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Demand Side Management and Demand Response

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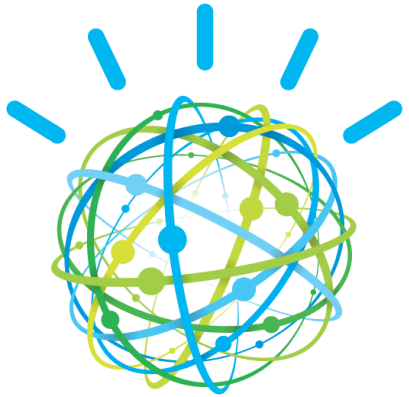
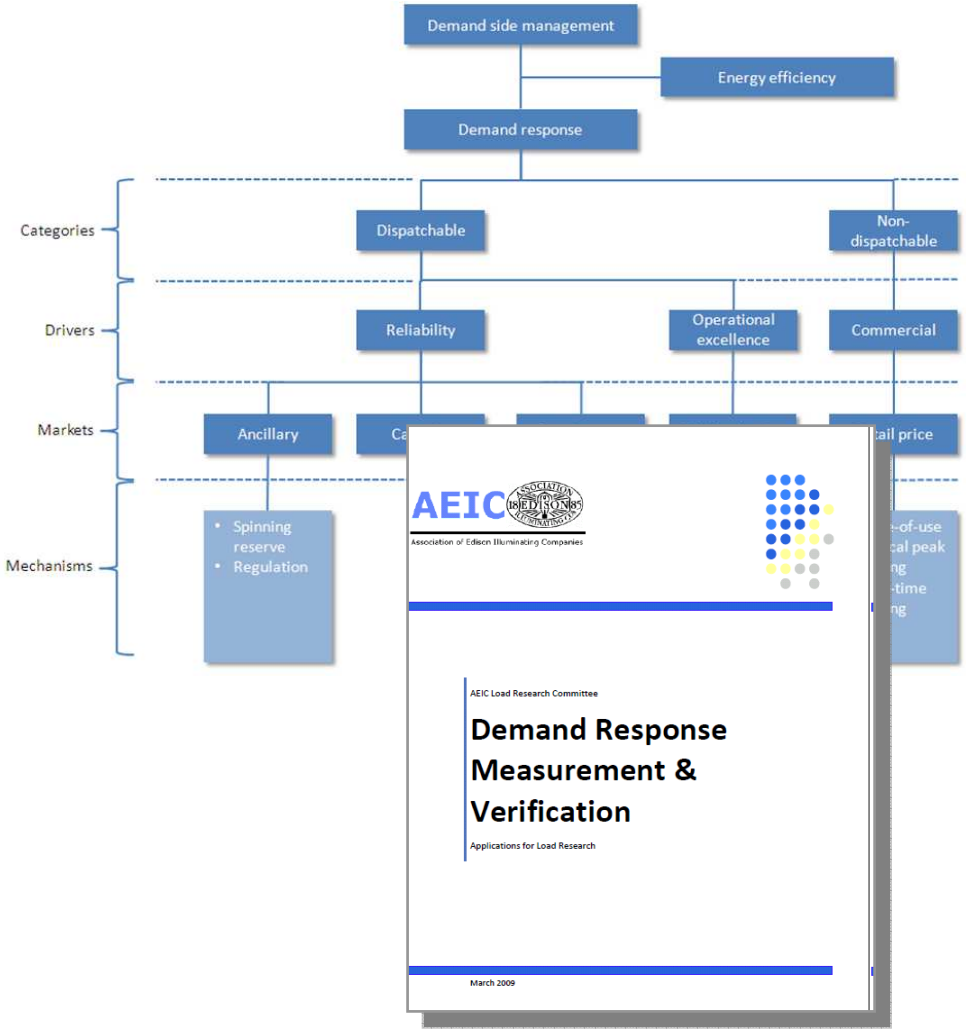


Key Points

- Demand Response / Demand Side Management is needed
- Customer engagement, understanding, trust and approval are vital
- Multiple market players will need to interact
- Energy tariff may not be the best mechanism to share value with customers
- Automation will be necessary
- We can learn from examples elsewhere

What are we talking about?



