



**ENERGY MANAGEMENT AND AUDIT - CEM
REFRESHER TRAINING COURSE**
KRISHNAJI PAWAR, LEED AP BD+C, GSAS CGP, ISO 14001:2015, GCP
CEM REFRESHER TRAINING COURSE





**ENERGY RATE STRUCTURE - 2
FOR ENERGY PROFESSIONALS**
KRISHNAJI PAWAR, LEED AP BD+C, GSAS CGP, ISO 14001:2015, GCP
ENERGY SPECIALIST CURRICULUM COURSE





WHAT SHOULD YOU LEARN



Early History of Rates
The Structure of Electric Rates
The Demand Ratchet
Typical Electric Cost Components
Economic Benefit of EMOs
Innovative Rate Schedules
Real Time Pricing

EARLY HISTORY OF RATES

- ✓ The earliest rates were very simple; \$10 per month per light bulb
- ✓ The first electric meter read in "cubic feet"
- ✓ Meters were soon changed to display "lamp-hours" and then to kWh
- ✓ Business was so good that many new customers were added, and soon caused a night "peak load" that brought on operational problems.



THE STRUCTURE OF ELECTRIC RATES

- ✓ Electric rate structures vary greatly from utility to utility, but they all have common features.
- ✓ Commercial and industrial customers have three or four major components to their electric bill.
- ✓ Customer cost
- ✓ Energy cost
- ✓ Demand cost
- ✓ Others such as power factor (Cos phi), time of day, voltage levels, interruptible or firm service, and customer class.



THE STRUCTURE OF ELECTRIC RATES +

- ✓ Customer Cost - a constant monthly cost; covers the utility's expenses in providing a meter, reading the meter, sending a bill, etc.
- ✓ Energy Cost - a proportional factor based on the number of kWh of electric energy used that month; occurs because of the utility's fuel and O&M expenses.
- ✓ Demand Cost - a proportional factor based on the number of kW of power measured. In some cases, it is hidden in the energy cost.



THE DEMAND RATCHET

- ☑ Some utilities want to make sure a customer pays a reasonable share of the cost of providing them electrical power. One way they do this is to add a demand ratchet to their rate structure.
- ☑ The demand ratchet is usually set such that the customer pays a large percentage of the highest demand experienced over the previous 11 months even if that peak was only reached one time.
- ☑ Typical demand ratchets range from 60% to 100%.



TYPICAL ELECTRIC COST COMPONENTS

- ☑ Energy cost - e.g. \$0.06/kWh
- ☑ Demand cost - e.g. \$6.50/kW/mo
- ☑ Fuel adjustment - e.g. \$0.025/kWh
- ☑ Power factor (Cos phi) penalty
 - e.g. \$6.50/kVA/mo
 - or kW billed = kW * (0.85/PF)
- ☑ Ratchet clause - e.g. Maximum of [kW this month, or 70% of maximum kW in last 11 months]



SAMPLE ELECTRIC RATE STRUCTURE #1 (CHARGES PER MONTH)

Rate structure:

- Customer cost \$50.00 per month
- Energy cost \$0.06 per kWh
- Demand cost \$6.50 per kW per month
- Fuel adjustment \$0.025 per kWh
- Taxes Total of 8% on entire bill



ECONOMIC BENEFIT OF EMOS

- ☑ The facility above has an average energy cost of (\$)/(150,000 kWh) = \$0.117 per kWh.
- ☑ An EMO that reduces peak demand would save the company \$7.02 per kW per month.
- ☑ EMOs that save both energy and demand on the first shift would save about \$0.117 per kWh.
- ☑ EMOs that save electrical energy during the off-peak shift would only save \$0.092 per kWh because they are already using off-peak energy and there would be no additional demand cost savings.

SAMPLE ELECTRIC RATE STRUCTURE #2

SECONDARY SERVICE (SERVICE LEVEL 5)

- ☑ Customer charge \$151.00/bill/month
- ☑ Demand charge applicable to all kW/month of billing demand:
 - On-peak season \$13.27/kW
 - Off-peak season \$4.82/kW
- ☑ Definition of season:
 - On-peak season: Revenue months of June-October of any year.
 - Off-peak season: Revenue months of November of any year through May of the succeeding year.

