Is DSM the answer ?

Task XIX International Meeting
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overview

- **Introduction to National Grid**
  - **The drivers for change**
  - **The generation mix – capacity at any time**
- **NG 2020 consultation**
  - Developments in Electricity Generation and Demand
  - Reserve and Operating Margin
    - Short term reserve, operating margin at peak demands, and operating at minimum demands
  - Network Operation
    - Physical operation
  - Balancing Services Development
  - **Transmission technologies & system issues**
- **Demand Side Management and technological links**
  - **Demand side balancing opportunities**
  - **What is needed in the future of new generation technology?**
- **Conclusions & how could it affect the future?**

National Grid

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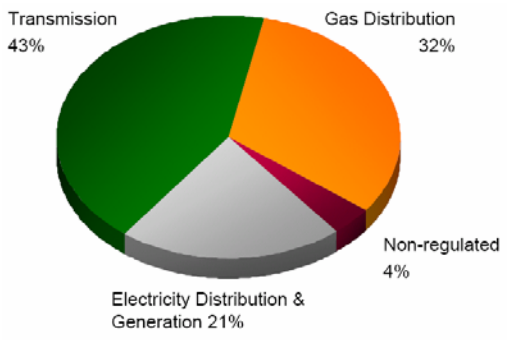
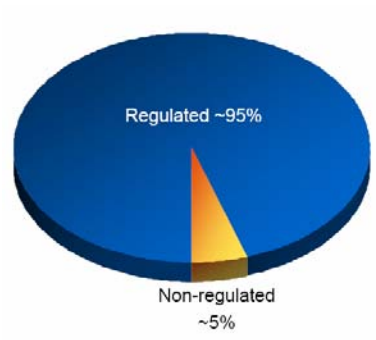
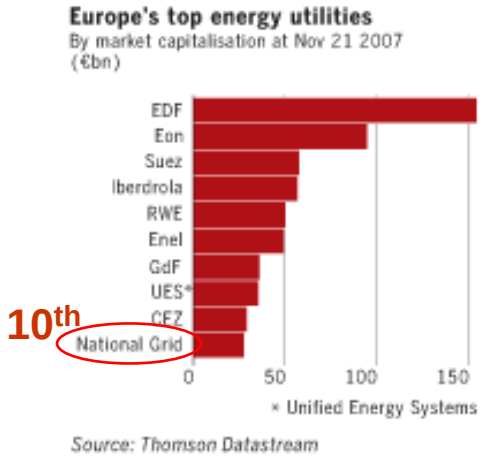
- Largest investor owned utility in the UK; second largest in the US;
- Listed on London and New York stock exchanges;
- Electricity and Gas; Transmission and Distribution; US and UK
- Target reduction in GHG emissions raised to 80% by 2050



