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Martin Orrill

British Gas

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The Move to Electric Heating

A strategy for the future

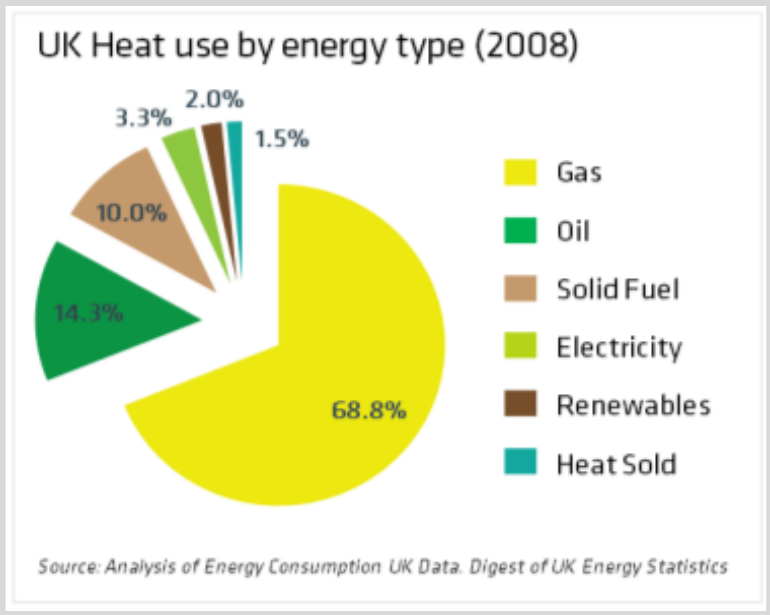
Agenda……..

- Back to the Future! - video
- Market context and opportunity
- Political context and opportunity
- Electric Heating – applications and how it works
- Case studies and UK's largest deployment
- Renewable heating - video
- The challenge of how we make it happen

The Renewable Heat Market… A sleeping giant?

Fact - Heating accounts for 47% of UK's CO2!!

- **69% gas, 10% oil, 14% electricity.**
- **2 million homes on oil – A key target**



Target - 15% of UK energy from Renewables by 2020

Target - 12% of heating from Renewables by 2020:

Actual - 1% of heat today from renewable sources

Note - RHI installations qualify for the Carbon Reduction Commitment.

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The Renewable Heat Incentive…….

World first - First financial support scheme for renewable heat in the world

The Renewable Heat Incentive plans to **revolutionise** the way heat is generated in homes and business's in the UK

The RHI will provide **long-term** financial support to renewable heat

The RHI provides **a key incentive** for our energy future where both carbon reduction and energy security are assured

Note – its **very different** to the Feed in Tariff……

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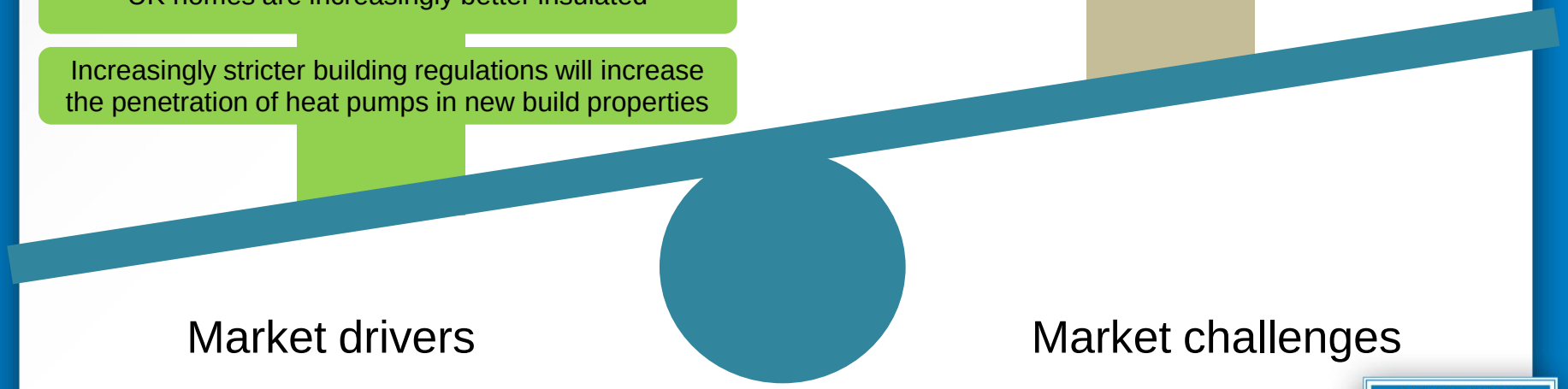
The Renewable Heating market is being driven by government subsidy, rising fuel costs and building regulations, but there are still challenges to overcome:

