



Grid ACADEMY

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Smart Grid

A Consumer's View

Doug Dillie

Director, Field Application Engineering • Eaton



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A consumer's view of the Smart Grid

Smart Grid – Past, Present & Future

- Introduction
 - Position our discussion in the Smart Grid world
 - The consumer's role in a Smarter grid
- Smart Grid in commercial and industrial (C&I) applications
 - Demand Response (Curtailment example)
- Smart Grid in Residential Applications
 - Smart Meters
 - Home Automation

Eaton Smart Grid Taxonomy

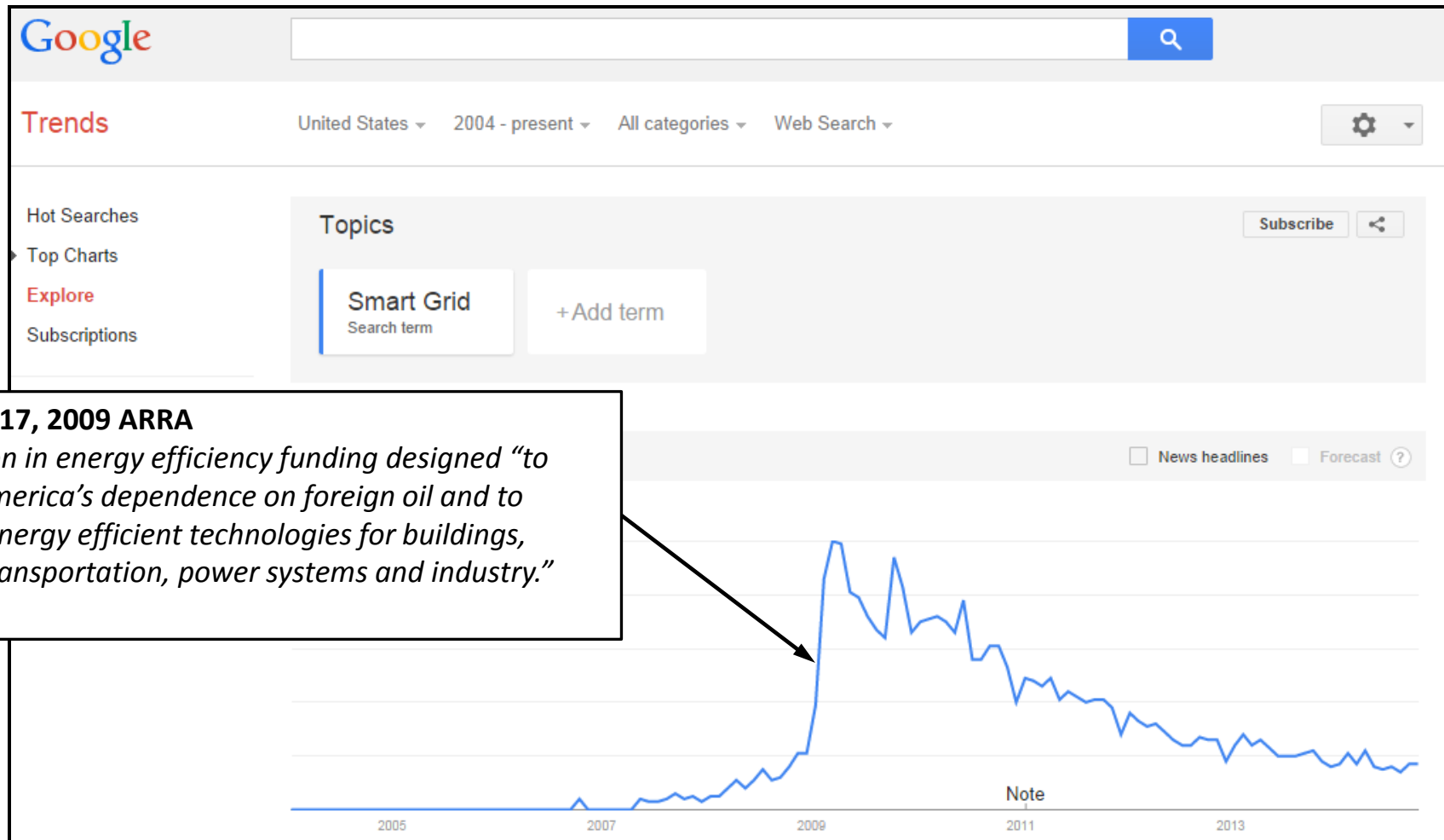
	Grid Automation	Smart Meters	Demand Response	EV Integration	Grid Connection Microgrid/Renewables
Utilities	Distribution Auto, Volt/Var Control, Outages, Back office services (IT)	Smart Meter <u>purchaser</u> Market	MDM Systems, Curtailment Service and Direct Control	Role still evolving. Will at least influence	Major wind & solar + Grid-connect standards/influence
Commercial / Industrial	IEC-61850 requirements at Grid connection	Secondary Smart Meter <u>user</u> market	BMS or EMS Lighting/Drives Curtailments Svcs	Retail outlets + office buildings	Stand-by power + solar / wind. Microgrid at Univs.
Residential		Primary Smart Meter <u>user</u> market	Home Automation & Networks, plus Direct Demand Control	Single and multi-family	Residential solar interconnect
Fed Gov't	IEC-61850 requirements at Grid connection		BMS or EMS Lighting/Drives	Opportunities as Military adopts	Microgrids with Islanding
Municipalities			BMS or EMS Lighting/Drives Curtailments Svcs	Fleet, mass transit power infrastructure and Port Electrify	

