

KVAh Billing Implementation

KVAh Billing – MERC Directives/ Ruling

(Case No.195 of 2017 dtd. 12.09.2018)

- **Commission intends to implement KVAh billing to all HT consumer and LT consumers having load above 20 kW from 1 April, 2020.**
 - **MSEDCL to educate the consumers and take all necessary steps to ensure that all the consumers are billed by KVAh method from the next MYT i.e. from 1st April 2020.**
 - **MSEDCL -**
 - **To take necessary steps such as meter replacement and preparedness of billing software if required.**
 - **Wherever possible, start collecting category-wise energy consumption details in KVAh terms**
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Introduction- Apparent Energy (kVAh) & Power Factor...(1)

1. Active or real power (kWh)

It is actually consumed and converted into useful work for creating heat, light and motion and is measured in (kW) and is totalized by the electric meter in (kWh).

2. Reactive power (kVArh)

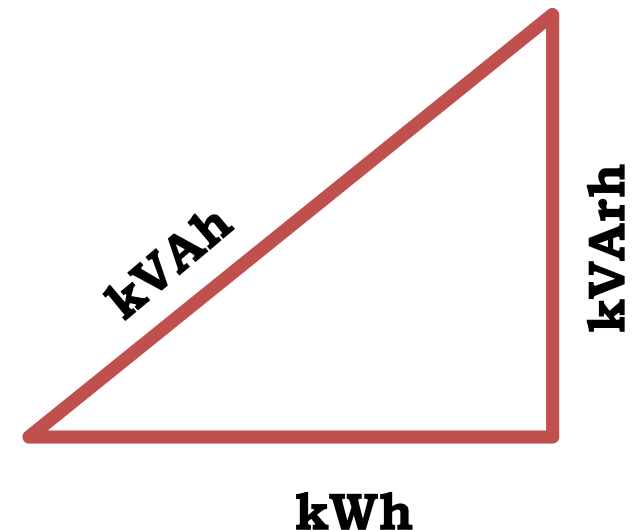
Reactive power is used to provide the electromagnetic / electrostatic field in inductive and capacitive equipment like motors, air conditioners, fans and is measured in kVAr (lag/ lead) and is totalised by the energy meter as kVArh .

3. Apparent Energy : kVAh

$$\mathbf{kVAh = \sqrt{(kWh^2 + kVArh^2)}}$$

4.

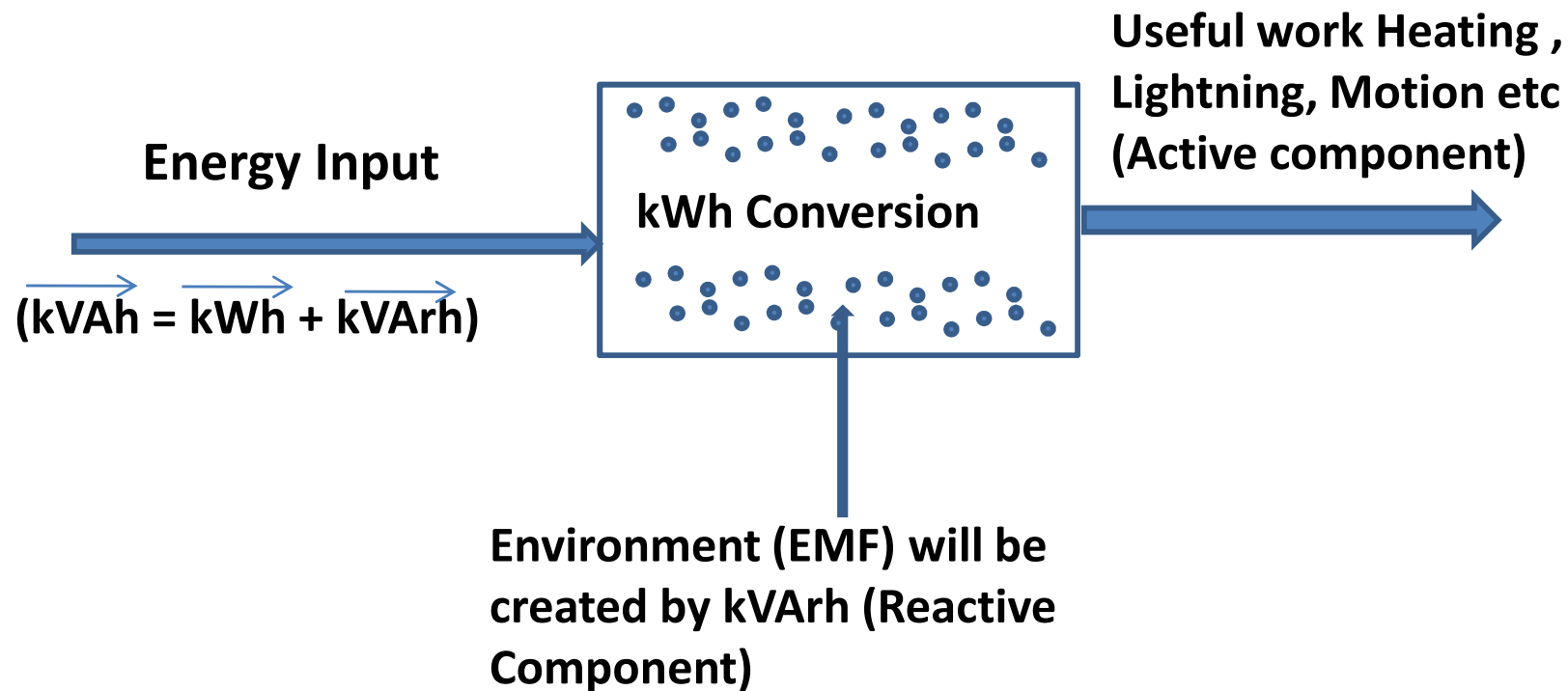
$$\text{Power Factor} = \frac{\text{KWh}}{\text{KVAh}}$$



