Microgrid Discussion

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Microgrid Interpretation

- A microgrid should be thought of as a local control and/or monitoring section of the electrical grid

  -- not necessarily stand-alone

Microgrid and Subgrid

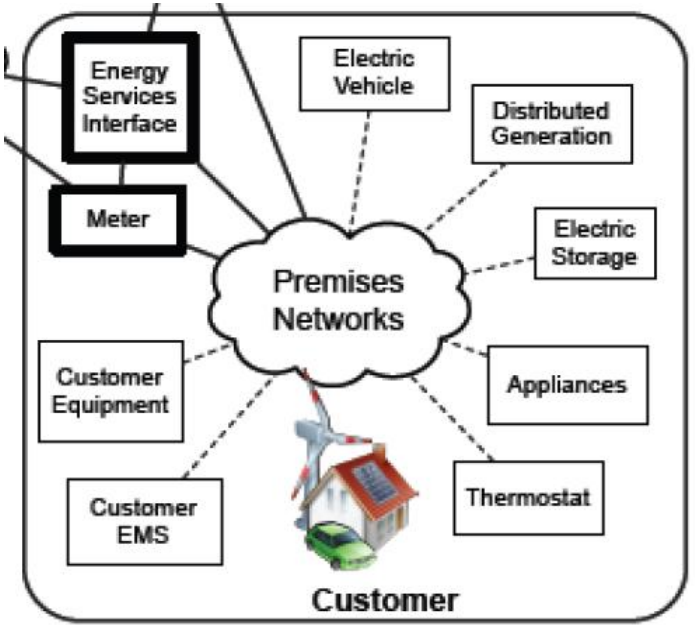
- Conventional Definition

  Microgrid is capable of operating independently or with macro-grid

- Extended Definition

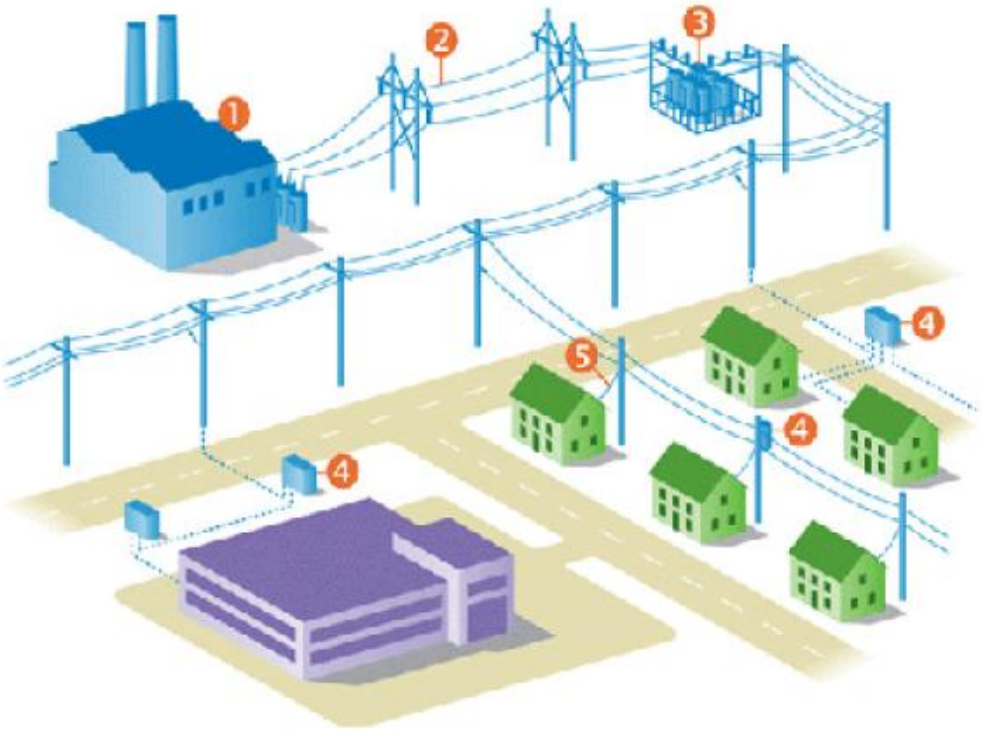
  A microgrid can also function as a subgrid (building or campus)

Many networked sensors used in Microgrid/ subgrid



Distribution and Microgrid/Subgrid

- Power generation (1), transmission (2) and substations (3) are under control of Utilities
- Commercial buildings (5) and part of distribution (4) are part of microgrid or subgrid
- All part of smart grid



Purpose of Subgrid
(when part of macrogrid)

- Region of control for energy usage
- Associated with specific building, functions or customers
- Monitoring of individual loads
- Modular to simplify installation and display

Relationship of
Smart Grid and Smart Building Sensors

- Many electrical devices (e.g. lighting, motors) are part of both smart grid and smart building arenas
- Energy efficiency affects both
- Many smart sensors and ensor networks are the same or similar for both
- A sub-grid is controlled or monitored by a specific group of sensors

Smart Building Concept

- Integration of HVAC, lighting, security and other building services
- Reduce energy use
- Automation of operations
- Interaction with outside service providers (e.g. utilities)
- Three main wired standards:
  - BACnet , Lonworks and Modbus
- Poplar wireless standards:
  - WiFi , Zigbee (but Bluetooth, 4G, proprietary gaining acceptance)