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History of “Smart Grid”

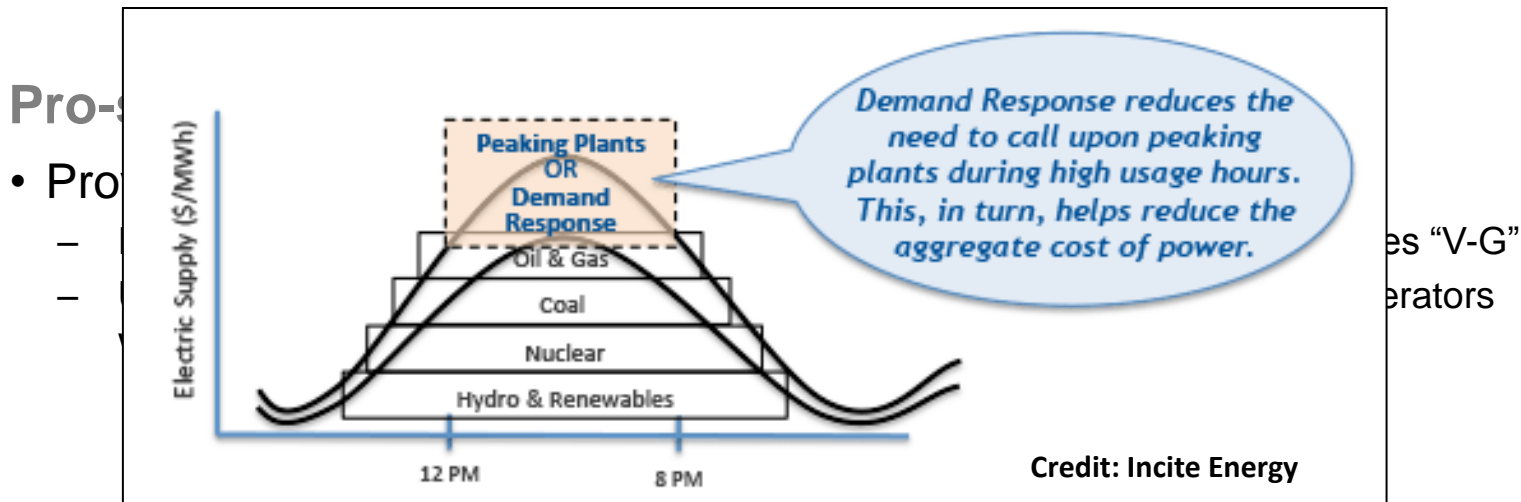
The term began in 2009....not the efforts