Introduction- Apparent Energy (kVAh) & Power Factor...(2)

System:-

Conversion



Ideally kVArh = Zero

So that kWh = kVAh and Power Factor = 1 (Unity)

Why kVAh Billing –

Advantages of maintaining Unity Power Factor :

- 1. At Unity Power Factor, kWh consumption is equal to kVAh Consumption.**
 - 2. Overloading of Distribution System is avoided resulting in better voltage profile.**
 - 3. Reduction in Line & Transformer losses.**
 - 4. Insulation Failures reduces.**
 - 5. Increase in Line Capacity.**
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Why kVAh Billing –

Demerits of Leading/Lagging Power Factor:

- Increased line losses
- Harmonic Resonance
- Over Voltage
- Switching spikes
- Tripping of Protection Relays
- Effects on consumer installations like temperature rise of equipments, overvoltage & equipment insulation failure etc.

Effect of power factor on load current & Transformer capacity

PARAMETER	COMPUTED VALUES FOR V = 440 VOLT				
kW	100	100	100	100	100
P.F. (Lag/Lead)	1	0.9	0.8	0.7	0.6
kVARr (Lag/Lead)	0	48	75	100	133
KVA	100	111	125	142	167
LOAD Amp.	131	145	164	186	219
TRANSFORMER Capacity (KVA)	125	150	150	200	200

So, for same load of 100 Kw of consumer with 0.7 P.F. transformer capacity required is 200 KVA and with improved power factor of Unity, capacity required is 125 KVA only.

kWh Billing Vs. kVAh Billing

kWh Billing	kVAh Billing
Consumers are billed as per kWh Consumption	Consumers are billed as per kVAh Consumption.
Power factor is also monitored separately though Incentive & Penalty Mechanism.	Inbuilt incentive/ penalty mechanism. No need for computation and monitoring of PF.
	Consumer drawing/injecting more reactive power will have to pay more and vice versa.
	Encourage consumer to minimize reactive power drawal/ injection

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

Hence, kVAh billing.....

KVAh Billing implemented in other states

Category	AP	CG	Delhi	Gujarat	Haryana	J&K
HT						
Industrial	✓	✓	✓	×	✓	✓
Commercial	✓	✓	✓	×	✓	×
Railways	✓	✓	✓	×	✓	×
Agriculture	✓	✓	×	×	×	×
PWW/LIS	✓	✓	✓	×	×	✓
Temporary	✓	✓	✓	×	×	×
Bulk Supply	✓	✓	×	×	✓	✓
Start up	×	✓	×	×	×	×
LT						
Domestic	×	×	×	×	×	×
Non Domestic /Commercial	✓*	×	✓*	×	✓\$	×
PWW	✓	×	✓*	×	×	×
Agriculture	×	×	×	×	×	×
Industrial	✓#	×	✓*	×	✓	×
Street Light	×	×	×	✓	×	×

MSEDCL also intends to implement the category wise KVAh billing like other states

MERC Directives regarding treatment of power factor till April 2020

Mid Term Review order dated 12.09.2018:-

- As a first step towards implementation of kVAh billing which is devoid of any separate incentive / penalty for power factor , the Commission has reduced PF Incentive from 7% at Unity power factor to 3.5% & introduced Penalty for leading power factor also.
- Whenever the average Power Factor is more than 0.95 lag to 1, an incentive from 0.5 % upto 3.5 %.
- MSEDCL has implemented the Order w.e.f. 01.09.2018

Petitions filed in PF related matters

- Various consumers filed petitions seeking review of PF related clause in the Commissions' Order on MSEDCL's MTR dated 12th September'2018.
- Following Orders are passed by the Commission on 2nd January'2019 in this regards.

