

Customer-Led Network Revolution: A multi-disciplinary smart grid project

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Customer-Led Network
Revolution



Northern Powergrid's distribution network serves the North East and Yorkshire



Regulated electricity distribution network operator

3.8 million customers

31,000 substations, 33,000 km of overhead line and 66,800 km of underground cable

2500 employees

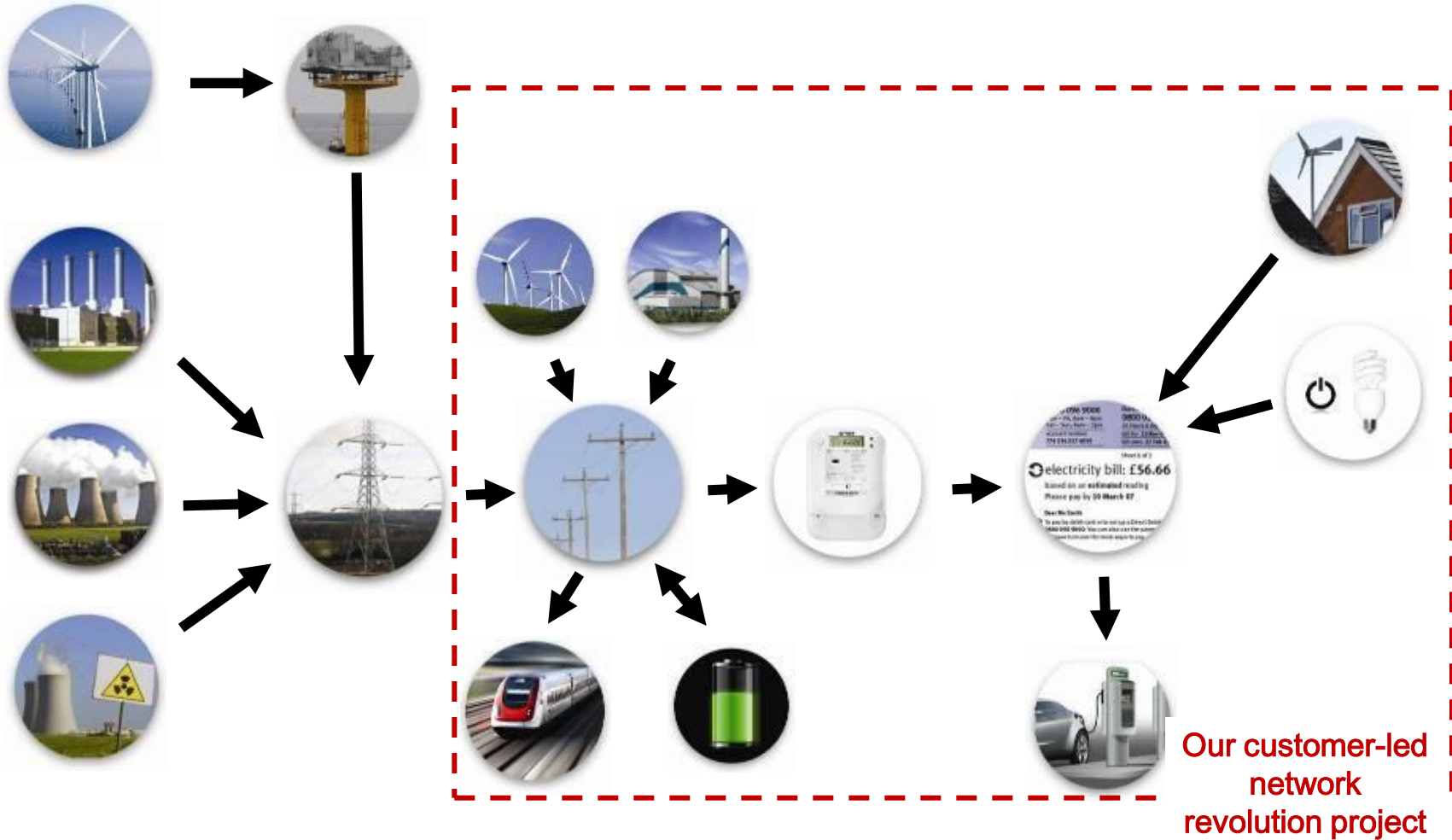
Annual capital investment £280 m

Annual operating expenditure £180 m



Power generation and usage is changing

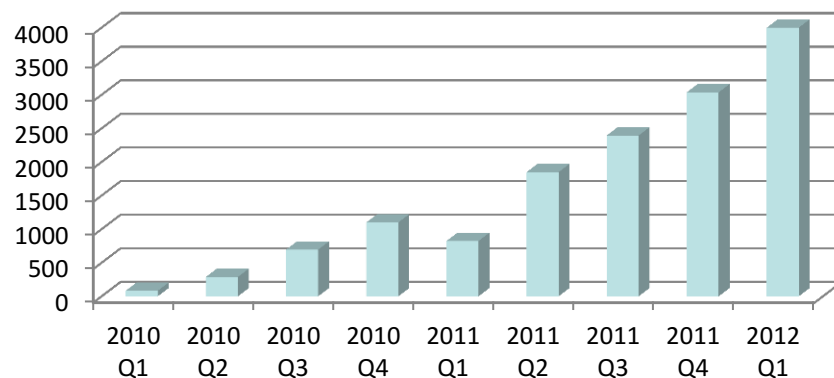
A changing landscape: 2010 - 2025



Customers' use of our network is changing

- Feed in tariff (Apr 2010) has led to a massive increase in micro-generation installations in our area
- At least 1000 air source heat pumps already installed. Renewable heat incentive will provide further encouragement
- Plugged in Places project in North East could result in 1300 electric vehicle charging points installed

Microgen notifications



Why does this matter?

- Network operators have a duty to ensure that everyone's power supply remains within statutory limits
- Networks currently designed to an average demand of 1.5kW and no generation
- Heat pumps and EV charging use more than this over sustained periods
- Solar panels will push up the local voltage
- Traditional solutions can be expensive and we need to get smarter

C-LNR is the UK's largest "smart grid" project