- Renewable Heat Incentive (RHI, due Oct 2012, will make renewable heat very attractive cost wise
- The Green Deal (Oct 2012) promises to help with financing the capital cost of renewable heat
- Fossil fuel price rises and volatility (especially oil) alter the cost equation in favour of renewable heat
- Confidence in the industry is increasing through installer accreditation and educating consumers
- UK homes are increasingly better insulated
- Increasingly stricter building regulations will increase the penetration of heat pumps in new build properties

- Retrofit (the largest market) usually has a higher cost and complexity of install
- Consumers don't make the trade off between high capital costs and future energy bill savings
- Continued government delay on RHI is destabilising investor confidence and putting the market on hold
- The impact of the RHI Premium Payment scheme will be marginal; the market will stall until late 2012/2013



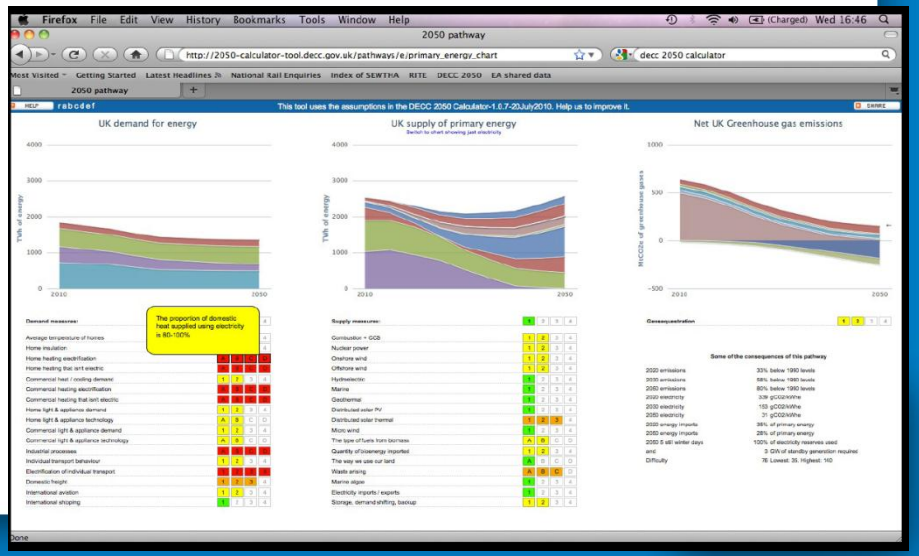
Market drivers

Market challenges

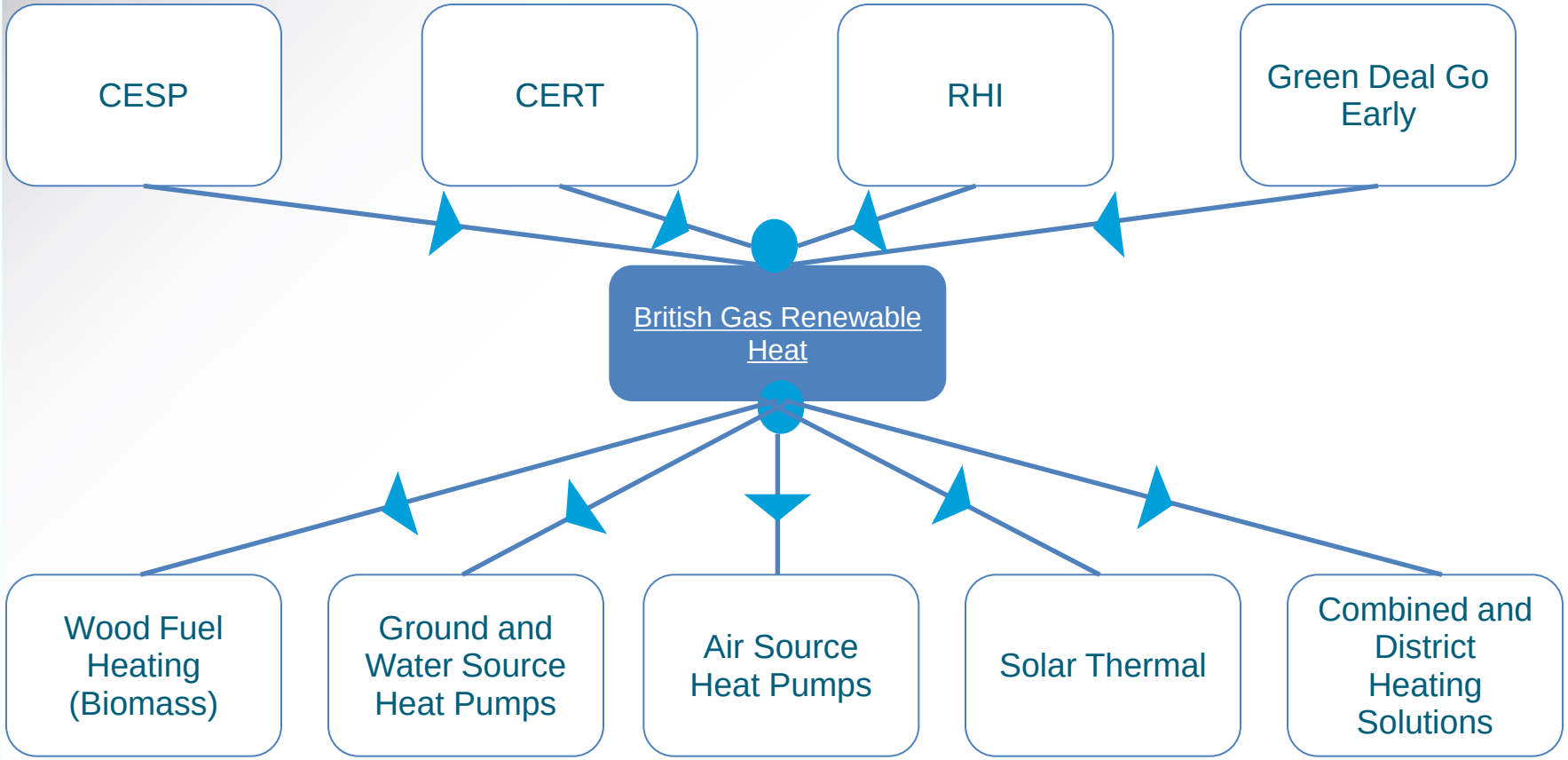
Political context from DECC……..

