Low Carbon London

Smart Meter Trial: an early perspective from our pilot trial

15 February 2012

Liam O’Sullivan
Programme Director
• Welcome
• Housekeeping
• Safety
Agenda

• Low Carbon London – introduction, refresher and summary of progress to date
• Smart grids – context and consumer experience
• Lessons from the smart meter pilot trial – the supplier view
• Lessons from the smart meter pilot trial – the importance of team work
• Demographics – the logic behind the recruitment process for the main roll out
• Next steps – what the trials will look like
• Emerging issues
Low Carbon London

• A learning journey primarily funded by Ofgem’s Low Carbon Network Fund
• Collaborative, ‘end to end’ programme to create and evaluate innovative ways to deliver sustainable electricity to businesses and communities in a low carbon future
• Series of participative trials covering residential, I&C and SME customers
• Looking at engineering, contractual and tariff based tools to assess their effectiveness in moving to a low carbon economy
• Detailed design of trials
• Engaging participants
• 18 month operation of trials
• Reporting findings
Low Carbon London – some highlights

• Programme trial design complete
• Communication materials and strategy approval by Ofgem
• Learning event on the demand response trial and winter trial started
• Learning Laboratory at ICL set up
• Some EV trail participants recruited
• 500 smart meter pilot installation achieved
• Website live - www.lowcarbonlondon.info
Smart grids – context and consumer experience

Rich Hampshire
Logica
Low Carbon London: More than a Learning Journey

Low Carbon London Knowledge Sharing
Smart Meter Trial: An Early Perspective
21 October 2010
Richard Hampshire
The Energy Challenge

Security of Supply

- Reliability
- Exposure to Global Markets

- Decarbonising Energy

Sustainable Energy

Affordability

- Impact on disposable income
- Energy Austerity?
Low Carbon London | Context
Delivering Sustainable Energy | Enabling the Market for Low Carbon Technologies
Enabling a transformation in how we satisfy our energy needs

It’s all about Consumers:
• Britain is transitioning to a low carbon economy
• We must transform how we satisfy our demand for energy
• Our relationship with energy has to change

... so what does that mean?
• More journeys will be powered by electricity rather than petrol or diesel
• More space heating by heat pumps rather than gas boilers
• More energy demand satisfied locally by micro generators
• Replacement of centralised generation with more embedded, intermittent, renewable sources

... and that fundamentally changes how we will design build and operate our energy infrastructure
• More intelligence further into the networks: A Smart Grid
From Sustainable Homes to Responsive Distribution Grids

- Renewable generation associated with intermittency of supply
  - Increase risk of interruptions to supply
  - Capacity margin would need to increase from 20% today to 60%
  - Plant utilisation would reduce from 55% to 30% by 2020 and to <20% beyond 2030
- Distributed Heat and EVs deliver controllable demand
  - ...but the ability to control demand to match available supply could push capacity utilisation back above 50%
  - That drives the need for responsive, intelligent distribution systems
Move people from feeling they ought to do something...
...to wanting to act!
Low Carbon London

But what about the consumer?

- More than half (52%) of consumers believe renewable energy is at the heart of a sustainable future
- 7 out of 8 people haven’t received information on smart grids
  - Yet, more than 1 in 3 (35%) anticipate will help them manage energy consumption
  - And almost 1 in 5 (19%) believe being connected to a smart grid will help them to lower energy consumption
- But there’s contra-indications that tell us we need to engage people
  - 1 in 6 (17%) of respondents said they wouldn’t use low carbon technologies connected to a smart grid
    - And the percentage grows in the over 55s
  - 34% always opt out of allowing use of their data

Source: Logica Eco Environment and consumer attitudes surveys
Consumers do see renewable energy at the heart of satisfying energy needs

Intermittency creates challenges for the design and operation of our energy distribution systems

But heat technologies deliver the opportunity to match demand and to available generation

Smart meters deliver the information and communication infrastructure at the heart of this transformation

Consumers need to be engaged

Our collective challenge is to provide them with meaningful choices to satisfy their energy needs

It’s more about when you use it than, than how much you use

Delivering a sustainable energy future relies on engaging consumers, incentives and technology
More information about Smart Grids and Smart Metering can be found in Logica’s “Smart Metering for Dummies” and “Smart Grids for Dummies”

http://www.logica.co.uk/we-are-logica/media-centre/articles/smart-metering-for-dummies/

http://www.logica.co.uk/we-are-logica/media-centre/articles/smart-grid-for-dummies/
Logica is a business and technology service company, employing 41,000 people. It provides business consulting, systems integration and outsourcing to clients around the world, including many of Europe’s largest businesses. Logica creates value for clients by successfully integrating people, business and technology. It is committed to long term collaboration, applying insight to create innovative answers to clients’ business needs.