- £54m 3-year programme of technology and customer engagement to drive a low-carbon future:
 - *Monitoring* - making use of the existing British Gas smart meter rollout to understand 14,000 customers' usage patterns
 - *Customer engagement* - working directly with around 4,000 customers:
 - Installing low carbon technology
 - Testing tariff incentives
 - Understanding customer behaviour
 - *New network technology* - making more efficient use of the capacity in existing assets
 - *Real time interaction* – between customers and network



Electric vehicles



Heat pumps



Solar photovoltaic



Industry

Customer-Led Network Revolution partners from bid preparation and through delivery



- Largest energy supplier in UK
- UK leader in deployment of smart meters
- Industry-leading customer sales
- To install 2m smart meters across UK
- Extensive experience in innovation



- Extensive knowledge of distribution networks, micro-generation, heat pumps, demand side management
- Broad experience of practical trials
- Monitoring and analysis of domestic generation and its network impact



- Internationally recognised leading researchers
- Multi-discipline approach
- Customer analysis
- End-to-end monitoring and analysis
- Smart campus test site in Durham





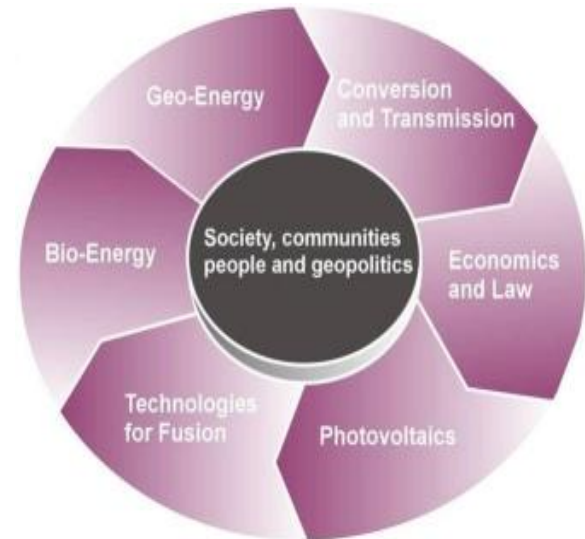
Durham Energy Institute

Multidisciplinary Input Socio-Technical Approach

Trial Design, Data Analysis, Trial Evaluation,
Simulation, Emulation, Robust Learning
Outcomes, Dissemination