- Heat pumps that work are a vital component of all plausible pathways that meet 2050 emissions targets
- Electrifying the UK's domestic heat supply will be extremely challenging- consumers must have confidence in the technology
- Good performance is important for grid balancing

DECC's view of the world pathways to 2050……..

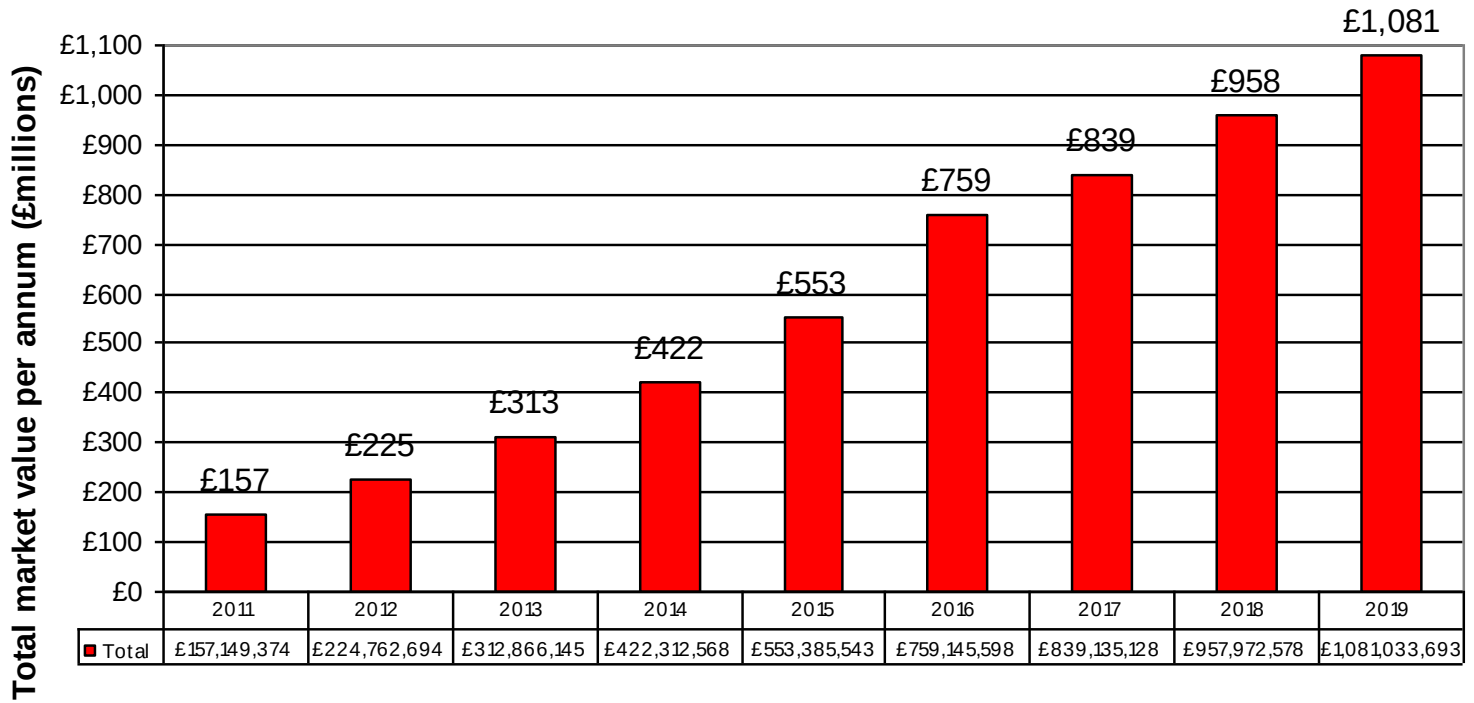


There are a number of technologies and funding streams that qualify for the RHI:



By 2020 the domestic renewable heat market alone is forecast to be worth over £1bn p.a

Revenue potential for domestic renewable heat installations (low scenario) – (£millions per annum)



Source: Renewable Heat team internal forecast (LOW scenario)t ased on data from DECC, Environment Agency, Delta Energy & Environment and Biomass Energy Centre.
Based on assumptions of technology cost reductions from DECC

Where does renewable electric heating fit in our homes…….