Logica is listed on both the London Stock Exchange and Euronext (Amsterdam) (LSE: LOG; Euronext: LOG). More information is available at www.logica.com.

The company is a public company incorporated and domiciled in the UK. The address of its registered office is 250 Brook Drive, Green Park, Reading RG2 6UA, United Kingdom.
Lessons from the smart meter pilot trial – the suppliers view

EDF Energy
EDF ENERGY – Smart Metering Programme
Agenda

- EDF Energy’s commitment
  - What are we delivering for Low Carbon London
- Smart Meter Journey…what we did
  - Recruitment
  - Pre-installation, Installation and post-installation
- What’s happening in the field
  - Recruitment
  - Installations
- Difficulties experienced so far
- Metrics
  - Customer Decline Reasons
  - Installation Abort Reasons

So what do our customer participants think?
EDF Energy's commitment…

Aims & Objectives
• Recruit and install 5000 smart meters for EDF ENERGY customers within the London region.
• Offer an In-home Display, accurate billing, energy efficiency advice as part of the ‘Smart’ proposition
• Offer customers a range of Time of Use tariffs
• Install smart meters as ‘sub-meters’ for Electric Vehicle (EV) customers

Rollout Location
• Phase 1 - situated around DNO substations
• Phase 2 – customers across the London supplier region

<table>
<thead>
<tr>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2</td>
<td>Q3</td>
</tr>
<tr>
<td>Business Case</td>
<td>Meter Procurement</td>
</tr>
<tr>
<td>Customer Proposition</td>
<td></td>
</tr>
</tbody>
</table>
LCL – Smart Meter Journey…what we did

Recruitment

- Advisors trained to educate customers on smart
- Outbound telephone campaign
- Direct mail campaign
- Community engagement
- Political engagement
- Explain benefits of smart metering
- Explain data usage and gain customer consent
- Offer a range of appointment slots
- Book installation appointment
- Communications material
- Newspaper advertorials
LCL – Smart Meter Journey…what we did

Pre-installation
- Reminder Service e.g. SMS
- Welcome Packs
- Inform customer of install steps
- Walkthrough using IHD
- Provide user manuals
- Installation carried out in a safe and efficient manner
- Ensure installation follows SMiCOP

Post-installation
- Post-installation telephone Survey
- Monthly energy efficiency tips
- Offer ToU tariffs
- Follow up customer research
What's happening in the field - Recruitment

Sue Teague: “When I spoke to a prospect, I understood they were a landlord for a number of properties. I therefore asked whether they would like a smart meter for the additional residences”

Tina Small: “Initially on the first day, it seemed that customers found the terms & conditions to be too long and put them off”

What did we learn?

• Target landlords as a way to recruit more premises for install
• Landlords have a propensity to stay with the same supplier for their properties and therefore are a good source of recruitment for trials

What did we learn?

• Terms & Conditions too lengthy and dissuading prospects from joining trial
• Quick turn around from Legal enabled 150 words to be removed from the script
What's happening in the field - Recruitment

Mark:
“Upon speaking to a prospect, there was some reluctance at first to carry on the call as they felt it was a sales call”

Chris Sercombe:
“When contacting customers from the Perry Vale area, it seemed as if they had a better knowledge of both LCL and smart meters leading to a better take up rate.”

What did we learn?
- Liaising with the Perry Vale door knocking enabled the customers to be given an insight into the trial and smart meters
- Providing the prospect with background of the trial and the benefits it could provide improved the customers perception.

What did we learn?
- CSAs were very good at reassuring the prospect as to the nature of the call
- The interaction with customers meant that they were ‘warm leads’.
- Providing the prospect with background of the trial and the benefits it could provide improved the customers perception.
What's happening in the field - Installations

What did we learn?

• Using a single network provider for GPRS in the smart meter wasn’t sufficient when installing in premises with signal strength problems.

• All engineers have signal strength testers and carry spare smart meters with alternative network provider SIM cards.

