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Time of Use and Demand Metering - Why They are Important

TESCO's Meter School

TESCOOL

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Electric Power and Energy

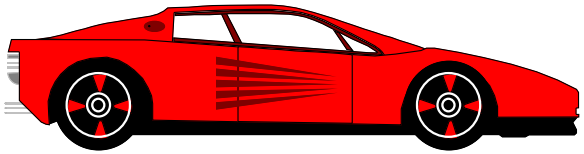
Power (P)

- **Rate** at which energy is produced or consumed
- Measured in Watts or kW*
- At any single point in time, $P = V \times I$

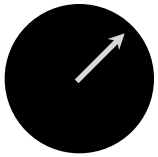
Energy (W, for Work)

- **Summation** of power applied over time
- Measured in Watthours or kWh*

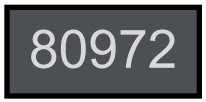
Electric Power and Energy



Power is like your car's rate of speed as shown on the speedometer.



Energy is like your car's traveled distance as shown on the odometer.



MEASURING WHAT IS DELIVERED

Delivered Item	Units of Delivery	Units for Rate of Delivery
Gasoline	*Gallons*	*Gallons/Hr*
Natural Gas	*Cubic feet*	*Cubic feet/Hr*
Water	*Gallons*	*Gallons/Hr*
Electricity	***Watt-hours***	***Watts***

Principles of Demand Metering

What is **"Demand"?**

- The average value of power (or related quantity) over a specified period of time
  - Expressed in units of:
    - kilowatts (kW)
    - kilovolt-amperes (kVA)
    - kilovars (kvar)
    - amperes (A)
  - Or other suitable units

WHY IS DEMAND IMPORTANT?

- Heavier loads tax the utility system more than smaller loads, and require larger equipment for generation, transmission, and distribution
- Utilities must recover for the costs of the infrastructure necessary to support the larger loads
- Demand is a measure of the impact of a consumer's loads
- Demand is used to determine how much a consumer should share in paying for infrastructure

WHY IS DEMAND IMPORTANT?

- More equitably allocates the “cost of service” to users
- Provides information on unexpected customer load growth
- kW demand is relatively easy to measure and record

Demand and Cost Recovery

- Utilities meter for Energy Consumption (kWh) in order to recover for cost of fuel.
- For larger, typically C&I customers, utilities also meter for Peak Demand in order to recover for cost of infrastructure.

VOCABULARY

Power: The rate at which energy is being used (watts)

Energy: The total use of power over a period over time (watt hours)

Demand: The average value of power (or related quantity) over a specified period of time.

Demand Interval: The length of the interval of time upon which the demand measurement is based.

Block Demand: Demand calculation based on a single demand interval.

Rolling Demand: Demand calculation based on several demand sub-intervals.

VOCABULARY (Con't)

Maximum Demand: The largest of a particular type of demand occurring within a specified period, such as one month. Also called peak demand.

Cumulative Demand: The sum of the previous billing period maximum demand readings. At time of billing period reset, the maximum demand for the most recent billing period is added to the previously accumulated total of all maximum demands.

Continuously Cumulative Demand: The sum of the previous billing period maximum demands (cumulative demand), and the present period maximum demand.

HOW DO WE MEASURE FOR DEMAND?