Heating via an Air source or ground Source heat pump

Low temperature Fanned Radiators or Underfloor

Unvented hot water / thermal energy storage - KEY

Hot water and heating from a combination of Solar thermal, PV and Heat pumps

British Gas is building capability to install Electric Renewable Heating, but success will require industry help and partners…….

The Renewable Heating sector is on the verge of market transformation in the UK partly driven by an incentive mechanism but also assisted by the cost of carbon, legislation, planning regulations and changing consumer behaviour

cool planet
sustainableenergy solutions

Heat pump capability development

- British Gas can now install Ground and Air source Heat pumps to commercial, social housing and residential customers
- Cool Planet provide market leading capability in Heat pump design
- Example installations include the ASDA Eco store the BASF Eco house and the UK's largest heat pump deployment in Toryglen

ECA Delegates – Key partnerships opportunity

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How does renewable electric heating work…….

Definition;

A heat pump is a machine that moves heat from one location to another location using mechanical work.

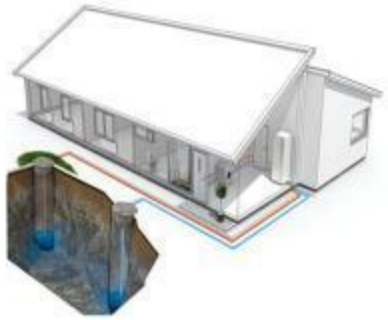
Most heat pump technology moves heat from a low temperature heat source to a higher temperature use…

Many types of Electric Heating…..

Open Loop

Water is utilised as a constant temperature sources (i.e. Lakes, reservoirs, rivers or sea) or ground water.

For ground water two holes are drilled in the ground below the level of the ground water (aquifer). One pipe extracts water from the ground and the other rejects the water to the ground.



Closed Loop – Bore Holes

A series of holes are drilled down into the ground at a depth of 50 to 200m, depending on geothermal conditions.

Two water pipes connected via a 'u bend' are fed directly into the holes

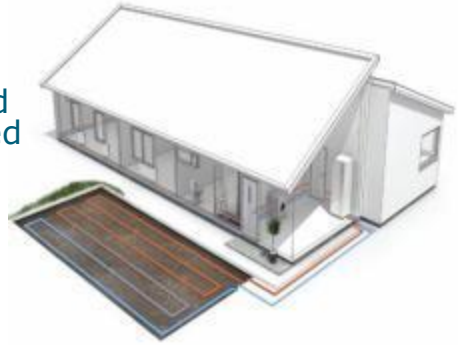
Highly efficient constant performance throughout the year

Closed Loop - Horizontal

A trench is dug to a depth of between 1.7 to 3 m and plastic pipe is laid into the bottom.

The pipe is covered with sand to provide good ground to pipe contact and then the trench is backfilled with the excavated soil.

Cheaper than bore holes but require significant space.



Air Source Heat Pumps

The external unit is sited adjacent to or near to the property.

This is connected to the internal unit which in turn connects to the radiator or underfloor heating system.

Installations are quick to carry out

Case study- British Gas has installed the UK's largest ever heat pump project…

SCOPE
- 6 tower blocks consisting of 232 individual properties
- Provide heating and hot water for residents via Air Source heat pump solution
- All properties to have replacement windows and external wall cladding

SOLUTION
- 112 Mitsubishi ASHP to be installed in clusters of four on communal balconies
- 4 tower blocks benefiting from a district solution of 2 purpose built compounds each containing 3 x 100kW heat pumps

CUSTOMER BENEFITS
- Lower running costs and better insulation
- CERT and CESP funding on Heat pumps
- 'One-stop shop' solution from British Gas: renewable heating, external walls, and windows

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Case study - British Gas is delivering a £10m energy efficiency project Dumfries and Galloway Housing Partnership

1650 homes will benefit from: smart meters; insulation; ASHP; solar thermal systems

547 ASHP to be installed with 300 installed so far

Changing from night storage heaters

Working with local labour

Created local Green Skills Academy

Customer testimonial:

"I am delighted with the new system, it really is fantastic. It was a big change for me to start with, but it has been absolutely worth it. I am saving in the region of around £20-25 per month on my old storage heating system and what I like about it is it is very simple to use. It is also a very pleasant heat in the house. So although there was a bit of disruption initially, the fact that my house is warmer and it costs less to run is brilliant."