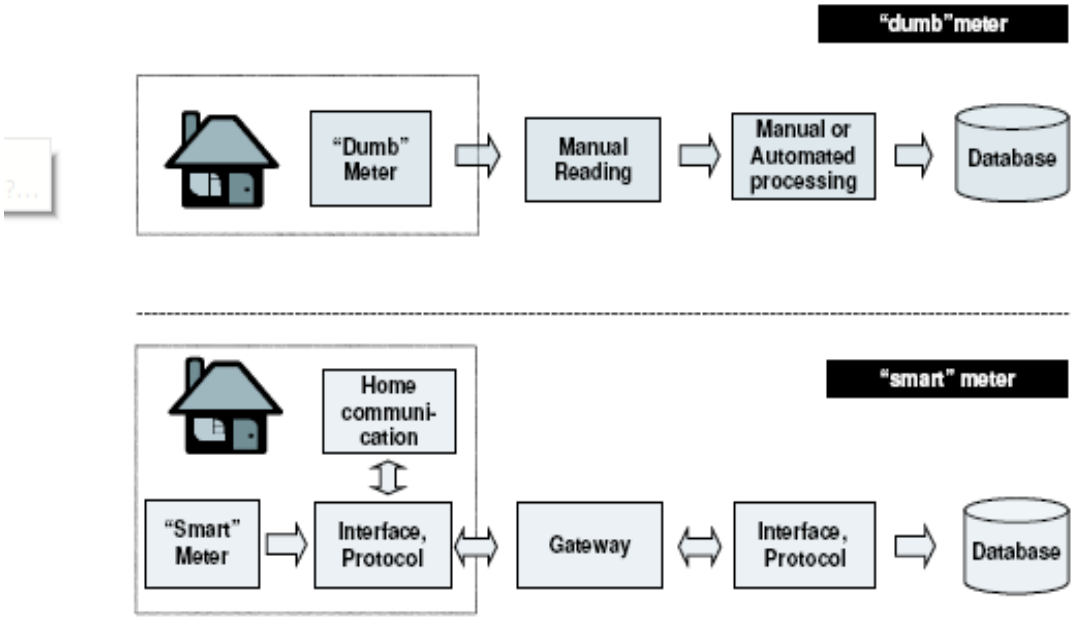
Smart building communication choices
with connection to Internet

- Ethernet
  - Lowest cost to Internet
  - Installed base but often not at sensor site
- Other wired*
  - USB, RS232, RS485, Lonworks, DALI
- WiFi
  - Mobile and convenient (if router * already present)
  - Requires power at sensor (usually), somewhat costly
- Local wireless (LAN)*
  - Mesh: Zigbee, 6LoWPAN, Wireless HART, ISA100
  - Star: 2.4 and sub-GHz, mostly proprietary
  - Low-power (battery), small size, lowest cost
- Powerline*
  - Attractive concept but both narrowband and wideband not fully proven
- Cell phone
  - SMS, G4 modems available but costly (and requires higher power)
  - Highly mobile and convenient

** Requires gateway to reach Internet*

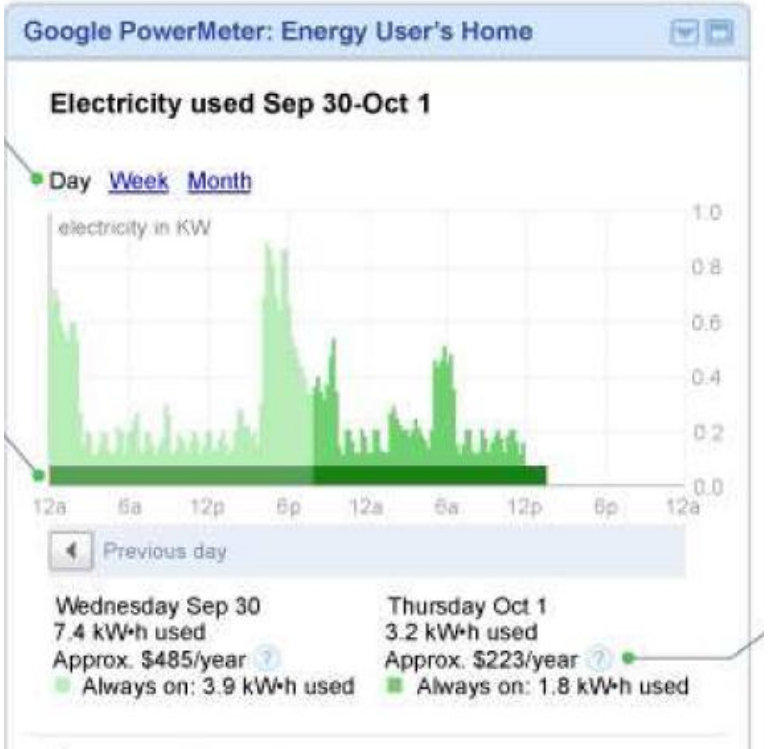
Energy Conservation --1

- Smart meters (at subgrid level) provide information needed to analyze energy usage and thus allow energy minimization algorithms to be implemented
- Real time data, best at individual loads
- Control programs by utilities or private companies



Energy Conservation -- 2

- Energy usage monitoring websites or dashboards
- Specific loads identified
- Power use vs time ($ calculated)
- Google Powermeter and MS Hohm discontinued
- Others available – eMonitor, Tendril, Wattvision, PowerCost Monitor
- 5% to 30% (15% avr) savings reported in usage studies



Future Work

- Provide subgrid sensor/control packages

  Better displays or dashboards
- Real-time and intuitive
- Standardize

End of Slides
(Wobschall)