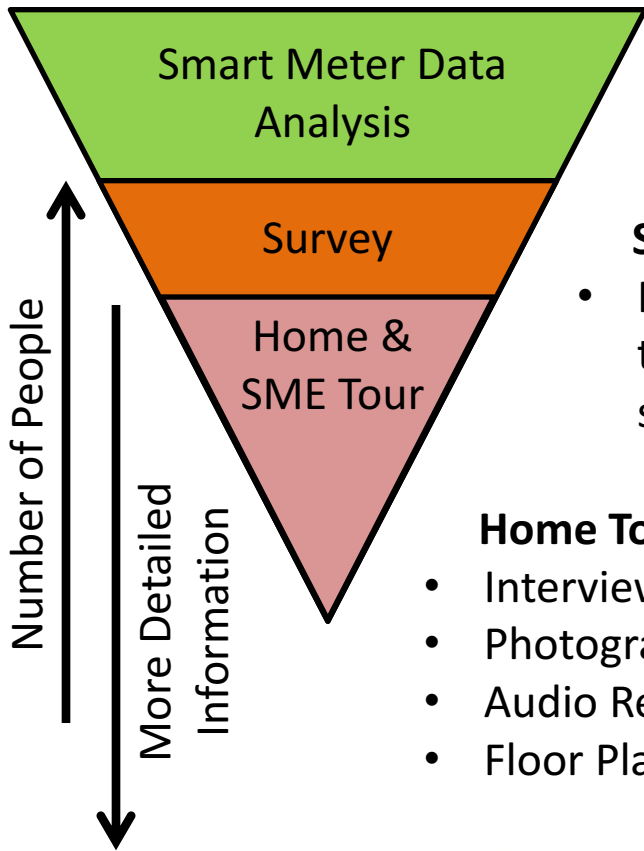
Disciplines

Engineering and Computing Sciences
Mathematics/Statistics
Human Geography
Anthropology
Earth Sciences
Chemistry
Physics
Durham Business School ...



Analysis

Methods



Smart Meter Data Analysis

Survey

Home & SME Tour

Smart Meter Data

- Used with the survey to search for larger social trends



Survey

- Participants invited to fill out online survey



Home Tours

- Interviews
- Photographs
- Audio Recording
- Floor Plans



Looking Forward

- Recruitment Underway
- Surveys begin soon
- Tours started March 2012



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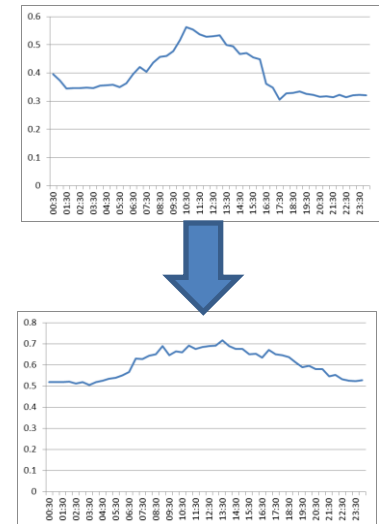


Analysis Outcomes

An understanding of how to define “customer flexibility” and how we can use this in network planning and management

A theoretical base for explaining how customers interact with energy and smart grids concepts

New load profiles for customers using low-carbon technologies and interacting with new tariff propositions