Case Study – Industrial Electric Heating for schools and college's

LUTON 6TH FORM COLLEGE

- Designed and specified a 850kW peak load Mitsubishi WR2 VRF ground source heat pump
- Client had previously been advised the site would require 175 100m deep bore hole closed loop solution.
- Detailed appraisal and Hydro-geological assessment ensured we offered an optimum solution: 2 bore hole 55m open loop
- Provided a turnkey solution including all interaction with EA

PROSPECT COLLEGE

- Ground source heat pump: closed loop
- 100m test bore allowed us to accurately model the thermal conductivity of the ground
- 12 year design warranty offered on ground array
- System comprised of 24 bore holes and offered simultaneous heating and cooling
- Completed to client's satisfaction, on time and on budget

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Summary…….

With the UK's Renewable targets, off grid propensity and skilled Electrical engineers should the UK lead in delivering Electric Renewable Heating?

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Appendix for ECA delegates –

Scope and objectives of the Low carbon Networks fund:

The Low Carbon Network Fund is a £500M programme running until 2015

- Projects led by the Distribution Network Operators (DNOs) to try out new technology, operating and commercial arrangements
- British Gas won a collaborative bid led by Northern Powergrid (DNO for the NE and Yorkshire region) for the **Customer Led Network Revolution (CLNR)**

Customer-Led Network Revolution

- The CLNR is a £54 million project aiming to find solutions to some of the 21st century's key energy challenges:
  1. General increase in home energy use caused by low-carbon agenda
     - Electric vehicles;
     - Heat pumps and electrical replace gas central heating
     - Increasing 'discretionary loads'
  2. Wider rollout of microgen
  3. Ageing grid infrastructure and much higher penetration of utility-scale renewables (Offshore wind)
- British Gas is one of four partners in the project; our leadership in the roll-out of Smart Meters made us the partner of choice for this project

The Low Carbon Network Fund is based in the NE and Yorkshire region:

Customer-Led Network Revolution

Why are we running the Customer-Led Network Revolution?

- Rising investment is needed to secure energy supplies and meet carbon targets
  - Rising electricity demand
  - Carbon targets/new technologies
  - Ageing infrastructure with little investment
- Up to £200bn may be required over the next 10 to15 years, more than double the recent rate of investment
  - Rising investment in networks - £32bn over next 10 years
- Consumer bills will rise due to the levels of new investment required and increasing costs of carbon
- Joined-up thinking required across the electricity supply chain:
  - Alternative solutions sought to traditional reinforcement of the network
  - Use up headroom in existing network assets with new technology
  - Test customer flexibility

The key partners:

British Gas Looking after your world	ea technology	Durham University
• Largest energy supplier in UK • UK leader in deployment of smart meters • Industry-leading customer sales • Extensive experience in innovation	• Extensive knowledge of distribution networks, microGen, heat pumps, demand-side management • Broad experience of practical trials • Creation of implementation strategies and tools	• Internationally recognised academics • Multi-discipline approach • Customer analysis • End-to-end monitoring and analysis • Smart campus test site in Durham

The project's key aims/desired outcomes:

1. **Learning Outcome 1 (LO1) - Monitoring**: What are current, emerging and possible future customer (load and generation) characteristics?

2. **Learning Outcome 2 (LO2) – Customer flexibility**: To what extent are customers flexible in their load and generation, and what is the cost of this flexibility?

3. **Learning Outcome 3 (LO3) – Network flexibility**: To what extent is the network flexible and what is the cost of this flexibility?

4. **Learning Outcome 4 (LO4) – Optimum solutions**: What is the optimum solution to resolve network constraints driven by the transition to a low carbon economy?

5. **Learning Outcome 5 (LO5) – Effective delivery**: What are the most effective means to deliver optimal solutions between customer, supplier and distributor?

Learning Outcome 1: What are current, emerging and possible future (load and generation) characteristics?