Role of the consumer in a smarter grid

Demand Response

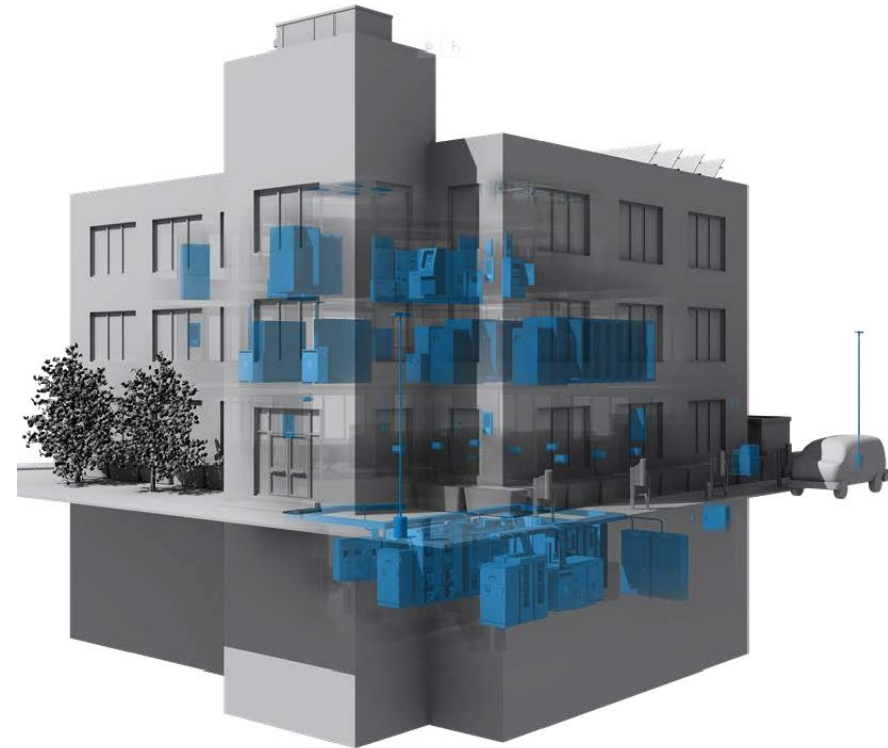
- Reduce the consumption of electricity in periods of high demand.
 - Benefits the grid operators (and society) by reducing the amount of generation capacity that must be available (less power plants)
 - Various tools to provide financial benefit to the consumer
 - Variable Pricing – Time of Day, Peak, Real-time
 - Curtailment commitments



Smart Grid – Commercial & Industrial

Driven by ROI, reliability and safety

- Today
 - Cogeneration / Combined Heat & Power (CHP)
 - Energy Efficiency vs Demand Response
 - Demand Response example



Demand Response Example

Eaton / Moon Township, PA

Program

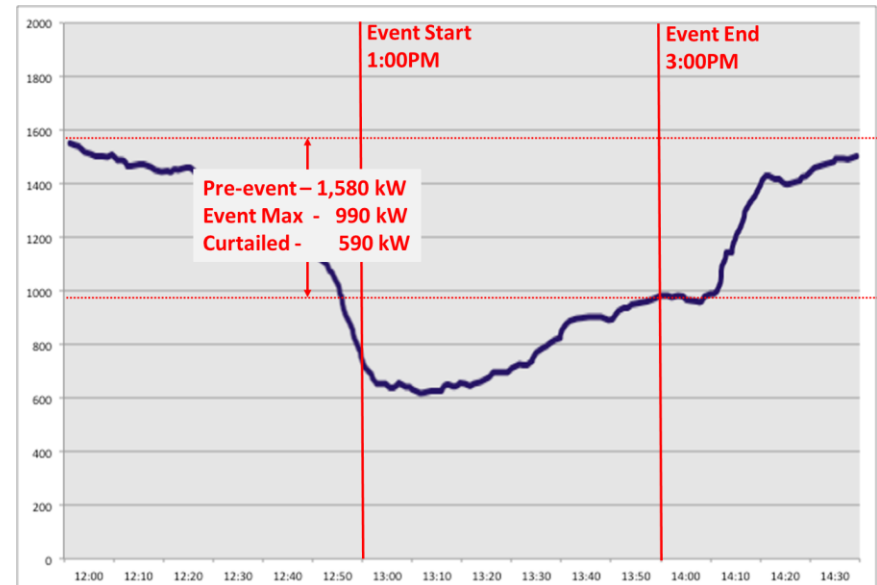
- Annual commitment (kW curtailment)
- Contract with 3rd party 'aggregator'
- Guaranteed payment
- No more than 10 events per year
- Maximum event duration = 6 hours