• Providing a customer with an hour before call reminder service helps reduce No Access aborts.

• More efficient to schedule installations across London rather than have clusters in specific geographical areas.

• Good customer satisfaction in regards to install time taking less than advised upon recruitment.

“We often find that premises we visit there are meter obstructions or intake rooms that are locked leading to an abortive call which is frustrating as the site overall is suitable for a smart meter installation”

“Customers were appreciative that we talked them through what the smart is and how the IHD works, they were particularly happy with the personalised message we get them to read on the IHD”

“Signal strength has been a real problem which has meant some appointments have been aborted. It would have been beneficial for all engineers to have a range of meters with different SIM cards to try and combat the problem”
Challenges Experienced with Low Carbon London

**Recruitment**
- Large number of prospect volumes required
- Challenging to engage customers about Smart Metering
- Educating customers about smart metering and TOU tariffs
- Trying to gain access to customer data and educate about data privacy

**Installation**
- Issues with signal strength
- No access to customer properties despite reminder service
- Dealing with poor maintenance of old meters that prevents a new installation

**Pre-installation**
- Ensuring customers are aware of appointment
- Understanding why a customer cancels their appointment
- Try to re-schedule when convenient
- Understand why a customer may wish to leave the trial

**Post-Installation**
- Ensuring customers response to post-installation survey
- Keeping customers engaged about the benefits of a smart meter
- Maintaining ongoing customer satisfaction
The graph indicated that from the original Low Carbon Zones targeted in the pilot, Lewisham and Perry Vale gained the most appointments. This is directly linked to the awareness campaigns in those areas which helped raised the profile of LCL and educated local communities of the benefits Smart metering can bring.
Customer Decline Reasons

This slide indicates based on call outcome the reasons for why a customer has declined joining the LCL trial.

<table>
<thead>
<tr>
<th>Decline Type</th>
<th>% of total declines</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not interested</td>
<td>49%</td>
<td>Customers feel more of sales call</td>
</tr>
<tr>
<td>Don’t have time</td>
<td>28%</td>
<td>Customers called at time of day when not convenient</td>
</tr>
<tr>
<td>Ineligible</td>
<td>10%</td>
<td>Customer has churned or too much debt on account</td>
</tr>
<tr>
<td>Too technical/confusing</td>
<td>7%</td>
<td>Over introducing smart meters into the initial conversation can be too confusing. Some elderly customers find it difficult to understand what a smart meter is and the benefits it yields.</td>
</tr>
<tr>
<td>Consent required</td>
<td>3%</td>
<td>Customer needs partner or landlord consent</td>
</tr>
<tr>
<td>Others</td>
<td>3%</td>
<td>Anti-smart meters – aware of government mandate but suspicious of data privacy (‘big brother’ mentality) and/or if there are any clear benefits.</td>
</tr>
</tbody>
</table>

Customer Declines

<table>
<thead>
<tr>
<th>Decline Reason</th>
<th>% Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not interested</td>
<td>49</td>
</tr>
<tr>
<td>Anti-Smart Meters</td>
<td>3</td>
</tr>
<tr>
<td>Data Privacy Concerns</td>
<td>0</td>
</tr>
<tr>
<td>Don’t Have Time</td>
<td>28</td>
</tr>
<tr>
<td>Health Concerns</td>
<td>2</td>
</tr>
<tr>
<td>Mistrust</td>
<td>1</td>
</tr>
<tr>
<td>Needs Landlord Consent</td>
<td>10</td>
</tr>
<tr>
<td>Needs Partner Consent</td>
<td>7</td>
</tr>
<tr>
<td>Too Technical/Confusing</td>
<td>1</td>
</tr>
<tr>
<td>Ineligible</td>
<td>10</td>
</tr>
</tbody>
</table>

N.B. Figures as of 30/01/12
Installations - Reasons for Abort...