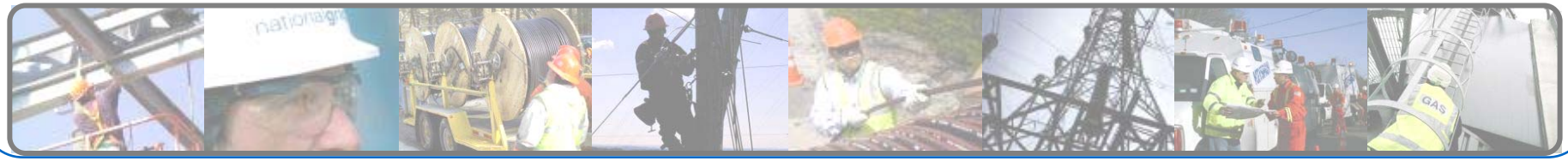
Asset Base



Revenue



Source: Thomson Datastream



Our Business

50:50

UK

US

Transmission

Distribution

Electricity

Gas

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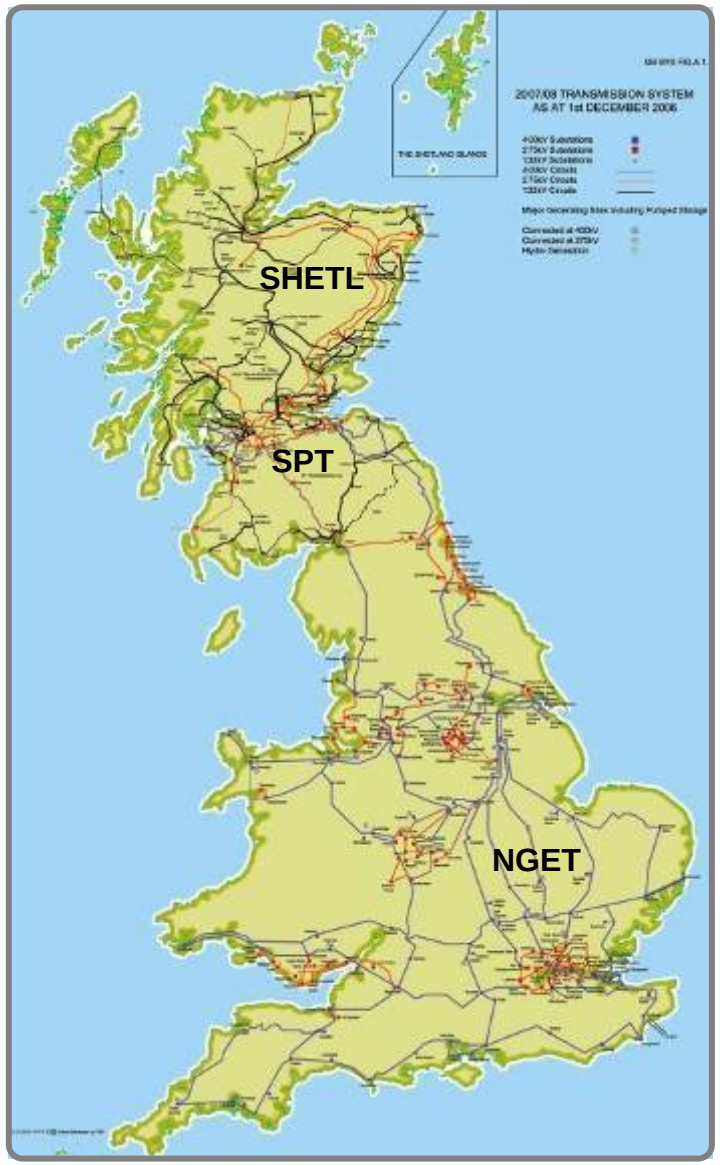
Electricity Transmission in GB

Characteristics



400 KV

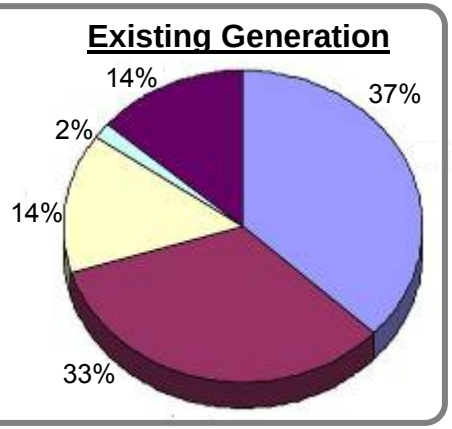
275 KV

132 KV

Increasing power transfer capacity

- Majority of generation in the North
- Demand centres in the South
- North – South flows congest system
- Topology to interconnect large generators

- Changing generation
- Location & output
- Flattening demand?