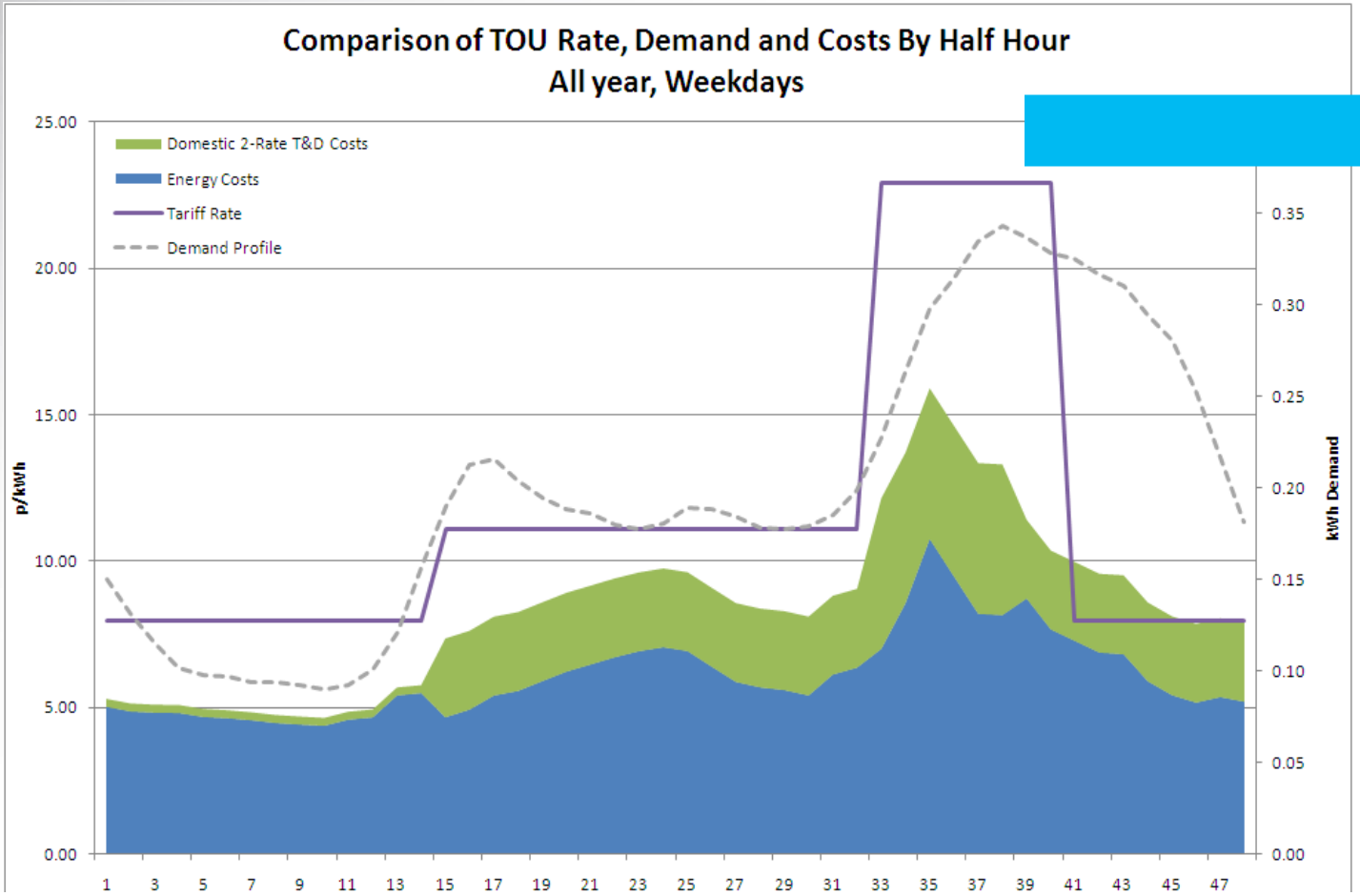
- Construct a detailed understanding of customer consumption and generation profiles across a representative cross-section of customer and demographic groups using eight individual test cells
- Mix of domestic, small and medium enterprises and large industrial and commercial and distributed generators
- Domestic customers **with and without low-carbon technologies**
- Durham Energy Institute involved in specifying customer types to make up a demographic that would be applicable to 80% of GB networks
- Collect at least 12 months data - most likely leave monitoring equipment in to extend this monitoring period

Learning outcome 2 - To what extent are customers flexible in their load and generation, and what is the cost of this flexibility?

Testing three customer propositions:

1. Time of use tariffs
   - Very high rates during network peaks – lower all other times
2. Restricted Hours
   - One specified load restricted from operation during peak without manual override
3. Direct Control
   - One specified load turned off or down at the request of the network

Example: will aggressive pricing during peak help shift demands and use spare capacity?



"Load shifting"

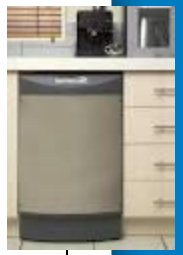
- Peak rate 99% above day between 1600-2000
- Will customers choose to avoid charging EVs, run wash cycles etc. during this time?