Methods

- Uses existing equipment /controls
- Behavioral and automatic controls



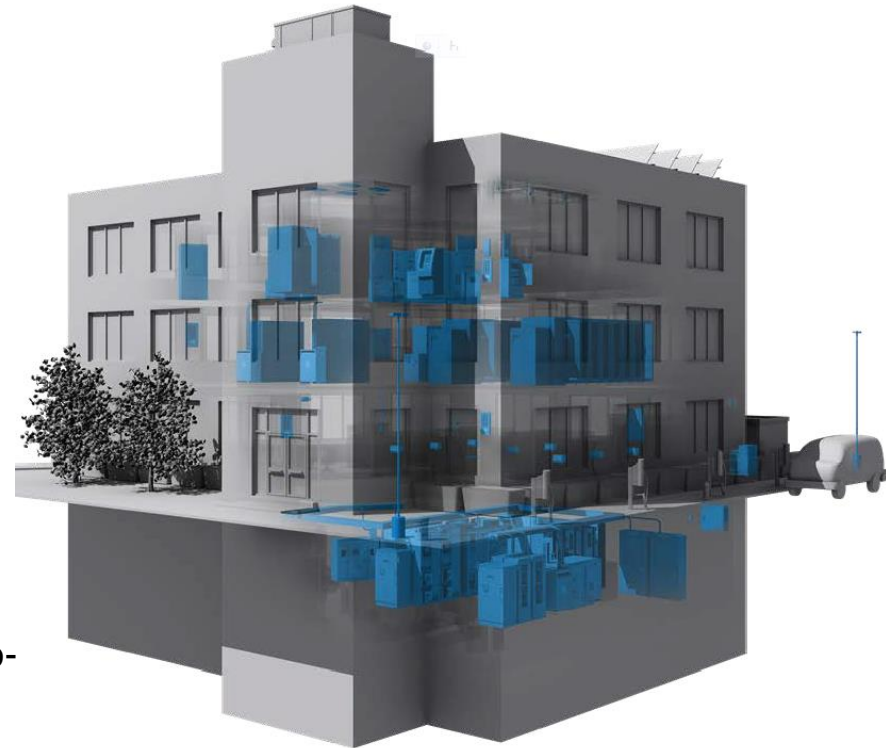
Year	Commitment (reduction)	Eaton earnings
1	1 MW	\$30,000
2	200 kW	\$5,500
3	400 kW	\$18,600