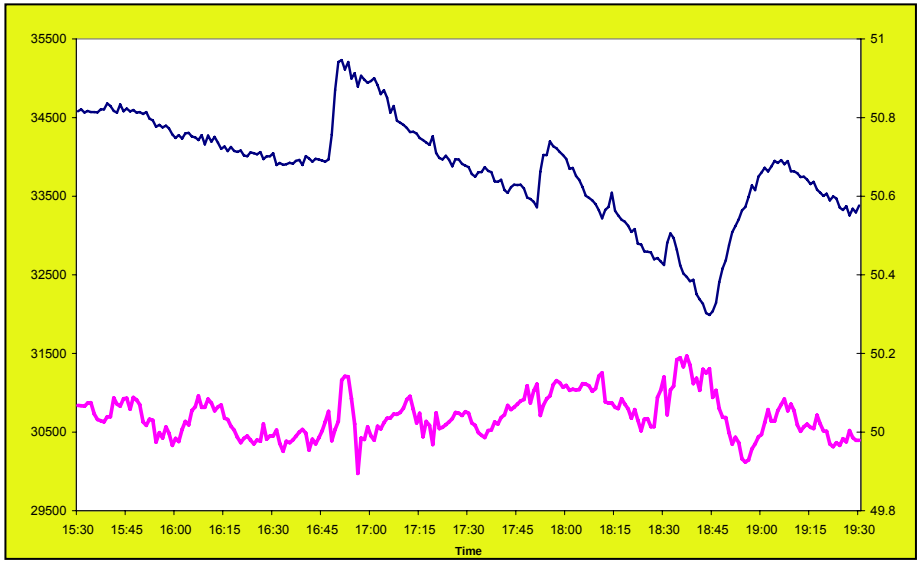


Balancing the Network

In 2009…

Demand is a given

Second by second balancing achieved by flexing generation



This won't work in 2020/30 because generation is intermittent or inflexible

In 2020/2030…

Dynamic demand
Smart meters
Storage
Flexing generation

Heat and Transport kicks in

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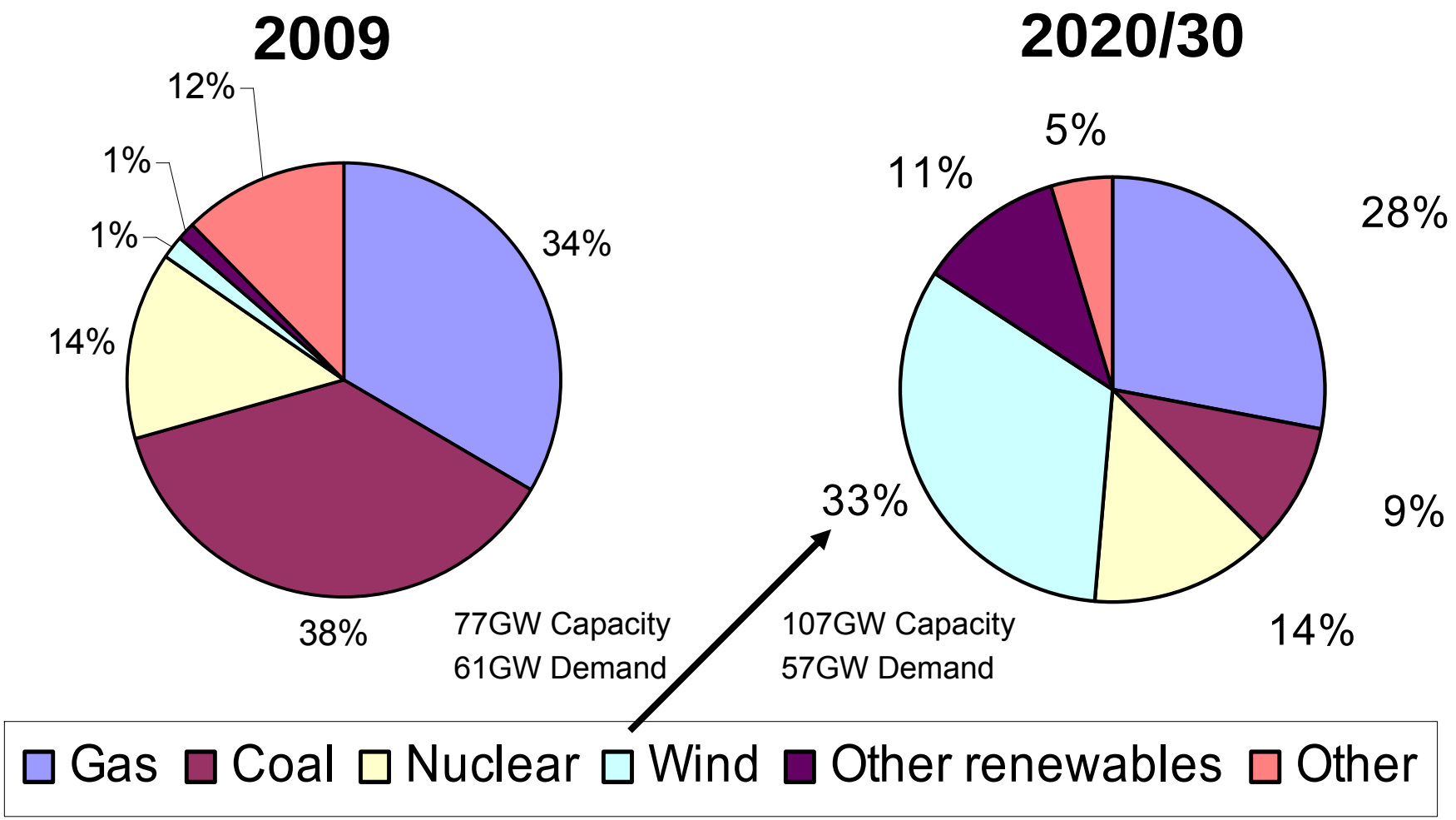
Electricity 2009 – 2030. A view of the future.