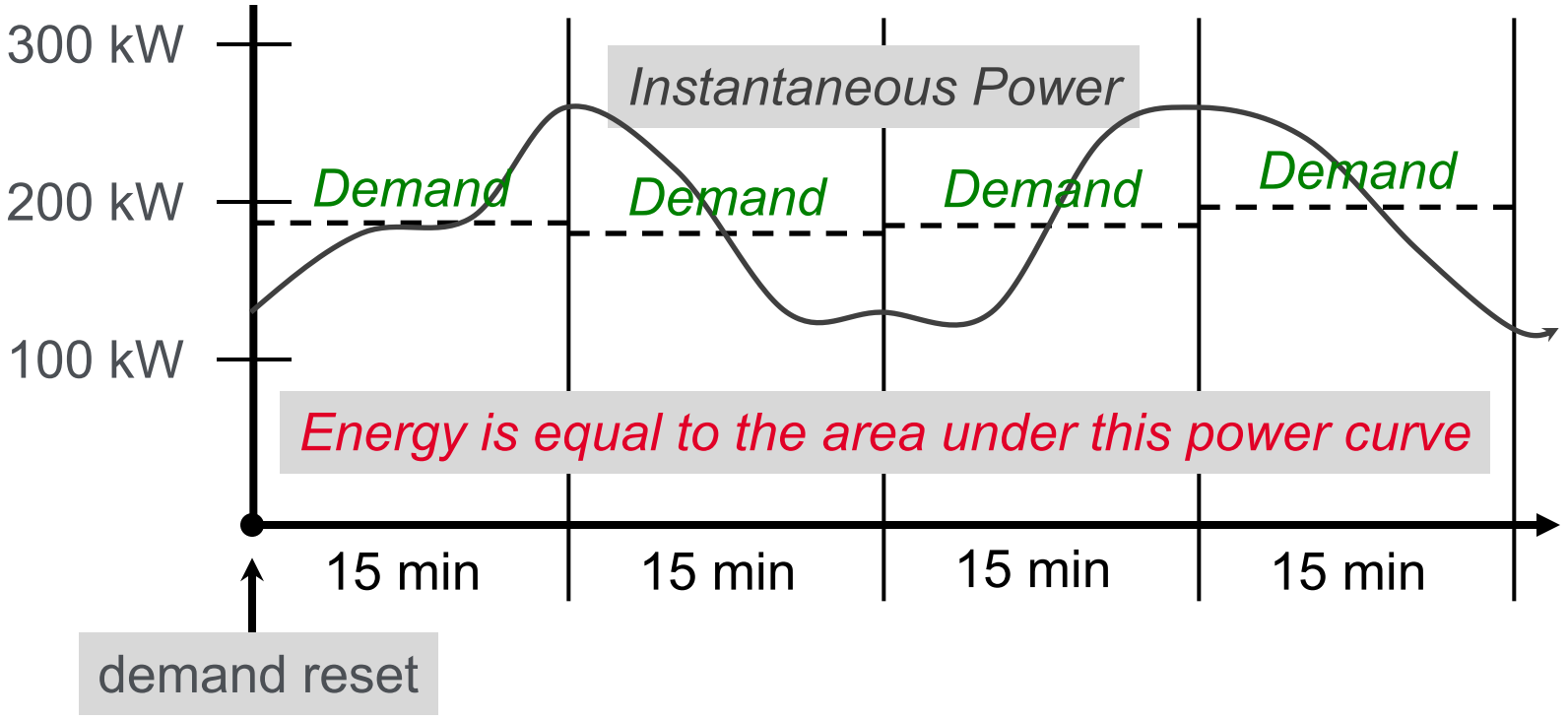
Demand is the average power calculated for every demand interval, simply **Energy / Time**.