**Installation Abort Reasons**

- **Customer**
  - Customers not at premise so engineer cannot perform install
  - Engineer leaves calling card so customer can re-schedule appointment
  - Customers do change their minds upon installation

- **DNO**
  - Installer visits premise and cannot remove and install meter due to issues with cut-out boards

- **Building Network Operator**
  - Installer visits premise and cannot gain access to the meter due to either obstructions or locked intake rooms
  - Responsibility is with customer to contact building network operator to ensure work is completed before a rescheduled appointment can be made
Customer Communications and Awareness

**Customer acquisition**
- Outbound telephone
- Direct mail letter
- Email

**Public relations**
- MP Briefings: Joan Ruddock, Shadow Energy Secretary (Lewisham)
- Council / Ward / local assembly briefings and demonstrations

**Media relations**
- Press Release: local and national and trade press

**Community Outreach**
- Smart meter drop-in events
- Partner Events: Renew initiative
- Green Doctors: Door knock, leaflet drop

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How interested would you be in having a smart meter installed in your home?

- Interested: 50%
- Not sure: 26%
- Not interested: 24%

Source: Consumer Focus face to face survey, May 2011 Sample size 1,374
Customer Communications and Awareness: Learning's

Customer acquisition
• Community outreach drives awareness
• Awareness drives increased acquisition rate and reduced call duration

Public relations
• Continue MP Briefings where appropriate
• Continue Council / Ward / local assembly briefings

Media relations
• Press Release: case study based

Community Outreach
• Partner Events: e.g. Renew initiative
• Partnership marketing
So what do our customers think? We’ve asked them…

Post-Install Customer Survey Objectives:

- **Capture all elements relating to the customer recruitment and meter installation experience for the first phase of installations**
  - To gauge customer experience from recruitment through to install, including NPS on recruitment, install and overall
  - To gain additional customer data for Imperial College/LCL Insight, eg demographics, household info, occupancy
  - To cover off/test some key areas which will be required for SMICoP compliance
- **208 quantitative telephone interviews**
- 10-12 minute interview
- No set quotas
- Conducted 1st December 2011 to 17th January 2012
- Unweighted data
Main Reasons For Participation (Spontaneous)

*Simply monitoring energy usage, (which is not necessarily intuitively linked to saving money), is the most common trigger to participation*

<table>
<thead>
<tr>
<th>Nets</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor/limit energy usage</td>
<td>47</td>
</tr>
<tr>
<td>Save money</td>
<td>19</td>
</tr>
<tr>
<td>Avoid the need for a meter reading (both self and inspector)</td>
<td>13</td>
</tr>
<tr>
<td>Avoid estimated bills</td>
<td>10</td>
</tr>
<tr>
<td>Help EDFE/with trial</td>
<td>10</td>
</tr>
<tr>
<td>Will become compulsory</td>
<td>8</td>
</tr>
<tr>
<td>Help the environment</td>
<td>4</td>
</tr>
<tr>
<td>Problems with existing meter</td>
<td>4</td>
</tr>
<tr>
<td>Interested in new technology</td>
<td>3</td>
</tr>
<tr>
<td>Participated before</td>
<td>3</td>
</tr>
<tr>
<td>It’s free</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: Q3. What would you say are the main reasons why you decided to take part in the trial? Base: all respondents.
Contact With EDFE

An appropriate level of contact seems to have been established

<table>
<thead>
<tr>
<th>Contact re: installation appt.</th>
<th>Personal contact</th>
<th>Written comms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>2%</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>95%</td>
<td>93%</td>
<td>95%</td>
</tr>
<tr>
<td>sig. female 9%</td>
<td>sig. male 97%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Q15. How would you rate the amount of contact you had with EDFE with regard to the installation appointment?

Q17. What do you think about the amount of personal contact, that is, F2F or telephone, you have had with EDFE?

Q18. And what do you think about the amount of written communications you had from EDFE?

Base: all respondents (208)
Almost universally positive ratings, although potentially room for improvement with regards to clarifying exactly what is involved in the trial.
Installation Process

_Largely positive ratings once more, although engineers’ knowledge and demonstration skills should be marked for improvement_

![Bar chart showing ratings for different aspects of the installation process.](chart.png)

- **Politeness**: 95% extremely good, 5% extremely poor
- **Professionalism**: 96% extremely good, 4% extremely poor
- **Ability to answer questions**: 85% extremely good, 15% extremely poor
- **Smart meter demonstration**: 84% extremely good, 15% extremely poor
- **Time taken to complete the installation**: 92% extremely good, 7% extremely poor
- **Physical appearance of the engineer**: 83% extremely good, 7% extremely poor
- **Installation process overall**: 91% extremely good, 9% extremely poor

**Source:** Q22. Thinking about the installation process, how would you rate the following...? Base: all respondents (208)
Demonstration

Almost a quarter of respondents claim not to have received a satisfactory demonstration, and less than half received information regarding potential savings from energy efficiency measures.