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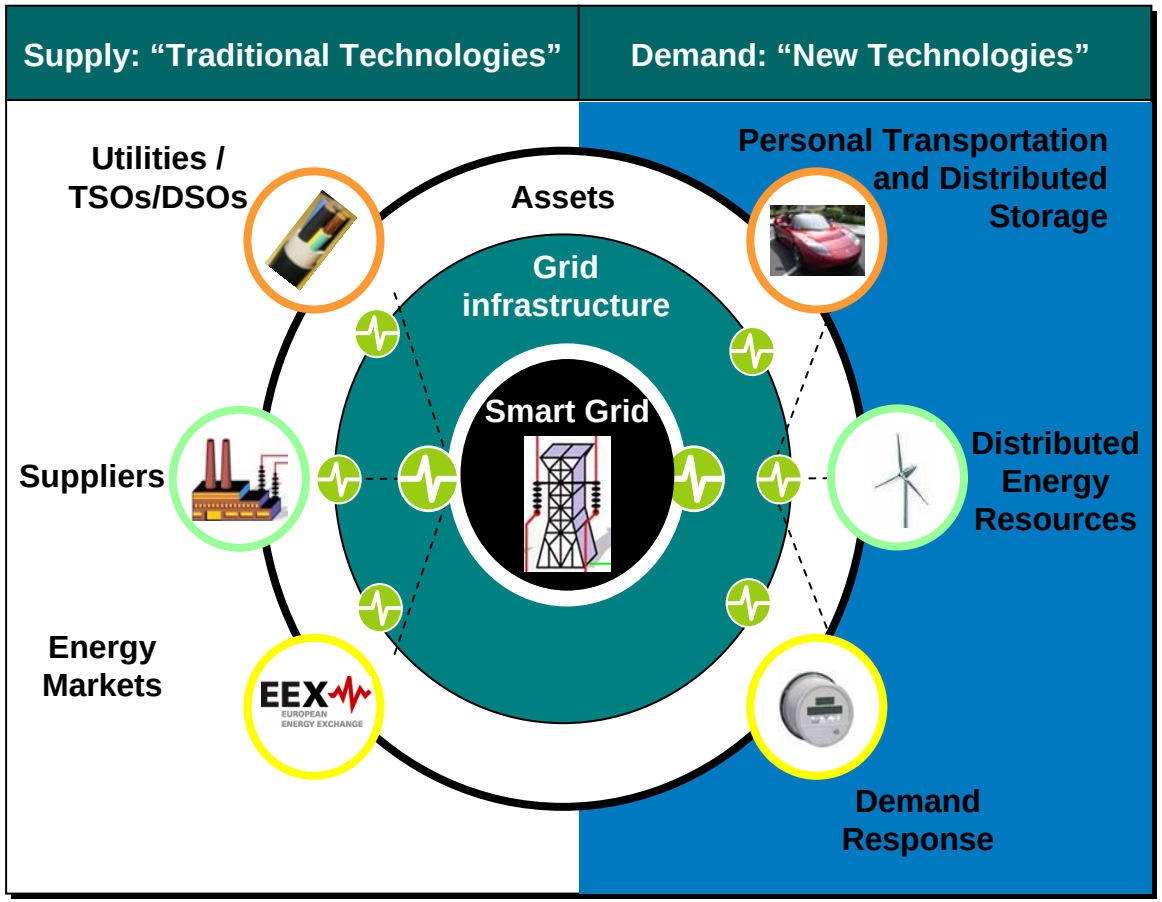
How Smart Grid and related technologies will reshape Energy Industry

Outline: The Future Energy Supply System



New assets and technologies will be added to existing generation and grid infrastructure, driven by the need to manage demand and increase share of Renewables /

Distributed Generation and Smart Metering / Grid technologies become reality across Europe

- Pilot installations in Smart Metering

Besides adding to system complexity, plug-in hybrids offer significant growth opportunities

How to grow at the customer interface?