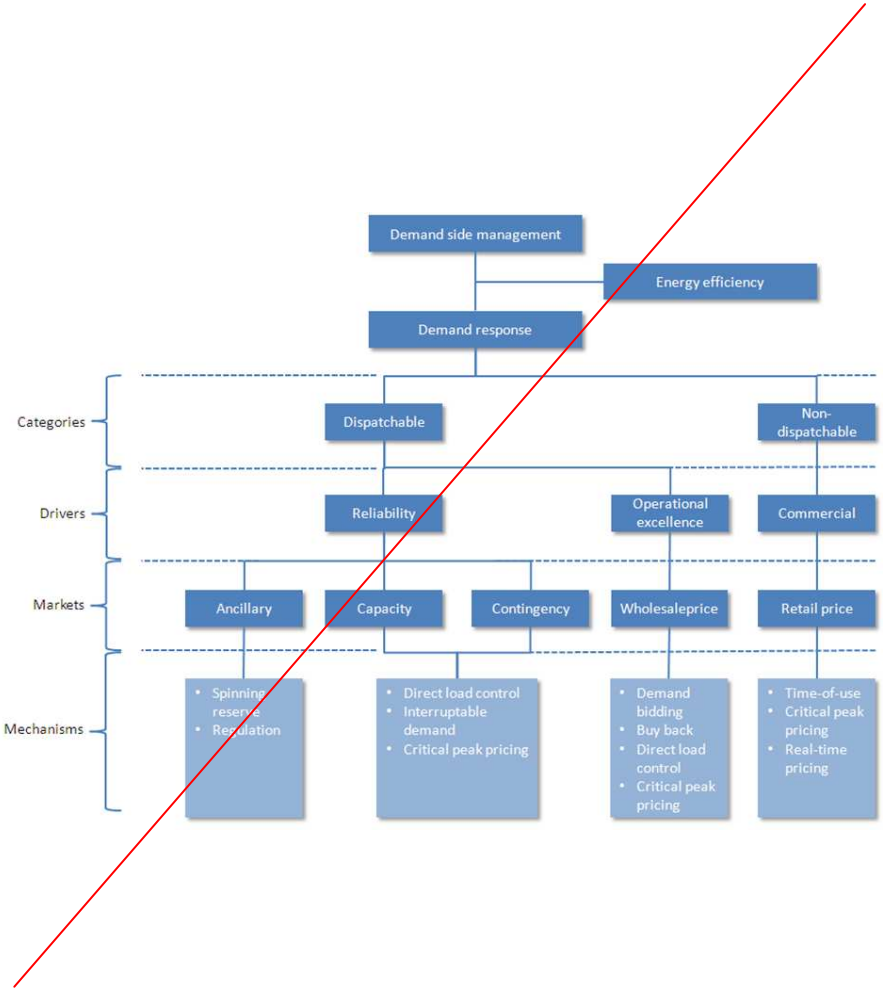
Technical Language

- Demand Side Management
- Demand Respond
  - Disptachable
  - Non-dispatchable
- Critical Peak / Time-of-use pricing
- Direct Load Control

What are we talking about?