Customer-Led Network
Revolution

NORTHERN
POWERGRID

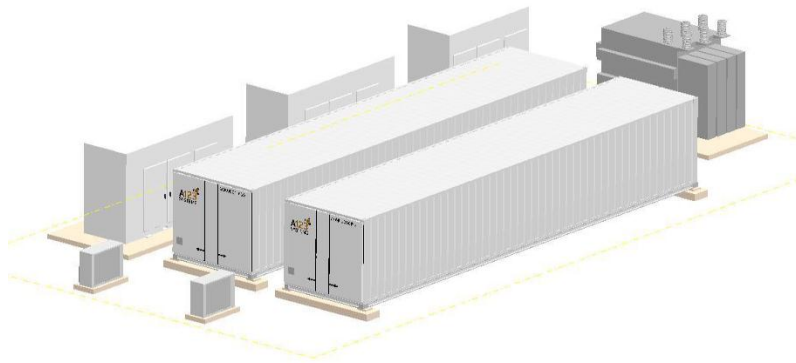
British Gas
Looking after your world

Durham
University

ea
technology

Network technology: supply, installation and commissioning in progress

- **Major contracts placed** – electrical energy storage (A123 Systems) and grand unified scheme control system (Siemens)
- Installation and commissioning in 2012
- **Real-time thermal rating** devices installed on 66kV and 20kV overhead line Denwick network
- Training packs and video installation guides produced



2.5MVA electrical energy storage



The CLNR is trialling DSR tariffs across a range of domestic and SME customer groups

Time of use

Static tariff that can vary by time of day, and between weekday and weekends

Restricted hours

Static ToU tariff with automatic appliance reductions at peak (with customer override)

Direct control

Payments for occasional interruptions to load (no customer override)

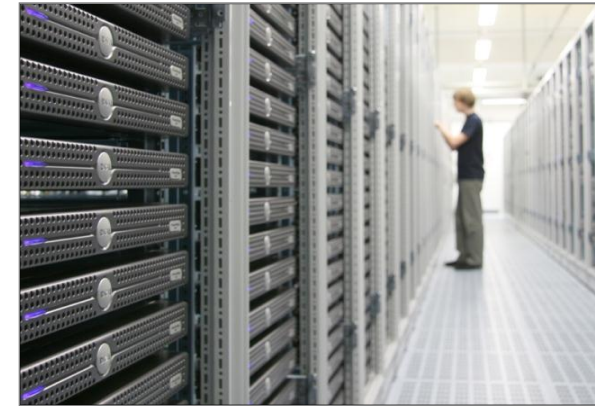
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The Role Of British Gas

- Recruit approximately 14,000 residential and business customers into 22 Test Cells through the development and fulfilment of 22 unique propositions
- Take advantage of British Gas's leadership in the roll-out of smart meters by providing historical data for over 11,000 existing smart meter customers
- Provide the essential data and insight for two of the project's key learning outcomes:
 - LO1: Understanding of current, emerging and possible future customer (load and generation) characteristics
 - LO2: To what extent are customers flexible in their load and generation, and what is the cost of this flexibility?



Customer Flexibility – I & C DSR trials Winter 2011/12



Customer 1: *Mining*

- Contracted DR: 2 MWh
- DR Type: CHP Generation
- Availability: 3pm – 6pm, Weekdays
- Response Time: 15 minutes
- Season: January – February 2012



Customer 2: *Refrigeration*

- Contracted DR: 0.75 MWh
- DR Type: Load Reduction
- Availability: 3pm – 7pm, Weekdays
- Response Time: 20 minutes
- Season: January – February 2012



Customer 3: *Web-Hosting*

- Contracted DR: 0.8 MWh
- DR Type: Diesel Generation
- Availability: 3pm – 7pm, Weekdays
- Response Time: 20 minutes
- Season: February 2012



Customer-Led Network Revolution



leading the way to lower energy bills and a low-carbon world

The UK's biggest smart grid project is in the forefront of the move towards a low-carbon economy. 14,000 homes and businesses in the North East and Yorkshire will be involved in this innovative £54 million project, helping us to find ways for customers to reduce both their energy costs and carbon emissions in the years to come.

Why are we doing this?

What is in it for you?

Knowledge zone

Industry zone