Source: Booz Allen Hamilton

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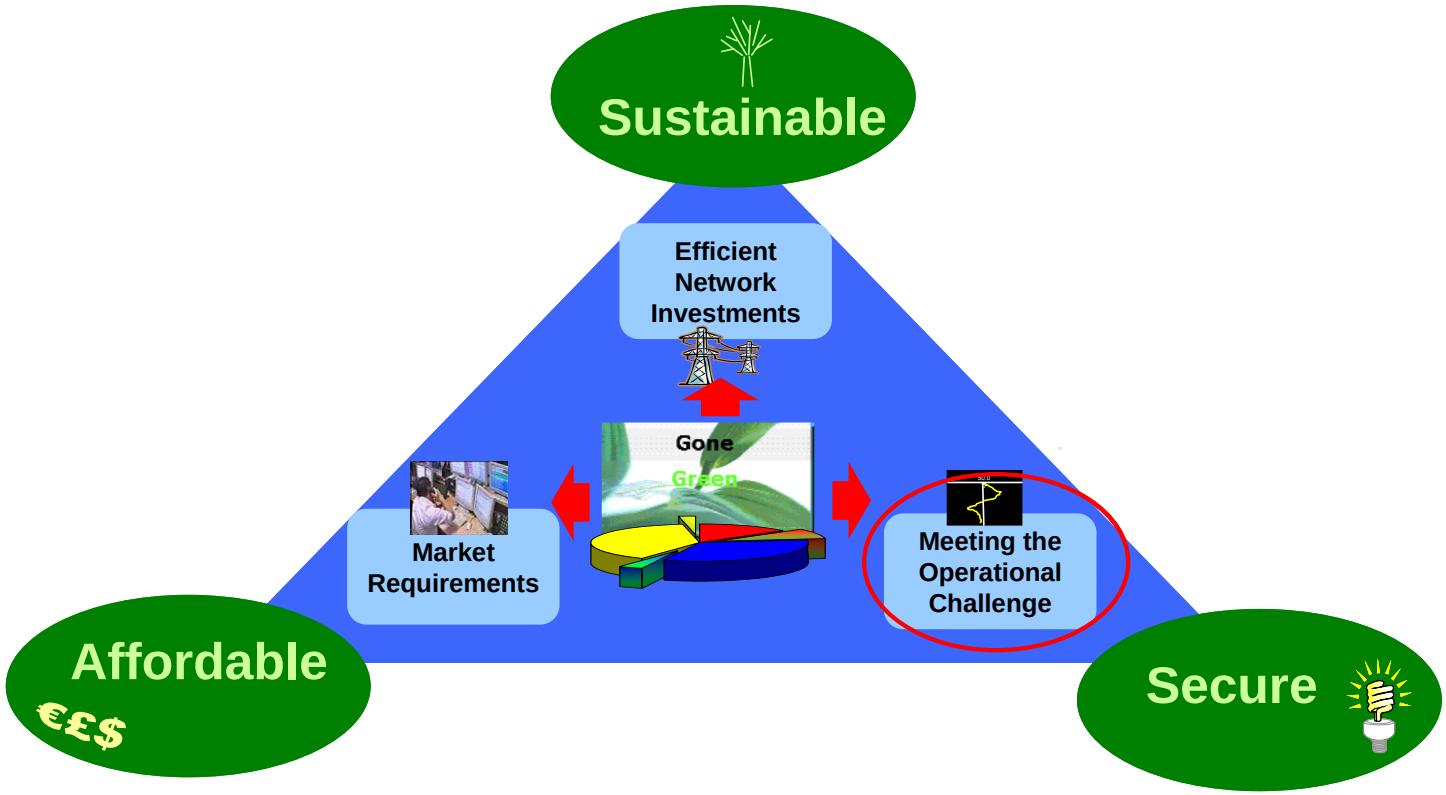
The ‘Operating the Electricity Transmission Networks in 2020’ consultation published on June 2009

- **And to feed into wider debates on energy markets and security of supply**



What is it?