Demand Response in Action

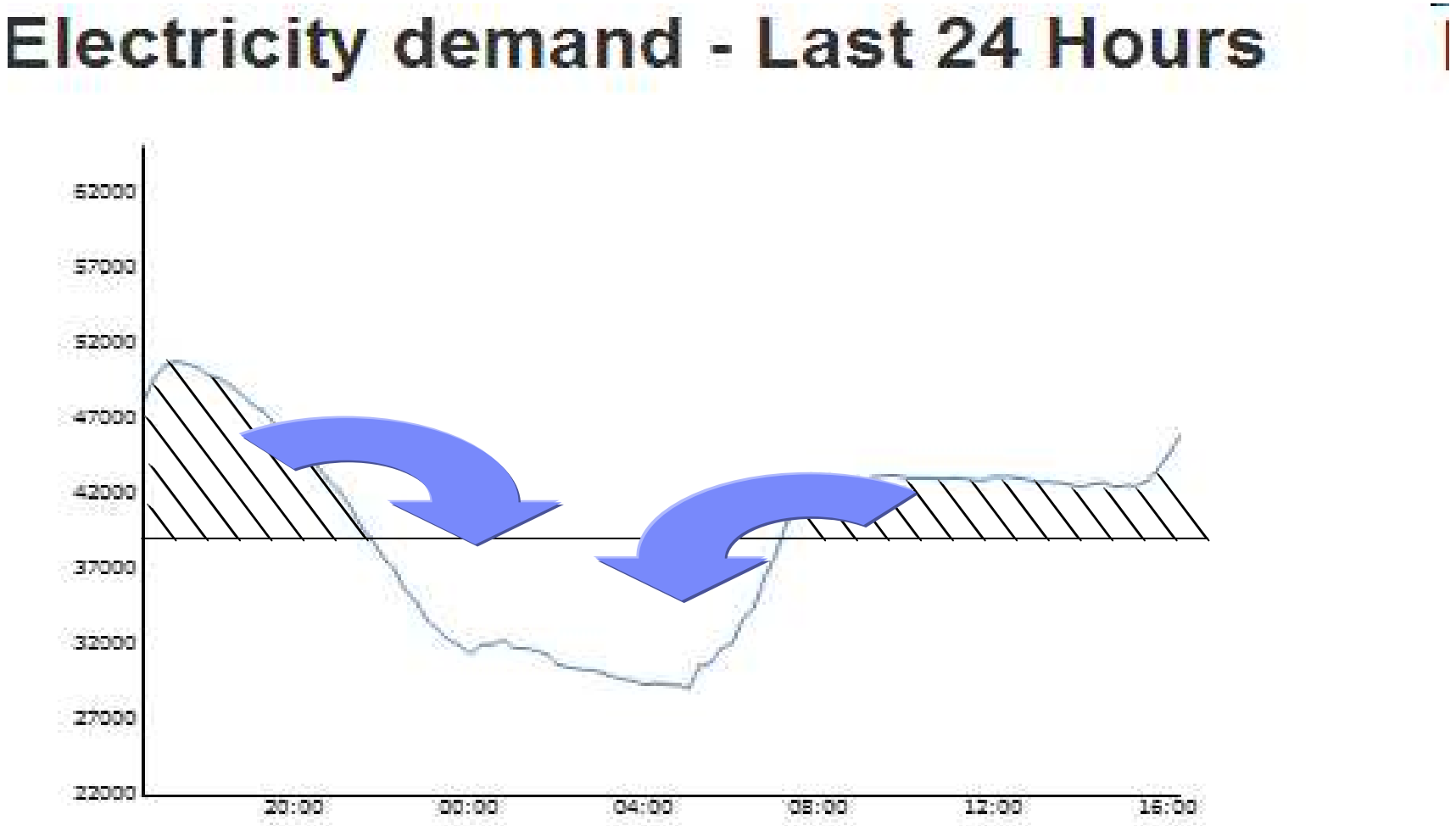
What are we talking about?