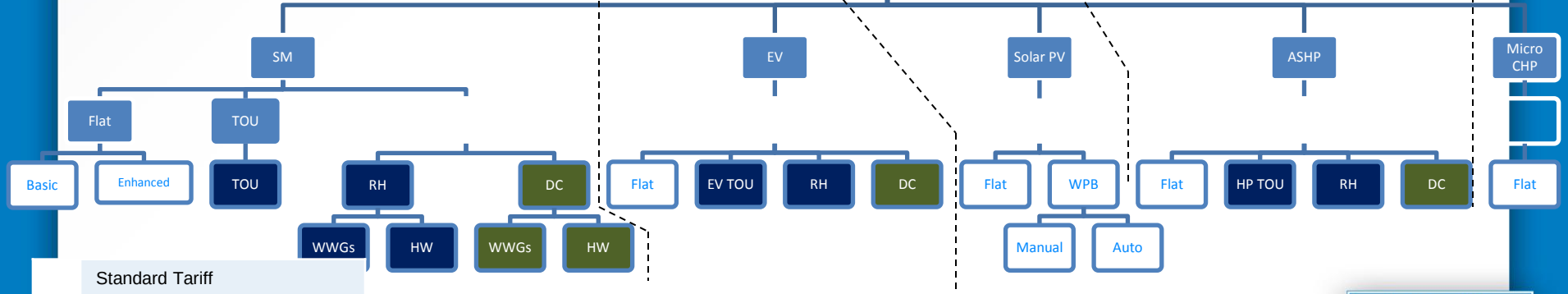
Our part of CLNR is structured in test cells:

- 18 “test cells” BGR, 4 BGB
- 4 low carbon technologies trialled
- Total of 14,000 participants desired