Purpose was to

- Set out National Grid's broad view of short term operating issues in electricity in the future
- Seek views of interested parties

Focussed on

- A 10 year horizon (2020)
- Operational issues in the period mainly 4 hours ahead to real-time

Based on the 'Gone Green' generation and demand scenario

- Used by the ENSG in developing the proposals outlined in the report "Our Electricity Transmission Network: A Vision For 2020"

Developments in Electricity Generation and Demand

‘Gone Green’ generation in 2020

- **Wind Capacity at 29.5GW**
- **Gas Fired Generation at 34.3GW**
- **Coal Fired Generation at 19.8GW**
- **Nuclear Generation capacity at 6.9GW**
- **Some 15GW of embedded generation (including on-site CHP)**

‘Gone Green’ demand in 2020

- **Trend for peak demands is flat**
  - **Economic growth, transport and new applications drive demand up**
  - **Energy efficiency and embedded generation have the effect of reducing peak demand**

Developments in Electricity Generation and Demand

Discussion of 'new' generation technologies

- Wind
  - controllable but more difficult to forecast than other forms
- Gas
  - expansion of capacity under 'Gone Green'
  - offers flexibility
  - increased reliance on single fuel source
  - change in load factors changes economics
  - further work underway to asses impact on Gas networks
- Supercritical Coal
  - controllable?
  - how will it interact with CCS?
- New Nuclear
  - larger units
  - focussed on base-load operation?
- Tidal
  - predictable but limited scope for flexibility?

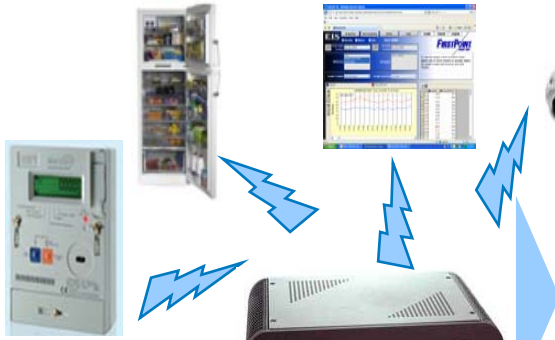
Developments in Electricity Generation and Demand

Discussion of 'new' demand side technologies

- Overall trend
  - 'Gone Green' trend is essentially flat for net peak demand
- **'SMART'**
  - **the smart meter**
  - **active demand management**
  - **Smart Grid**
- Electric Vehicles
  - charging period
- Embedded or Distributed Generation

Developments in Electricity Generation and Demand

Smart Meters and Smart Networks



PHEVs, heat pumps, etc

Home hub

Home hub providing greater choice; more granular consumption information and control of greater range of appliances, PHEVs, micro-generation, etc

Network control centre

- More effective peak shaving & more sophisticated demand response
- Remote/automatic prevention, detection & correction of network faults and problems