Smart Grid – Commercial & Industrial

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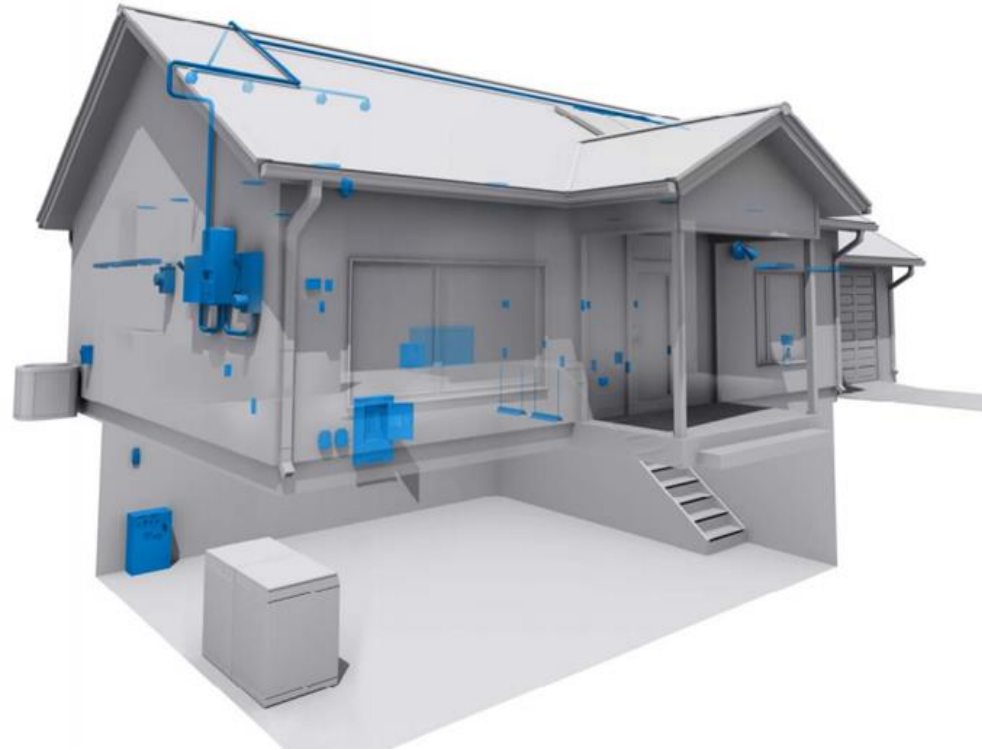
- Today
 - Co-Generation (co-gen)
 - Energy Efficiency vs Demand Response
 - Demand Response Example
- Tomorrow
 - Will grid connection requirements and feed-in tariffs evolve to encourage the expansion of distributed generation?
 - How will changing regulations affect the independent DR market?
 - How quickly will technologies like storage, micro-turbines and “Vehicle to Grid” evolve?



Smart Grid – Residential

Driven by comfort, convenience and cost

- Today
 - Demand Control
 - Direct Load Control
 - Smart Meters
 - Home Automation



Residential Smart Grid

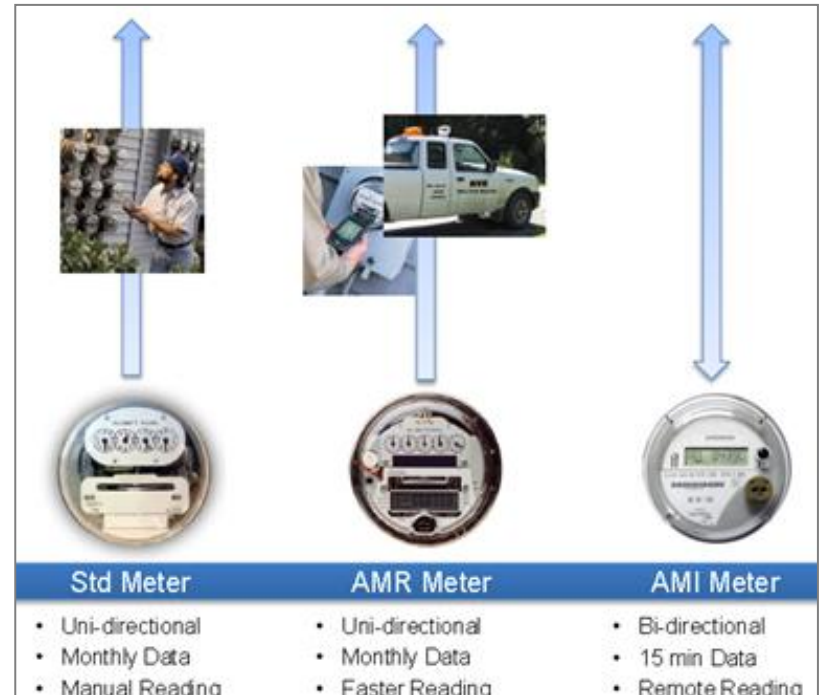
Today's technologies

Direct Load Control



- Has existed for many years
- Typically air conditioner control
- Optional participation to gain better rate

Smart Meters



- Most visible (controversial) part of Smart Grid
- Evolving from 'cash register' to grid sensor

A consumer's view of the Smart Grid

A tipping point in Home Automation?