Plain English

- Balancing demand to supply
- Shifting patterns of electricity use
  - When? How much?
  - By controlling equipment
  - By influencing customer choices
- Getting customers to agree to change
- Sharing the benefit with them

“Persistent Shift” – changing the baseline



Source http://www.nationalgrid.com/uk/Electricity/Data/Realtime/Demand/demand24.htm
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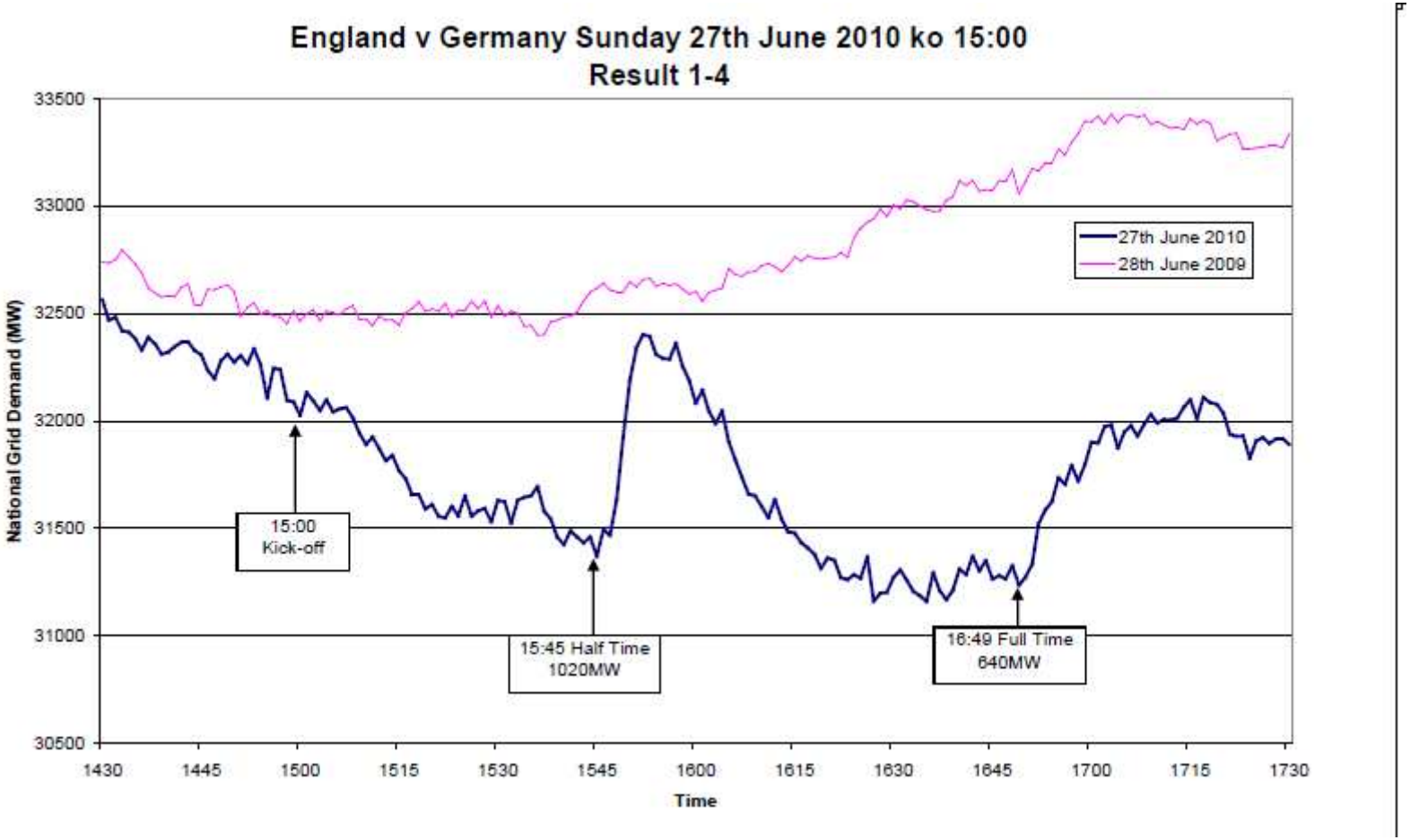
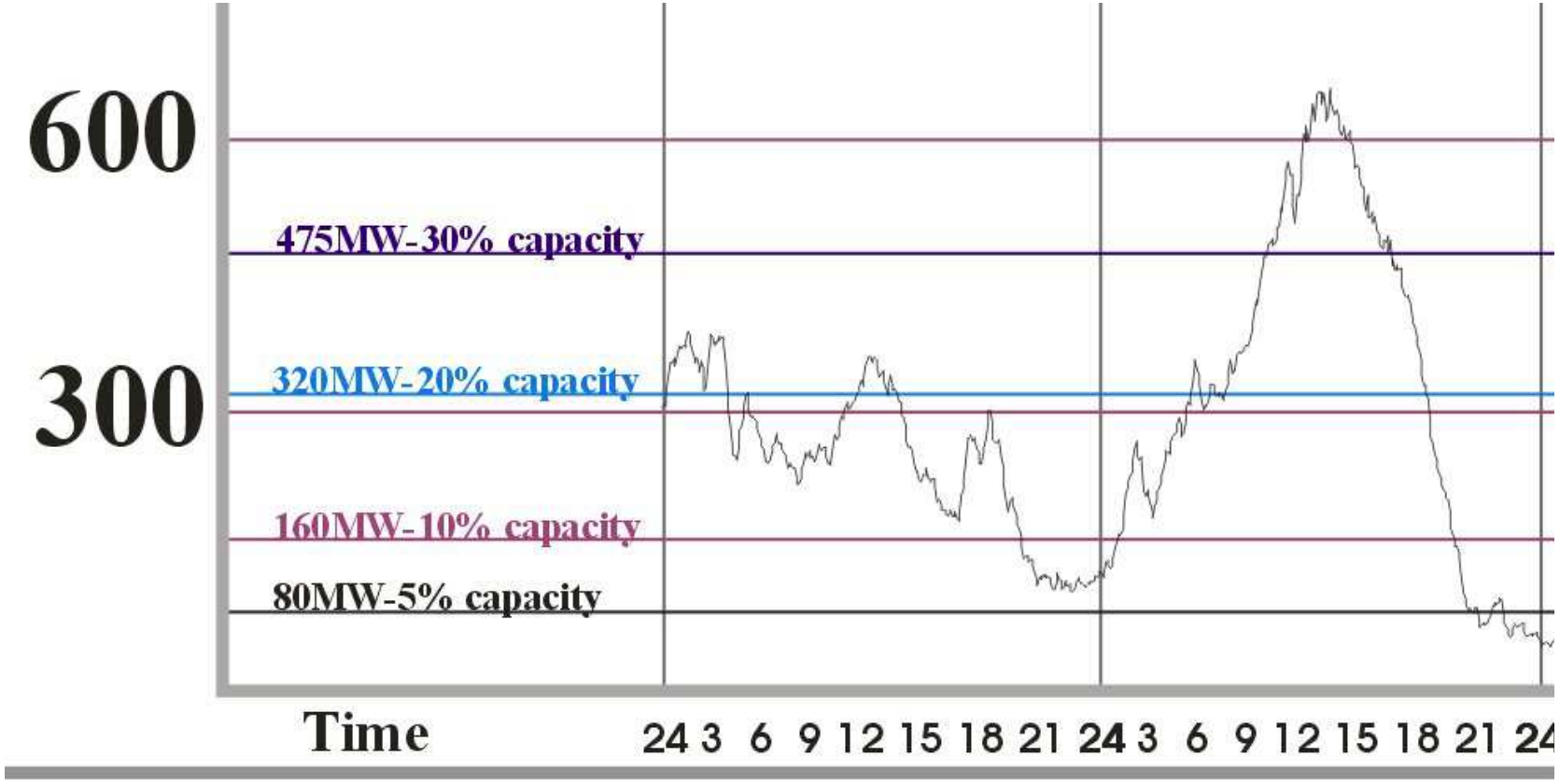
Temporary – catering for fluctuations in demand