Petitioner	Case No.	Subject
Chamber of Marathwada Industries and Agricultural	329 of 2018	Seeking clarification about the methodology to be followed for determination of PF (lag or lead)
Garware Polyester Limited	332 of 2018	Seeking deferment of implementation of revised methodology of computing PF stipulated in MTR Order
Alloy Steel Producers Association of India	338 of 2018	Seeking review of PF Penalty stipulated in MTR Tariff Order
Vidarbh Industries Association	344 of 2018	Seeking review / clarification of MTR Order relating to Power Factor Incentive / Penalty.
Shri Suresh Halwankar	347 of 2018	Seeking review / clarification of MTR Order relating to Power Factor Incentive / Penalty

Summary of MERC Order Dt. 02.01.2019

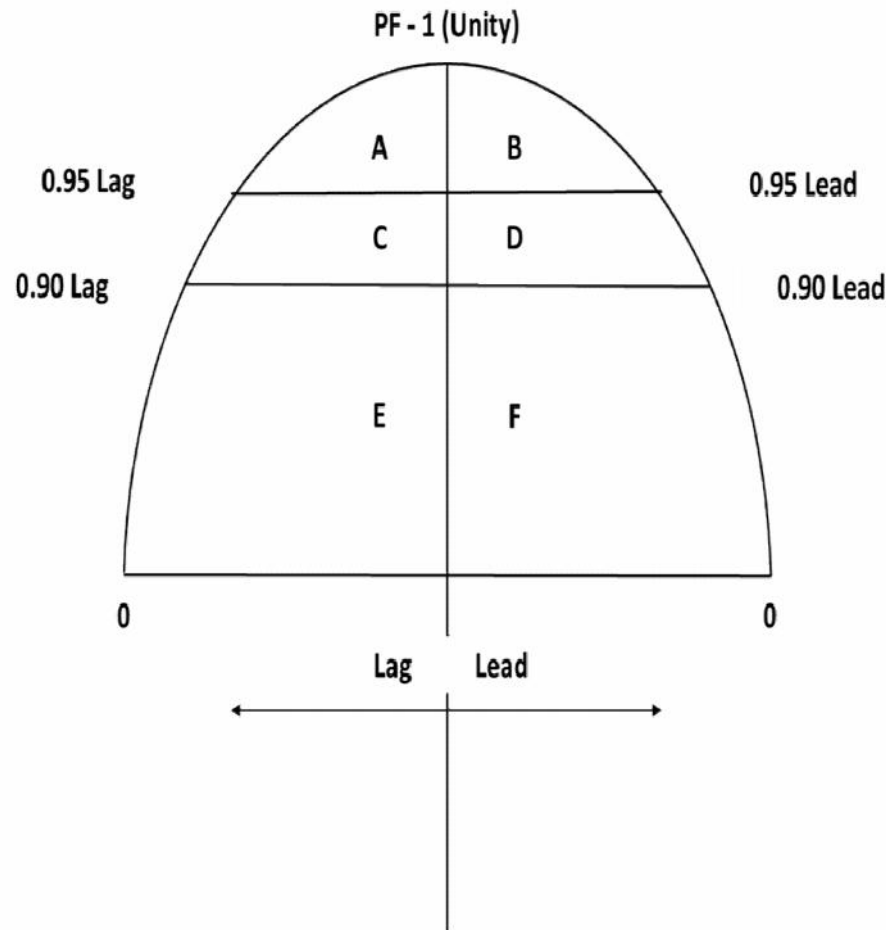
MERC approved formula for KVAh calculation as below:-

- Total kVAh for computing PF with Lead or Lag RKVAh shall be computed as follows:

$$\text{kVAh} = \sqrt{(\text{KWH})^2 + (\text{RKVAH Lag} + \text{RKVAH Lead})^2}$$

- Average PF can be considered as Leading or Lagging based on the following test:
 - *If RKVAh (Lead) > RKVAh (Lag), Average PF shall be considered as Lead*
 - *If RKVAh (Lead) <= RKVAh (Lag), Average PF shall be considered as Lag*
- Total PF incentive of 3.5% approved in MTR Order remains as it is

Applicability of PF Incentive/ Penalty mechanism



Particulars	Before MTR	After MTR (12.09.18)	After 02 nd Jan 2019
Incentives	A + B + D + F	A	A + B
Penalty	E	E + F	E + F
No Incentive/ Penalty	C	B + C + D	C + D

MERC directives on 02.01.2019 :

- B to be refunded in three EMIs from 01.02.2019.
- D & F conditional refund after April 2019 if PF is equal to or above 0.90 (Lead or Lag)

MSEDCL has issued circular No.312 dtd 15.01.2019 for implementation of the same

Thank You.