Example: For 10 kWh consumed in a 15-minute demand interval,

Demand = 10 kWh / 0.25 h
Demand = 40 kW

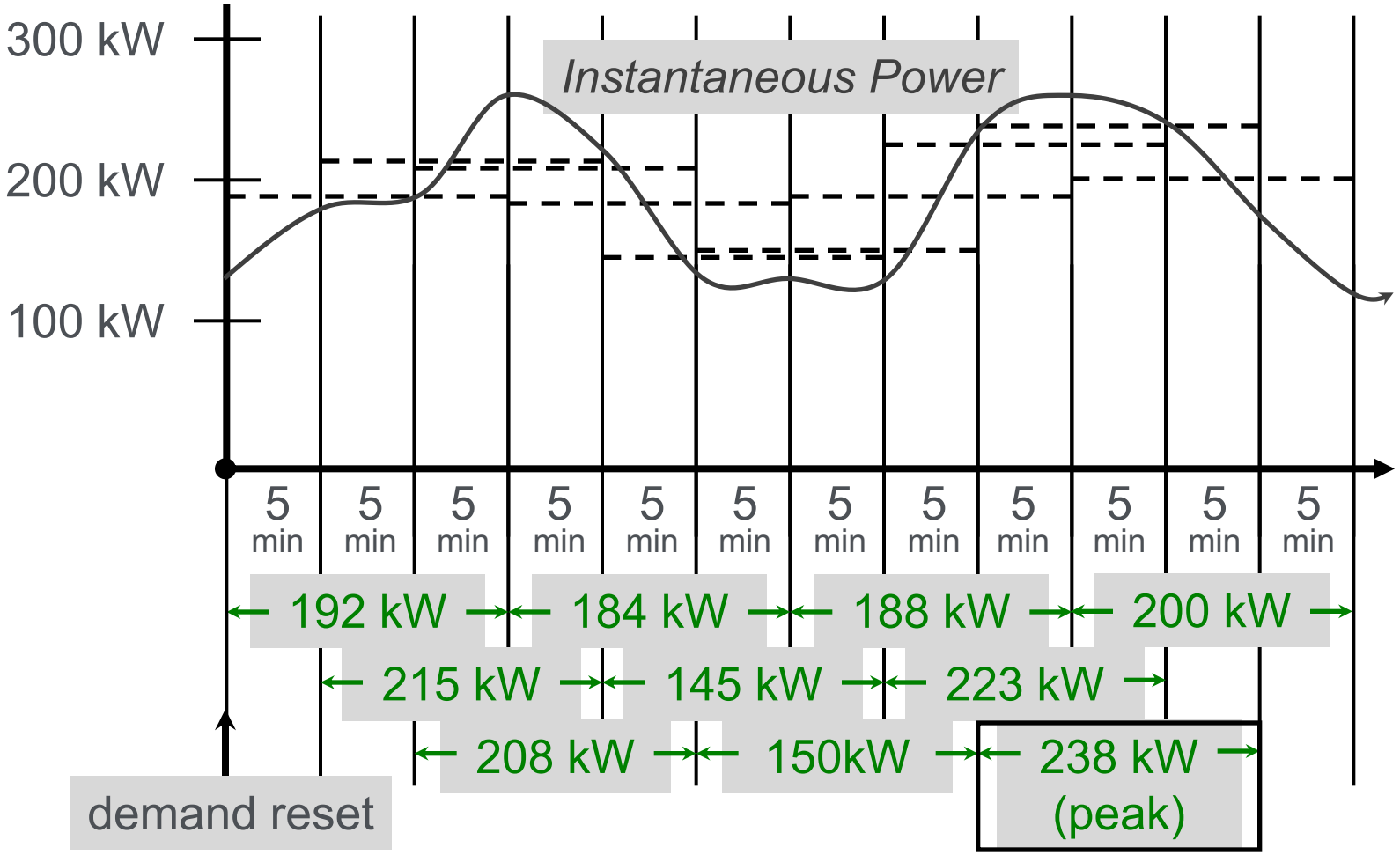
A watthour-demand meter keeps a record of the **Peak Demand** since the last demand reset, and this is used for billing.

BLOCK DEMAND



Energy:	48 kWh	46 kWh	47 kWh	50 kWh
Demand:	192 kW	184 kW	188 kW	200 kW (peak)

ROLLING DEMAND



PEAK AND CUMULATIVE DEMAND

Interval	Demand	Peak Demand	Cumulative Demand	Cumulative Demand Continuously Updated
TOTAL RESET				
		0	0	0
1	40	40	0	40
2	42	42	0	42
3	50	50	0	50
4	47	**50**	0	50
DEMAND RESET				
		0	50	50
1	47	47	50	97
2	44	47	50	97
3	41	47	50	97
4	49	**49**	50	99
DEMAND RESET				
		0	99	99
1	43	43	99	142
2	46	46	99	145
3	44	46	99	145
4	45	**46**	99	145
DEMAND RESET				
		0	145	145

What is Load Profile?

Load Profile Data is a collection of discrete time interval metering data (kWh, kVAh, V2h, etc.) recorded for each channel in a meter over a user-defined period of time. Load Profile parameters have to be defined for every account. The parameters in specific may be:

- Interval size in time units*
- Interval length, i.e. number of such intervals*
- Channel unit of measurement*
- TOU (time-of-use) Calendar name
- TOU Schedule name

Time of Use (TOU)

- Large utilities generate power from a variety of sources
- Fuel costs are very low for some types of plants, higher for others
- Very large and efficient “base-load” plants (the newest coal or nuclear plants) may have very low fuel cost. These also run 24 hours per day and every day possible
- Some old or less efficient plants are run only when the need is great, perhaps for only a few hours each day
- Some plants with very high fuel cost may be run only in emergencies

Time of Use (TOU)

The result: Varying energy cost as overall demand varies according to hour, type of day, and season

So, a utility may offer lower pricing during “off-peak” periods when the energy is less costly, and impose higher pricing during “on-peak” periods when more costly plants must be run.