Source http://www.decc.gov.uk/assets/decc/statistics/publications/trends/articles_issue/560-trendssep10-electricity-demand-article.pdf

Temporary – catering for fluctuations in supply

UK Wind Generation

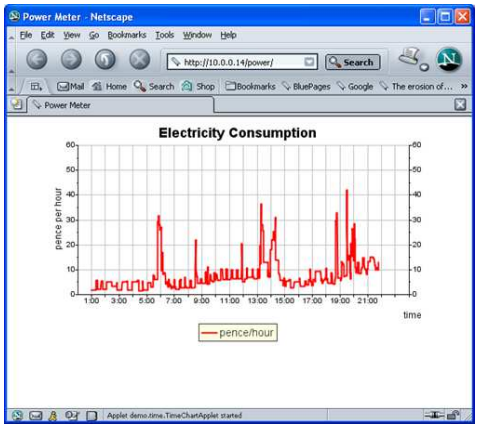


June 2010

Source http://www.jmt.org/assets/pdf/wind-report.pdf
John Muir Trust

Behaviour Change won't solve these problems

- 1-3% change per household*
- Decay effect?
- Unsuited to rapid response to dynamic signals?
- Even 10% is only £2 per wk in an average dual fuel household: < 1 pint of beer
- 3% is 60p: < the daily newspaper
- 50% saving is possible
  - But its difficult .. And costly
  - Dr Andy Stanford-Clark is on a mission and is a self-confessed geek

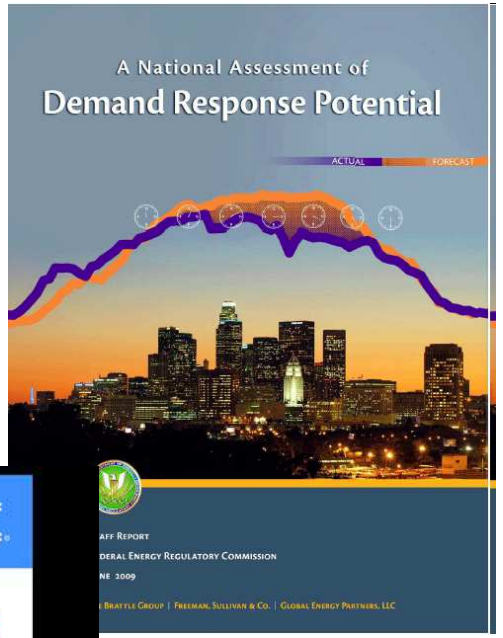


0-20p/hour – green
20-40p/hour – amber
40-60p/hour – red!

*** DECC** "What works in changing energy-using behaviours in the home?" Nov 2012

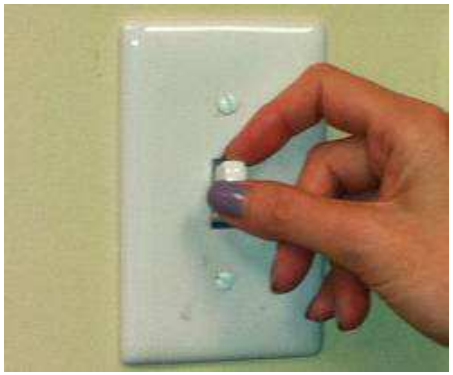
Economic signals and multi-party market will be key

- 20% reduction in peak demand due to dynamic pricing *
- Gain-share or “Permission Fee” for ceding demand control?
- Role of aggregators / Energy Service Companies?
- Economic mechanism(s) need to reflect mutliple potential bidders for demand curtailment



*** FERC “A National Assessment of Demand Response Potential”**

Automation is vital



A nation of energy “day traders” on the power market is unlikely!

