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| **CMGT 235 – Electrical and Mechanical Systems** |
| **Calculating Power Bill** | **Unit 3 - Electrical Systems** |  |

**Utility Bills**

* The electric utility provides working (kW) and reactive power (kVAR) to your building power distribution system (plant) in the form of apparent power (kVA).
* While reactive power (kVAR) doesn’t register on kW demand or kW hour meters, the utility’s transmission and distribution system must be large enough to provide the total power.
* Utilities have various ways of passing the expense of larger generators, transformers, cables, switches, and the like, along to the owner.
* The utility measures and bills every ampere of current, including reactive current.
* The utility charges according to the kW demand and adds a surcharge or adjustment for power factor. The adjustment may be a multiplier applied to kW demand.
* Some utilities charge for low power factor (tariff) but give a credit or bonus for power above a certain level.
* Residential energy consumers are only billed for KWH.
* Commercial or industrial energy consumers are billed based on KWH but are also subject to a charge based on the KWH/KVAH ratio (power factor). As the power factor goes lower, your extra charge goes higher.

**Example 4. Some utilities charge for each kVAr of reactive power generated.**

If the actual demand is 1,000 kW, the power factor is 80%, and the power factor charge is $0.30 per kVAr each month, calculate the power factor charge.

KVAR = KW x Tan [Cos-1 (PF)] = 1000 kW x Tan [cos-1(0.8)] = 750 KVAR

PF Charge = 750 KVAR x $0.30/KVAR-month = $225/month

**Example 5. Some utilities add a demand penalty when the power factor is less than a set amount, usually 90%.**

For example, a utility may specify a demand penalty of:

Demand penalty = kW (0.90 – PF) / PF when PF < 0.90

If actual demand is 1,000 kW, the power factor is 80%, and the cost of demand is $15 /kW-month, calculate the power factor charge.

(0.9 – 0.8)

 0.8

Demand Penalty = 1000 kW = 125 kW

PF Charge = 125 kW x $15/kW-month = $1,875/month

**Example 6. Some utilities base the demand charge on the total supplied power (kVA) rather than actual power (kW). Basing the demand charge on kVA implicitly includes a power factor charge since kVA = kW / PF.**

If actual demand is 1,000 kW, the power factor is 80%, and the cost of demand is $16 /kVA-month, calculate the implicit power factor charge.

1000 kW

 0.8

KVA = = 1250 KVA

PF Charge = (KVA – KW) x $16/KVA-month = (1250 KVA – 1000 KW) x $16/KVA-month = $4000/month

**What is the PG&E Methodology for Power Factor Billing Adjustment?**

For customers with peak demand over 400 kW, PG&E will install revenue metering capable of recording kilowatt demand, kilowatt-hours (kWh) and reactive kilovolt-amp hours (rkVAh). Interval meters can record these values every 15 minutes. For the power factor that is used in billing, the kilowatt-hours and the reactive kilovolt-amp hours are totaled for the month and a single calculation is performed to provide an average value for that billing period. The equation is



**For more information see the PG&E Web site at** [**https://www.pge.com**](https://www.pge.com)