This is known as TOU Billing.

Time of Use (TOU)

1. TOU Billing more fairly allocates for the varying energy costs.

2. Consumers are incentivized to reschedule their loads. Utilities often assist consumers with tools to predict billing outcomes.

The resulting schedule changes can drive an overall flatter load curve, decreasing the dependence on the higher cost power plants.

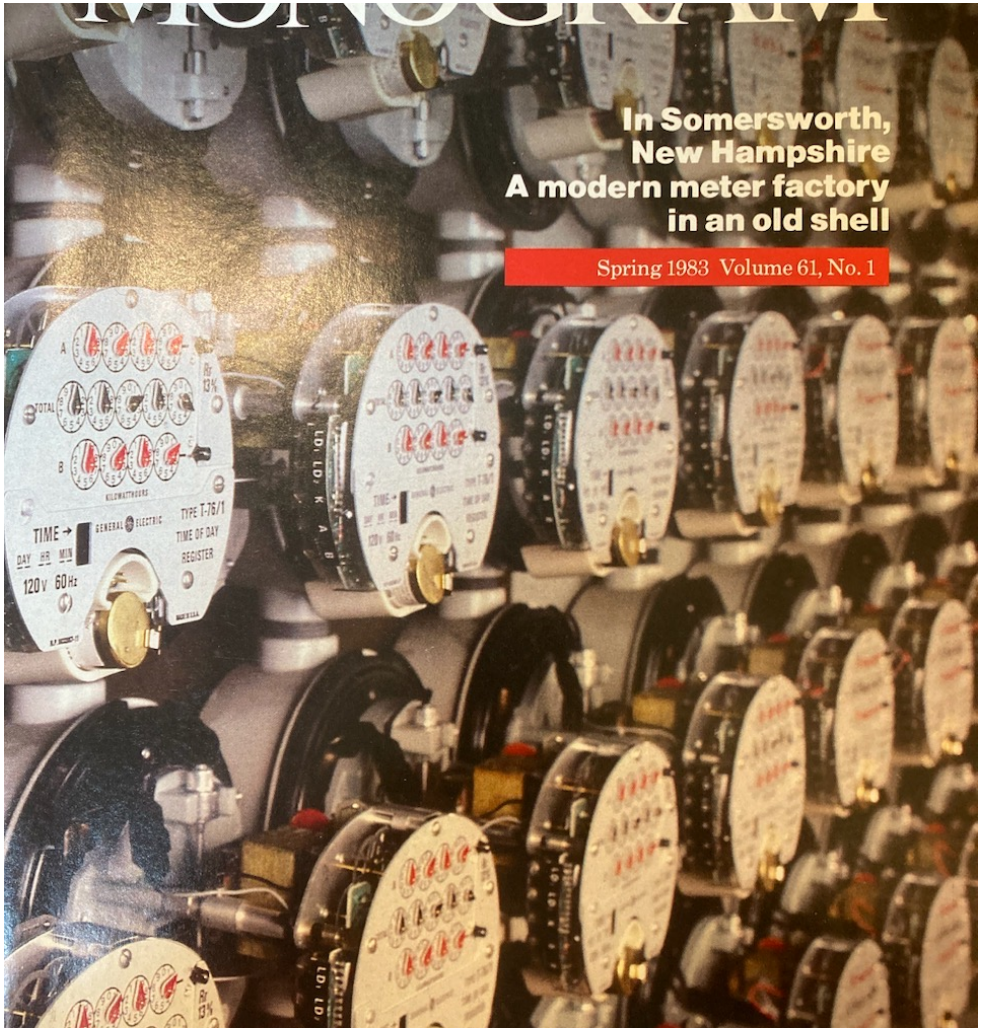
OK, so how do we meter for that?

Time of Use Metering

- A TOU meter accumulates energy, calculates demand and registers the data into specific rate “buckets” depending on the time of day
- TOU rate periods are typically called Peak, Shoulder Peak, Off Peak
- Different days of the week and holidays may have different TOU rate schedules
- You can have different “Seasons”
- TOU metering requires the meter to keep time and programmable dates are stored in calendars
- Meter can be programmed for self reads or demand resets on specific dates

T-76 Register

What did a TOU meter look like back in the day?



Thank you

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