Simple and customer friendly

"Rebate of 6p per therm of gas use avoided in a demand response event"

"ToU Tariff rises to 43p per KwH in a critical price period"

"10% off your heating bill if you agree to have the house 1 degree cooler during the day"

"£5 per month Tesco Voucher if you let us control your fridge between 6 and 8pm"

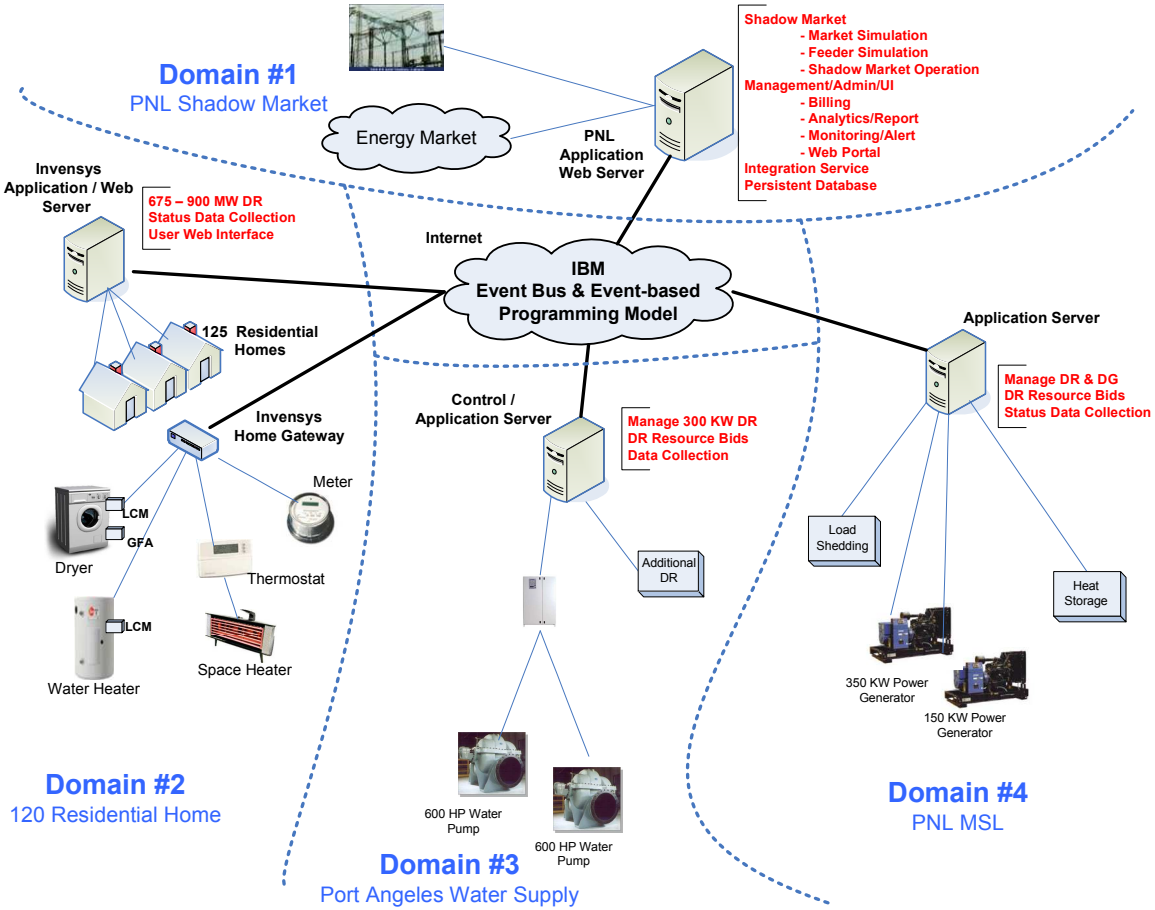
Business Problem: keep the electrical grid healthy in times of stress by managing demand through a combination of intelligent technology and financial incentives

Solution: two parallel studies :