Remote fault detection

Condition-based maintenance

Automated restoration

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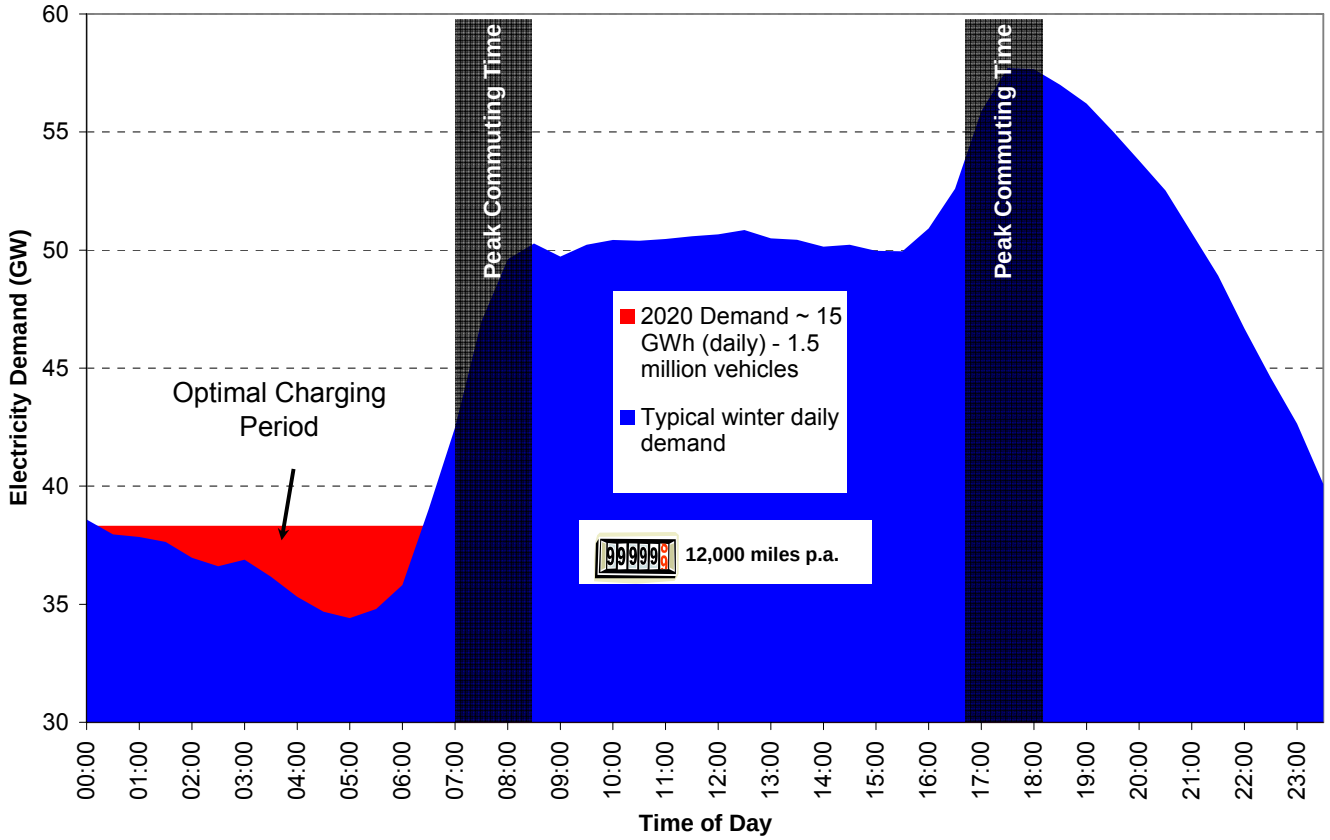
Developments in Electricity Generation and Demand

Electric Vehicles



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Balancing Services Development

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Overview of Balancing Services (1)

Frequency Response

Mandatory Frequency Response

Commercial Frequency Response: FFR, FCDM

Reserve Services

BM Start-Up, Fast Reserve, Short Term Operating Reserve

Reactive Power

Obligatory Reactive Power, Enhanced Reactive Power

System Security

Constraints Management, Maximum Generation, Black Start, Intertrips, SO to SO

Trading

Reserve Service

BM Start-Up

Short Term Operating Reserve

Fast Reserve

Demand Management

Frequency Control by Demand Management (FCDM)

What is FCDM ?

- The automatic reduction of an agreed amount of Demand (non-dynamic via LF Relay)

Why we need it?

- Additional frequency services that can be offered in competition to generation, by reducing reliance on generating plant for occasional frequency services.

Technical Requirements ?

- Delivery within 2 seconds
- Provide for 30 mins
- 3MW, but can be aggregated for a site

Payment ?

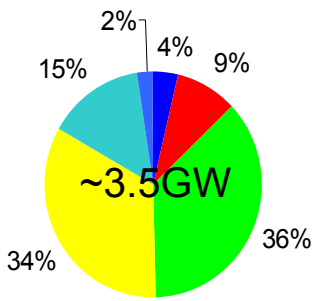
- Availability Fee only (£/MW/h)

Balancing Services Development

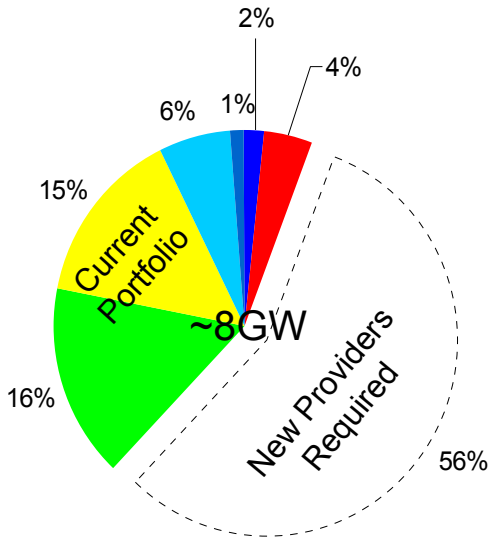
There are clear opportunities to provide Balancing Services

