Intro to DER

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DER vs DG

- DG = Distributed Generation
- DER = DG + Storage

May seem like semantics but small storage grew in potential since 2005

What is in DER

- Definitions vary but Small ($<$ 49MW) generation seems to count with $<$ 1MW most common.
  - Plenty of renewable
  - Small turbine
  - Backup generators
  - Battery banks.
- Combined Heat and Power
  - Steam Generation
  - Chill Water
  - District Energy

Why Would I (Private) Build It?

- Power Quality
  - Equipment is sensitive to voltage drops or spikes
  - Equipment is sensitive to frequency variation.
  - Wave shape and harmonics
  - High reactive power needs (Often avoids utility charge.)
- Reliability (Often combined with quality)
  - High cost of interrupted power, e.g., hospital
  - Two common measures
    - System Average Interruption Duration Index (SAIDI), average total time without power over a year.
    - Customer Average Interruption Duration Index (CAIDI), average time without given your power is out.
    - Many more relating to frequency and cost of lost service.
  - You could have lower rates if you have an interruptible tariff.

Why Would I (Private) Build It? (Cont)

- Peak reduction
  - If you have demand (kW) charges, your maximum use.
  - If you have a coincident peak (kW) charge, you use at system peak.
- Cogeneration Opportunity
  - Already need Steam or Chill water
  - Electricity generation is a bonus
- Reduction in volumetric (kWh) charges
  - Net metering just a bit to shave off the high block charges
  - Peak Pricing Tariff
  - Real-time Prices.
  - Nice subsidy.
  - Actually, social cost, cheaper.
- The utility side is significantly more complicated.

Three simple ways of thinking about costs

- The Make vs Buy trade-off (TC).
- The Minimum Efficient Scale (AC), i.e., volume such that AC is at a minimum.
- Investment Delay, a time value of money concept.

With all cost estimates the key conceptual problem is to only look at incremental costs.

- It is often unclear what those incremental costs are relative to.
- Cost does depend on your point of view.

Example Make vs Buy

Example MES

Example Investment Delay

How Did We Get to the Current G-T-D Arrangment