- **2007: Virtual marketplace (Olympic Penninsular)** that allowed consumers to trade flexibility in usage for lower costs.
- **2012: Transactive Control at Scale** Enables a 'market' of micro-bidding devices to establish optimal power supply and demand conditions (5 states, 60K premises, countless dev ices)

$180m US Fed Govt Fiscal Stimulus Project

The Olympic Peninsula, GridWise™ Project



50% reduction in short-term critical peak loads; 15% reduction in overall annual peak demand; 10% reduction in consumer energy bills

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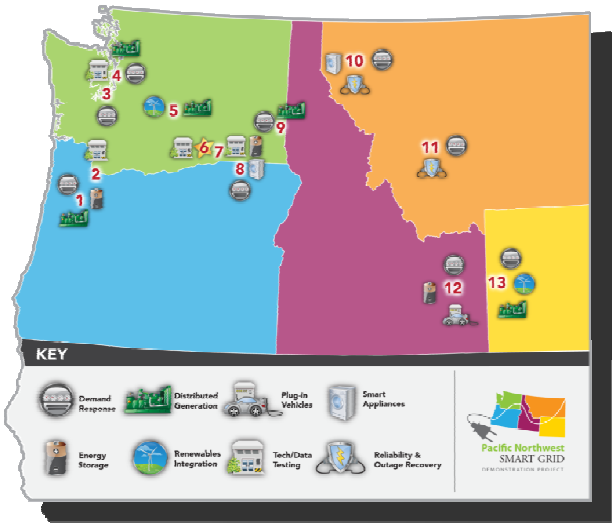
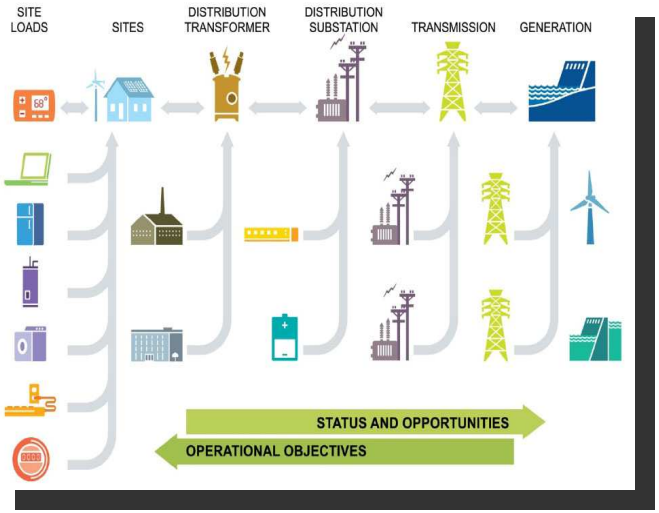
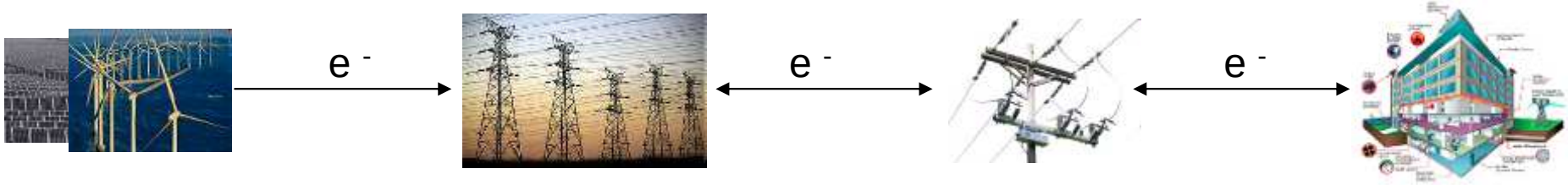
The PNW Smart Grid: Transactive Control (Just Live)





Transactive Incentive Signal (TIS): reflects true *cost* of electricity at any given point

Generation **Transmission** **Distribution** **Customers**



Transactive Feedback Signal (TFS): reflects anticipated consumption in time