power dissipates in the form of heat as the reactive current flows through resistive components like wires, switches and transformers.
8. How can reactive power be reduced or compensated?
- Improving Power Factor by installing capacitors of appropriate ratings [or Automatic Power Factor Corrector (APFC) Panels] you can locally compensate reactive power requirement, thereby reducing reactive power drawl from grid.
9. Explain more about Power Factor (PF)?
- Desired Power Factor is unity i.e. 1, and its range is Zero Lag – unity - Zero Lead. For purely capacitive loads PF is Zero Lead and for purely inductive loads PF is zero Lag.
  - Unity Power Factor signifies that there is no reactive power exchange between consumer and grid.
  - Power Factor is an indicator for efficiency of Energy Conversion. If PF is 0.85 it means that 15% of power is not resulting in actual work. If PF is 0.85 lagging it means that 15 % of power is used by inductive elements and

If PF is 0.85 leading it means that 15 % excess reactive power is supplied by capacitive elements. In both the aforementioned cases 15 % of power is not resulting in to actual work. Both Leading and lagging power factor are equally harmful to the power system.

10. How do I know my Power Factor?

- a.* For consumers having installed TOD, Tri-vector Meters, Meters, depending upon the nature of instantaneous load, instantaneous power factor is displayed on consumer's meter.
- b.* Consumers can also opt to install PF meters at their LT panel to measure the PF. It is advisable to monitor PF of each individual circuit / machine / plant, as may be possible, in their internal distribution network so that the "low PF section" can be easily identified and attended.

11. What is Power Factor improvement?

- a.* Power factor improvement means minimizing drawl of reactive power from power system so as to make power factor unity. It is nothing but providing adequate compensation so that the reactive power requirement of the load is locally fulfilled instead of drawing it from the power system.
- b.* This means determination of adequate size / rating of capacitors to be installed at each major inductive load is necessary.

12. How can I improve my Power Factor?

- a.* If power factor is on the lagging side it can be improved by installing capacitors of appropriate ratings and if the power factor is on leading side it can be improved by installing reactors/ removing excess capacitors of appropriate ratings.

13. Is kVAh billing implemented anywhere in India?

- a.* State Electricity Regulatory Commissions in various States viz. Himachal Pradesh, Delhi, Uttar Pradesh, Jammu & Kashmir, Andhra Pradesh, Chhattisgarh, Bihar, Haryana, Punjab etc. have already introduced kVAh based tariff for various categories.

14. Who has recommended kVAh billing? / What are Legal & Regulatory provisions for kVAh billing?

- a.* Forum of Regulators (FOR), has recommended kVAh billing. FoR in its report on “Metering Issues” published on August 2009 has stated that kVAh billing is the new trend in electricity billing, which is adopted worldwide. The report is available on FoR website on following link.

<http://www.forumofregulators.gov.in/Data/Reports/Report-Metering-Issues%20august%202009.pdf> .

- b.* MERC Multi Year Tariff (MYT) Order in Case No. 48 of 2016 dated 03 November, 2016.

<http://www.mercindia.org.in/pdf/Order%2058%2042/Order-48%20of%202016-03112016.pdf>

- c.* MERC Mid Term Review (MTR) Order in Case No. 195 of 2017 dated 12 September, 2018.

<http://www.mercindia.org.in/pdf/Order%2058%2042/Order-195%20of%202017-12092018.pdf>

15. What is advantage of KVAH billing from consumer’s point of view?

- a.* KVAH billing will ensure that the consumers who will utilize the power efficiently will be paying less energy charges as compared to others who are not using the power efficiently.
- b.* The new billing methodology will be much simpler to understand as number of parameters viz. PF, rkVAh (lead/lag), kWh units) will be reduced.