Tariffs, monitoring and “white goods” only





Standard Tariff

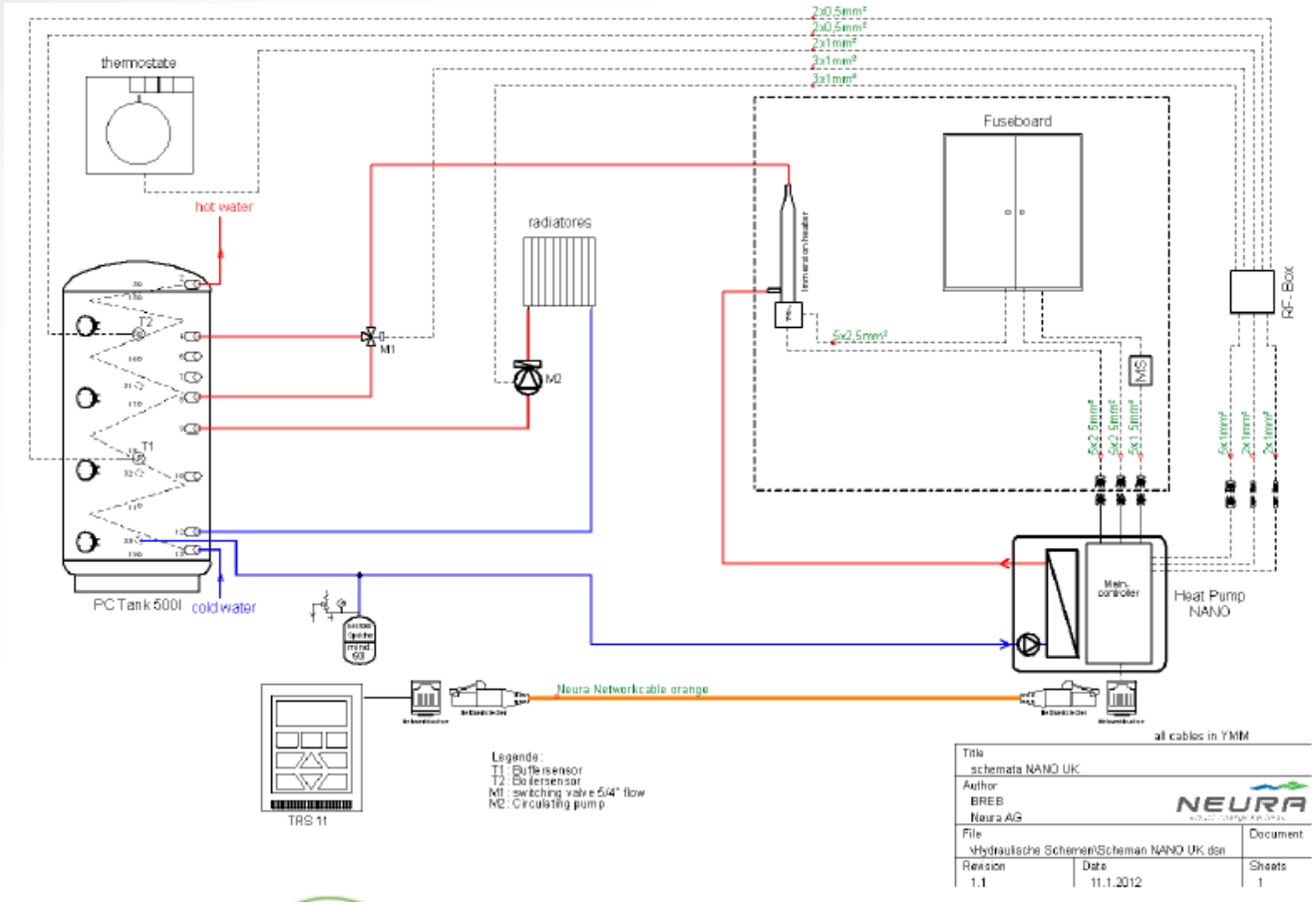
TOU Tariff

Direct Control Proposition

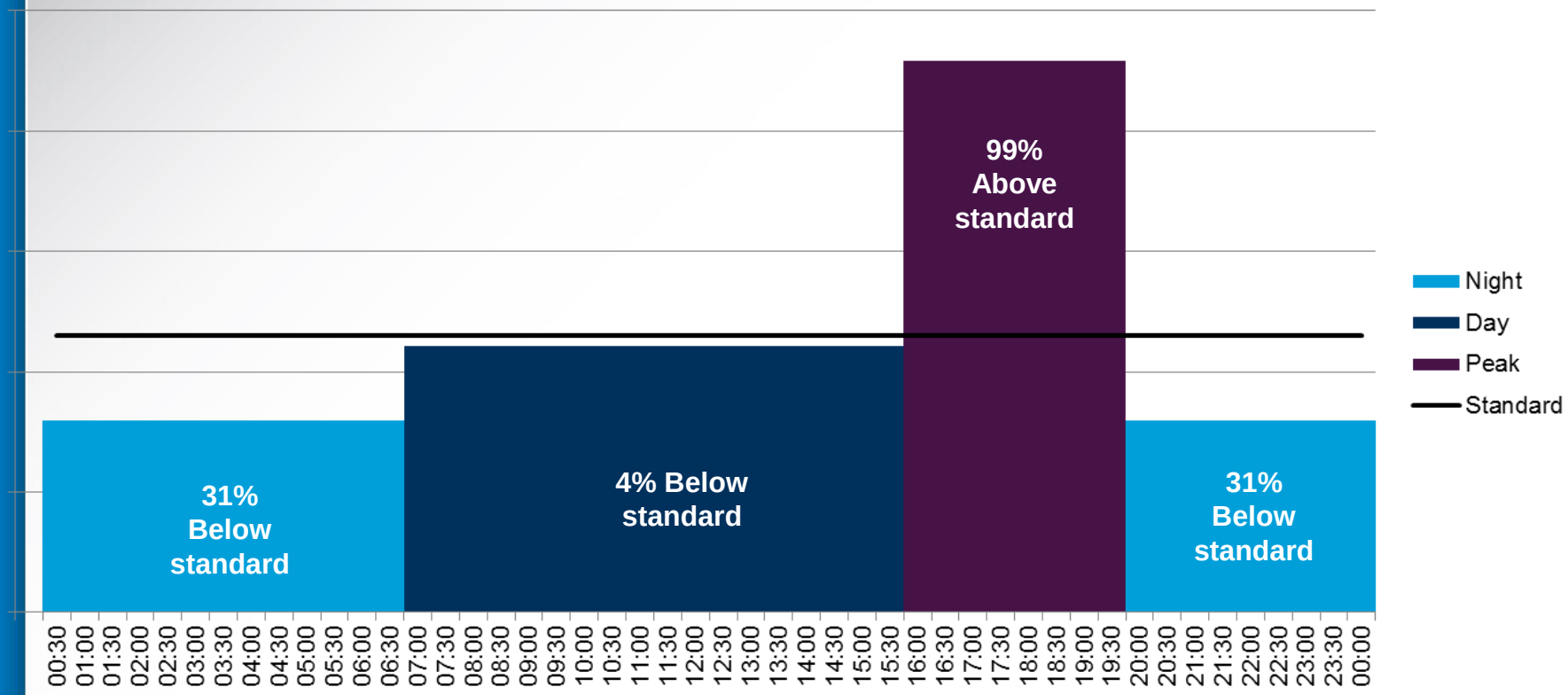
Air Source Heat Pump test cells in more detail:

Technical solution required for Restricted Hours and Direct Control: thermal storage to allow “load shifting”

•Advanced, highly controllable heat pump (Innasol) required for these modes



Three-rate TOU tariffs for the on the CLNR:



At weekends it is 31% below standard all weekend

“Standard” rate is 11.543p/kWh in Yorkshire and the NE region

Tariff facts (pre-price reduction):

How Time of Use compares against the standard tariff:

- **Night rate is on average 31% cheaper than the standard tariff.**
- **Day rate is on average 4% cheaper than the standard tariff.**
- **Peak rate is on average double the rate of standard tariff during these hours.**

Other details to mention:

The standing charge is 25 pence per day (approx, actual = 24.8p).

The VAT rate is 5%

Regional flat avg.	11.54
"Night" tariff 2000 – 0700 (next day)	7.741
"Day" tariff 0700 – 1600	10.77
Peak Tariff 1600-2000	22.269

£7 saved for every 10% of load shifted out of peak

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Technical solution still being finalised; three variants likely, depending on customer space available:

Test Cells 13 & 14 are most important for programme

Potential benefits of CLNR tariff:

1.£7 saved for every 10% of load shifted out of peak period (1600-2000)

Test Cells 13 & 14 are most important for programme

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