- **13%** did not receive one
- **46%** received info re: potential savings
- **41%** did not receive info re: potential savings
- **23%** did not receive a satisfactory demonstration

**How well did you understand the demonstration?**

- **53%** Very well
- **35%** Fairly well
- **5%** Not very
- **5%** Not at all
Impact Of Trial

The overwhelming response to the trial is positive – significantly more so for those aged <54

Effect on energy usage

- A big difference: sig. <54 39%, sig. 55+ 26%
- Some difference: 49%
- No difference: 18%
- Don’t know: 11%

Perception of EDFE

- Much more positive (+2): 19%
- Bit more positive (+1): 37%
- Neither (0): 18%
- Bit more negative (-1): 11%
- Much more negative (-2): 11%

Base: all respondents (208)

Source: Q27. How much of a difference do you think the trial will have on the way that you use energy in your house?

Q28. How has the experience so far affected your perception of EDFE?

Low carbon LONDON
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Net Promoter Scores

Comparable overall score to that of British Gas’ reported residential contact NPS*

*Source: British Gas Investor Slides, sl. 29, latest reported period in 2011
Questions?
thank you
Lessons from the smart meter pilot – the importance of team work

Loic Hares
UK Power Networks
Building relationships for the future

• Excellent communication with energy supply partner: EDF Energy
• Transparency and team work
• Good issue resolution
• 500 pilot customers delivered under extreme time restrictions

• Relationships built with new external companies who were excited to be part of LCL:
  - Customer behaviour
  - New technologies
Where we are today

• Due to the nature of the LCNF programme it is vital that the findings from the trials here in London can be used across the UK

• Completion of the pilot trial revealed that the trial participants were biased towards certain demographics

• To ensure that the project had a statistically viable pool of participants, the recruitments strategy was changed

• Imperial College London represent the academic interests of the project and will now take you through the steps we have taken to ensure that we have statistically viable trials
Demographics –
the approach for the main smart meter roll out

James Schofield
Imperial College London
Low Carbon London: sampling and trial design

James Schofield,
Imperial College, London
Content

• Sampling
  – What does London look like?
  – Our approach to sampling

• Residential demand response trial design
  – What are we testing?
  – considerations for tariff design
  – and experimental blocking
WHAT DO OUR SAMPLE AREAS LOOK LIKE?
Experian view

Experian’s Mosaic UK consumer classification provides an accurate understanding of the demographics, lifestyles and behaviour of all individuals and households in the UK.

[6]
LCL areas
London: money and power
Number of households by LCL area

- Hackbridge: 854
- Merton: 920
- Peckham: 1203
- Canning Town: 2018
- Muswell Hill: 2275
- Bow: 2488
- Queens Park: 2536
- Barking: 2780
- Lewisham: 3153
- Brixton: 3503
- HanPetersham: 4089
- Archway: 4409
Groups by LCL area

- Archway
- Ham
- Petersham
- Brixton
- Lewisham
- Barking
- Queens Park
- Bow
- Muswell Hill
- Canning Town
- Pekham
- Merton
- Hackbridge
- London
- UK

- Terraced Melting Pot
- Liberal Opinions
- Upper floor living

Legend:
- A Alpha Territory
- B Professional Rewards
- C Rural Solitude
- D Small Town Diversity
- E Active Retirement
- F Suburban Mindsets
- G Careers and Kids
- H New Homemakers
- I Ex-Council Community
- J Claimant Cultures
- K Upper Floor Living
- L Elderly Needs
- M Industrial Heritage
- N Terraced Melting Pot
- O Liberal Opinions
Upper Floor Living
• 5.18% of UK households
• Limited incomes and rent small flats from local councils
• Little money is spent on the purchase of large household appliances or electronic equipment

Terraced Melting Pot
• 7.02% of UK households
• Many residents in these neighbourhoods belong to groups that have recently arrived in the UK
• Homes tend to be poorly maintained

Liberal Opinions
• 8.48% of UK households
• Young, professional, well educated people, cosmopolitan in their tastes, liberal in their views
• Small but smart rented flats, many of which experience a rapid turnover of tenants
CACI’s Acorn analysis