- Home Automation – Everybody wants to play
 - Cable companies: Verizon, Comcast
 - Security companies: ADT,
 - Technology companies: AT&T/Cisco, Google, Apple
- Historical challenge is getting dissimilar devices to communicate. (Protocols)
- The emerging “Internet of Things” architecture appears to be the solution



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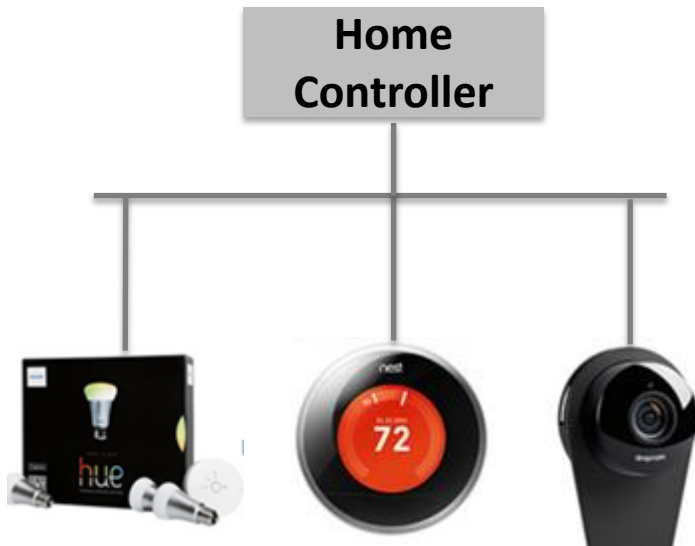
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Home Automation

Traditional automation architecture



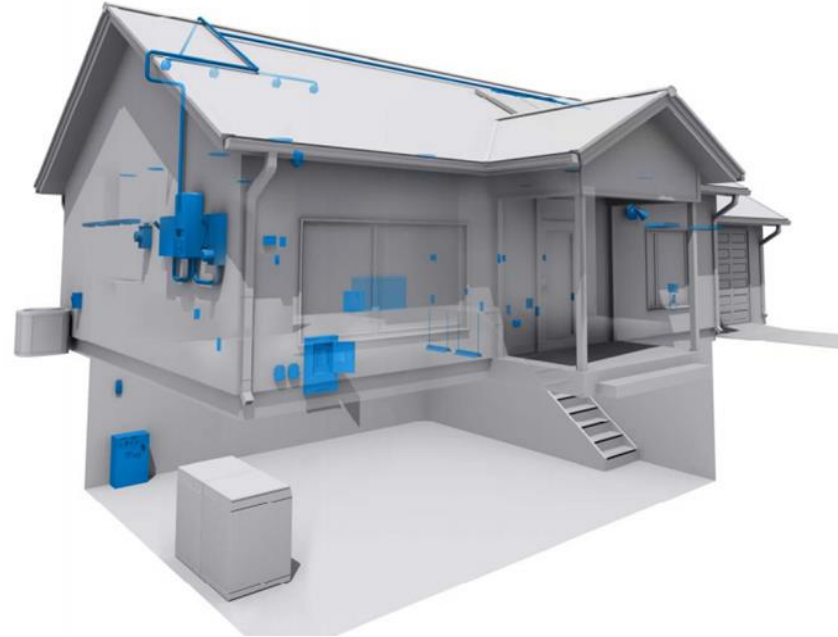
"Internet of Things" architecture



Smart Grid – Residential

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- Today
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- Tomorrow
 - Who owns the data from the meter hanging on the wall of my house? ...and can I access it?
 - Will an “Internet of Things” architecture help solve cyber security issues? Or make them worse?
 - How much will I have to save to be willing to forgo my comfort?



Smart Grid will evolve at the ‘speed of value’. The value to the Consumer and to the Utility is paced by energy cost and price. The value to Society is the wildcard.

- Unknown