- The consultation document discusses and seeks views on the provision of services from demand side, storage and interconnectors amongst others

Typical Current Winter Reserve Provider Breakdown



Potential Opportunity for New Reserve Providers in 2020



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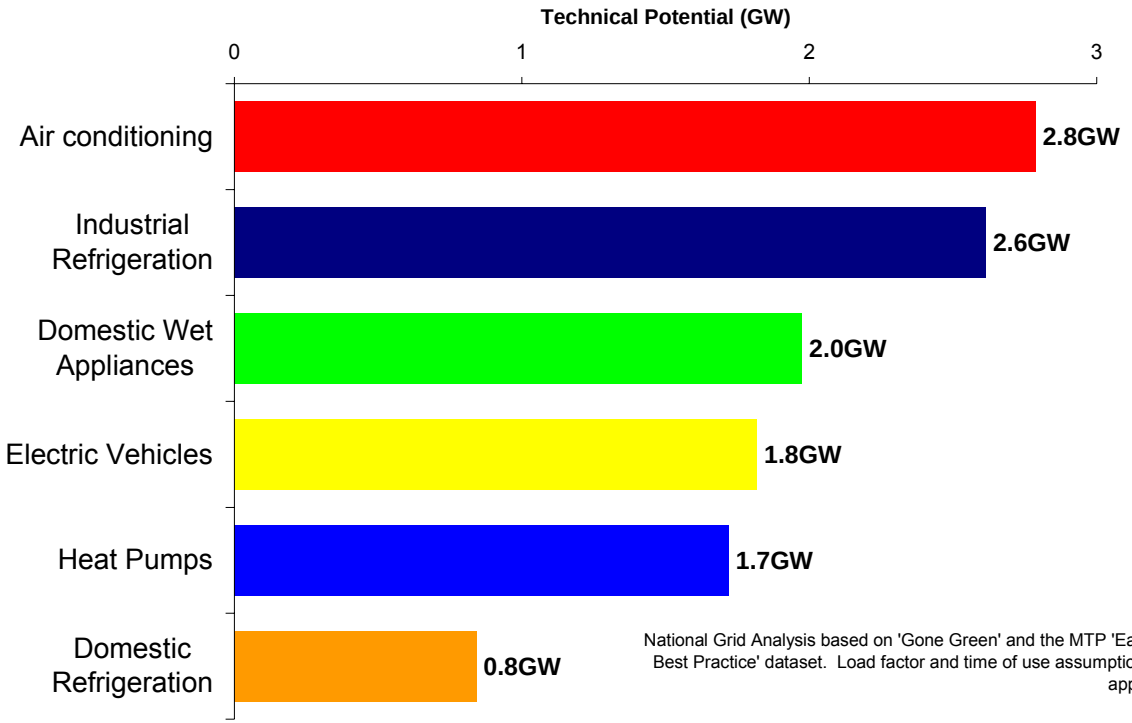
Balancing Services Development

For example – estimate of new demand side potential in 2020 based on 'Gone Green' and the 'Market Transformation Programme' dataset

- Reliant on 'Smart' type infrastructure to access domestic services
- Better appliance efficiency assumptions reduce potential service volume
- Who else is interested in these services?



National Grid Analysis based on 'Gone Green' and the MTP 'Early Best Practice' dataset. Load factor and time of use assumptions apply.

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How will it work -- Demand Response

- Freezers & fridges Demand side future balancing opportunities
  - Defer or advance cooling
  - Seconds and minutes
- Road Transport
  - Charging millions of batteries or producing H2 on the forecourt when it suits the system
  - GWs of response from a national battery
  - Seconds, minutes & hours
- Heat pumps
  - Defer or advance heating (operation of electric pumps)
  - Seconds, minutes and 10s of minutes
- Overseas large hydro (replace their demand)
  - Minutes, hours, days and months
  - Access to 50TWH storage

In Summary

Massive challenge in a Era of unprecedented change

Great opportunity for technological innovation

Networks will play a key part in delivering solutions

Potential for Demand Side

– but expectations need to be realistic and should perhaps focus more on wholesale market participation;

Recognition of Investment Challenge for new generation; and

Need for strong incentive to balance the system.