- **Wealthy Achievers**: 25% (UK overall), 6% (Greater London)
- **Prosperous Urbanites**: 27% (UK overall), 12% (Greater London)
- **Comfortably Off**: 21% (UK overall), 17% (Greater London)
- **On Moderate Means**: 14% (UK overall), 11% (Greater London)
- **The Hard Pressed**: 21% (UK overall), 22% (Greater London)

More Prosperous Urbanites
Less Wealthy Achievers
Less Comfortably Off

http://www.caci.co.uk/395.aspx
London may not be representative of the UK, but with a population of 8 million, a Low Carbon London is an essential part of a low carbon UK.
Our approach to sampling

• We wish to represent London
• We are sampling within LPN network area
• We are using Acorn data as a guide to ensure samples are representative of Greater London
  – Income
  – Occupancy
  – Household make-up
  – Building type
TRIAL DESIGN
National Grid DR service descriptions

Frequency Response
National Grid procures frequency response services, to keep the electricity system frequency close to 50Hz on a second by second basis, by automatically altering the production or consumption of electricity in real time. A typical demand side provider of frequency response services would have electricity load that could be shed instantaneously and automatically in the event of a significant variation in system frequency. Trigger levels are set to statistically manage how many times per year this is likely to happen.

Fast Reserve
National Grid procures fast reserve to meet large, rapid rates of change of demand for which conventional power stations are too slow to respond. A typical demand side provider of fast reserve would be very large (e.g. tens of megawatts) and, upon receipt of an electronic instruction from National Grid, would be able to start backup generation and/or reduce demand very quickly (e.g. within a couple of minutes) and run for a short period.

Short Term Operating Reserve (STOR)
National Grid procures STOR during defined times of the day, in order to have reserves available to cater for general variations in demand and generation failures. A typical demand side provider of STOR would, upon receipt of an electronic instruction from National Grid, be able to start back up generation and/or reduce electricity demand within timescales of up to four hours, and be able to run for a couple of hours.

Constraint Management
National Grid procures Constraint Management Services to alleviate localised power flow constraints on the high voltage transmission network, for example during a planned network maintenance activity. A typical demand side provider would be able to, on a pre-planned basis, shutdown its demand or run backup generation continuously for a sustained period, e.g. a number of days. Occasionally the need for the service would only be for defined periods during the daytime.

http://www.nationalgrid.com/uk/Electricity/Balancing/demandside/servicedescriptions/
time 0 frequency 10 sec 2 min
What are we testing?

What are the opportunities for demand response?
<table>
<thead>
<tr>
<th>Service</th>
<th>Benefit</th>
<th>Required response time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency response:</strong> automatic regulation of system frequency</td>
<td>• Improving generation system’s reliability and security</td>
<td>~ 2 secs</td>
<td>~ 2-30 mins</td>
</tr>
<tr>
<td><strong>Fast reserve:</strong> for large rapid changes in demand or supply</td>
<td>• Reduced generation capacity margin and increased load factor from peak smoothing • Investment deferral due to higher load factors</td>
<td>~ 2 mins</td>
<td>&gt; 15 mins</td>
</tr>
<tr>
<td><strong>Constraint management:</strong> Unplanned outage</td>
<td>• Reduced load shed from outages due to reactive management</td>
<td>mins hours</td>
<td>hours days</td>
</tr>
<tr>
<td><strong>Constraint management:</strong> Planned outage</td>
<td>• Reduced load shed from outages due to reactive management</td>
<td>days</td>
<td>hours days</td>
</tr>
<tr>
<td><strong>Constraint management:</strong> Peak avoidance</td>
<td>• Reduced capacity margin and increased load factor from peak smoothing • Investment deferral due to higher load factors</td>
<td>N/A days</td>
<td>static dynamic</td>
</tr>
<tr>
<td><strong>Short term operating reserve (STOR):</strong> for general variations in demand or supply</td>
<td>• Deferred investment in peaking plant • Reduced CO₂ emissions as peaking plant is substituted</td>
<td>&lt; 4 hours</td>
<td>&gt; 2 hours</td>
</tr>
<tr>
<td><strong>Supply following:</strong> for renewable integration and absorption</td>
<td>• Reduced CO₂ emissions as fossil plant is substituted for renewable energy • Reduced wind curtailment • Truer to market interactions between the demand and supply side</td>
<td>days hours</td>
<td>dynamic</td>
</tr>
</tbody>
</table>
Tariff design
What can we control?