- ☑ Energy charge:
 - First two million kWh 3.528 ¢/kWh
 - All kWh over two million 3.113 ¢/kWh
- ☑ Power factor clause:
 - When the customer's average power factor (Cos phi) is less than 80%, the Billing Demand shall be determined by multiplying the metered demand by 80 and dividing by the actual average power factor expressed in per cent.
- ☑ Fuel cost adjustment:
 - A variable amount set by the utility to allow them to recover all their fuel costs.
- ☑ Ratchet Clause -- 65% demand ratchet

BILL CALCULATION EXAMPLE TWO

✓ Using the rate schedule above (Service level: Secondary-service level 5), calculate the September bill for the company whose electric use is below:

✓ Month: September

• Actual demand 250 kW

• Consumption 54,000 kWh

• Previous high billed demand (July) 500 kW

• Power factor 75% (Cos phi)

✓ Sales tax: 6%

✓ Fuel adjustment: 1.15 ¢/kWh (This value is calculated by the utility company according to the formula in the rate schedule.)

✓ As a first step, calculate the demand:

✓ Power factor (Cos phi) correction:

– PF corrected demand =
(actual demand) * (.80/PF) = 250 kW * (.80/.75) = 266.7 kW

✓ Minimum demand charge (ratchet clause)
= (500 kW) * (.65) = 325 kW

✓ Final Billed demand = Max (266.7 kW, 325 kW) = 325 kW

✓ Demand charge (on-peak season)
= (325 kW) (\$13.27/kW) = \$4312.75

✓ Consumption charge:
= (54,000 kWh) (\$.03528/kWh) = \$1905.12

✓ Fuel adjustment
= (54,000 kWh) (\$.0115/kWh) = \$ 621.12

✓ Total consumption charge = \$2526.12

✓ Customer charge: \$151.00

✓ Total charge before sales tax:

✓ $\$4312.75 + \$2526.12 + \$151.00 = \6989.87

✓ Sales tax:
 $\$6989.87 \times (.06) = \$ 419.39$

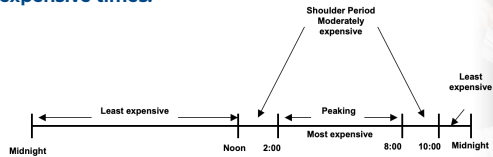
✓ Total*: $\$6989.87 + \$ 419.39 = \7409.26

* Ignoring franchise payment and late charges.

INNOVATIVE RATE SCHEDULES

☒ Time of Use Rates (TOU)

☒ **Concept:** Charge more for power (energy) at expensive (peaking) times for the utility. Charge less during less expensive times.



REAL TIME PRICING

☒ **Concept:** Charge for the “real” cost at that point in time. Price will change due to weather, season, power supply problems, power demand problems, etc. Since there is a strong seasonal and time of day component, it is a more sensitive time of use rate.

☒ **Notice:** Usually a 24 hour notice (day ahead pricing) is used. In “week ahead”, usually notice is given on Friday that will be accurate for Monday to Sunday of the next week.

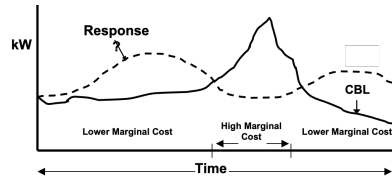
REAL TIME PRICING +

☒ **Method:** Many methods have been or will be tried; but most revolve around a “customer base line” (CBL), standard rates, and marginal rates for the specific time in question. The CBL is negotiated for 8760 hours (every hour in the next year) and is based on the customer’s history with the utility. Thus, the utility will likely take last year’s history and propose that as the CBL.

Remember, the CBL is negotiable; thus, it is worth spending time to examine and think about what you are going to do next year.

REAL TIME PRICING +

- ✓ Facilities can move energy use from periods when the marginal costs are high to periods when they are low, and save considerable amounts of money.



REAL TIME PRICING +

- ✓ This is a natural for computer (automated) control of select processes (reschedule electric furnace operation, turn off select equipment, or even alter production schedules to meet tomorrow's marginal costs).
- ✓ This is a natural for computer (automated) control of select processes (reschedule electric furnace operation, turn off select equipment, or even alter production schedules to meet tomorrow's marginal costs). If you do nothing and your consumption is the same as last year, the cost should be the same (CBL at standard rate). However, significant savings can be obtained by making active control decisions, and very large cost increases can occur if you consume more during high marginal costs (marginal costs can easily be 10 times as much as standard costs).

CHARACTERISTICS OF FACILITIES THAT HAVE FLEXIBILITY TO BENEFIT FROM TOU OR REAL TIME PRICING



The production process has:

- ✓ Discrete elements that can be interrupted or modulated.
- ✓ Excess production capacity.
- ✓ Intermediate storage capacity.

The customer can generate electricity on-site. heating needs

The customer can delay some production orders.

The cost of electricity is important compared to the cost of other inputs.