- **Duration** of DR action

- **Frequency** of DR actions

- **Notice** period of tariff changes

- **Price points** (incentives and disincentives)

- **Feedback** type and communications
  - E.g. in home display; website; paper bills...
High level concept

DR beneficiaries
- Generators
- Transmission network operators
- Distribution network operators
- Renewable energy producers
- Consumers

DR control variables
- Duration
- Frequency
- Notice
- Price points

DR use-cases
- Supply following
- STOR
- Constraint: planned outage
- Constraint: peak smoothing

Low Carbon London residential demand response trial
Tariff type examples

Static

Dynamic

Critical peak

Price multiplier

Time

changing daily

~ 15 events per year
## Thinking about tariff structure
(Example values)

<table>
<thead>
<tr>
<th>Use-case</th>
<th>Notice</th>
<th>Duration</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constraint management:</strong> Planned outage</td>
<td>days</td>
<td>hours</td>
<td>yearly weekly daily</td>
</tr>
<tr>
<td><strong>Constraint management:</strong> Peak avoidance</td>
<td>N/A days</td>
<td>static dynamic</td>
<td>continuous</td>
</tr>
<tr>
<td><strong>Short term operating reserve (STOR):</strong></td>
<td>&lt; 4 hours</td>
<td>&gt; 2 hours</td>
<td>~3/week</td>
</tr>
<tr>
<td>for general variations in demand or supply</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supply following:</strong> for renewable integration and absorption</td>
<td>days hours</td>
<td>dynamic</td>
<td>continuous</td>
</tr>
</tbody>
</table>

**Diagram:**
- Static
- Dynamic
- Critical peak
This work continues...
Experimental blocking
Volume increasing design

Complete factorial

\[ y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 - \text{main effect} \]

\[ m = \sum_{k=0}^{n} \binom{n}{k} \]

\[ x_1 = 1 \quad \text{Treatment 1} \]

\[ x_2 = 1 \quad \text{Treatment 2} \]

This is a big number. So, we can’t observe everything.

We must prioritise what we need to know.
Volume increasing design

Incomplete block – e.g. Latin square

If we had prioritised learning about Tariff effects, this design would mean better value for money.
Thank you for listening.

Any questions?
Next steps – what the trials will look like

Brian Kelly
Low Carbon London
A mixture of smart meter capabilities

Meters with half-hourly reads only

SMETS Compliant Meters (as soon as available)

Smart Meter Trials
Smart meters will be installed as both primary and secondary meters.

Primary meters

Primary or secondary meters – depending on participant’s electricity supplier

- Smart Meter Tariff Trials
- Heat Pumps
- PHEV
- PV
Brixton
Queens Park
Wandle Valley
SMETS-compliant
Meters only

Elsewhere:
Gen 2
(L&G 5236)
Meters only

Same trial treatments in both

No trials or tariff signals

Control Group

Day-ahead signals within a 3-tier price tariff structure

Dynamic ToU

Tariff Trials

Static ToU

Fixed 3-tier price tariff bands on previously published fixed time bands

Wind Twinning TOU

Day ahead tariff signals within a 3-tier price structure
Engineering trials

Profiles

DNO perspectives

Flexibility

Visibility
Profiles

- Assess adequacy of current planning profiles
- Establish load profiles for consumers with low carbon technologies: EV, HP, SSEG, Energy Conservation
- Measure impact of low carbon technologies on power quality
- Understand long-term business scenarios

Flexibility

- Establish how much load customers can shift
- Establish how much load customers will shift
- How can a DNO most effectively use its assets in a low carbon network?

Visibility

- What can we see and measure, and what can we do with the data?
  - Voltage levels
  - Fault identification and location
  - State estimation for confidence in network measurement and utilisation
- Visible & managed output from DG
  - Visibility & control of EV charging
- Planning & operating a low carbon network
Emerging issues

Liam O'Sullivan
UK Power Networks
Emerging issues

- Half hourly meter reads from the DCC – limited value to a DNO
- Will a DNO get funding to build its own smart grid measurement infrastructure?
- Why wait for a SMETS-compliant device if the DCC will only collect half hourly reads?
- How to reconcile the drive for tariff simplification with dynamic ToU tariffs?
- How will ToU tariffs work with PHEV charging posts?
- Can a DNO operate an effective ToU DUOS charge?
Thank you for attending, now for lunch!