Unlocking the Future of Energy

Our transition to a Customer-Led Distribution System Operator

Send us your questions and comments

#customerled

www.northernpowergrid.com/innovation

Welcome and introductions

Patrick Erwin

Policy & Markets Director

Unlocking the Future of Energy

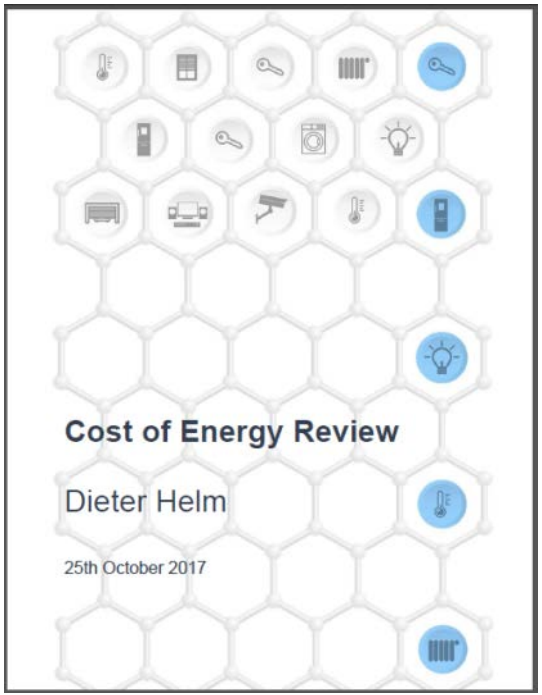
Agenda	
Welcome and introductions	10:00
Our Distribution System Operator transition	10:10
Project showcase: • Customer-Led Distribution System • Reducing our carbon footprint – distribution losses • Distributed storage and solar study Q&A	10:45
Break	11:30
Panel presentation and discussion	11:50
Closing remarks and next steps	12:50
Lunch and networking	13:00

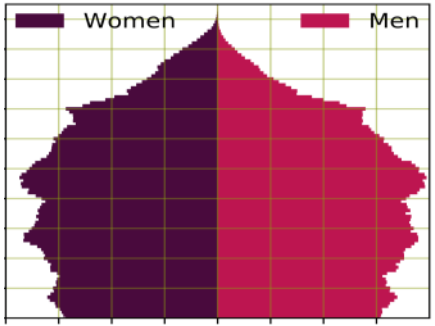
Do you know what a Distribution System Operator is?

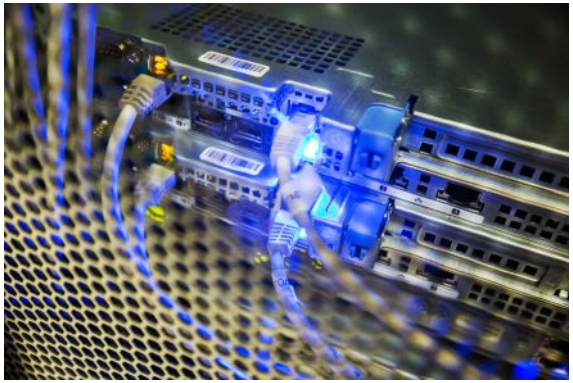
1. Yes
2. Unsure
3. No

Towards Distribution System Operation

A complicated context







Our Distribution System Operator transition

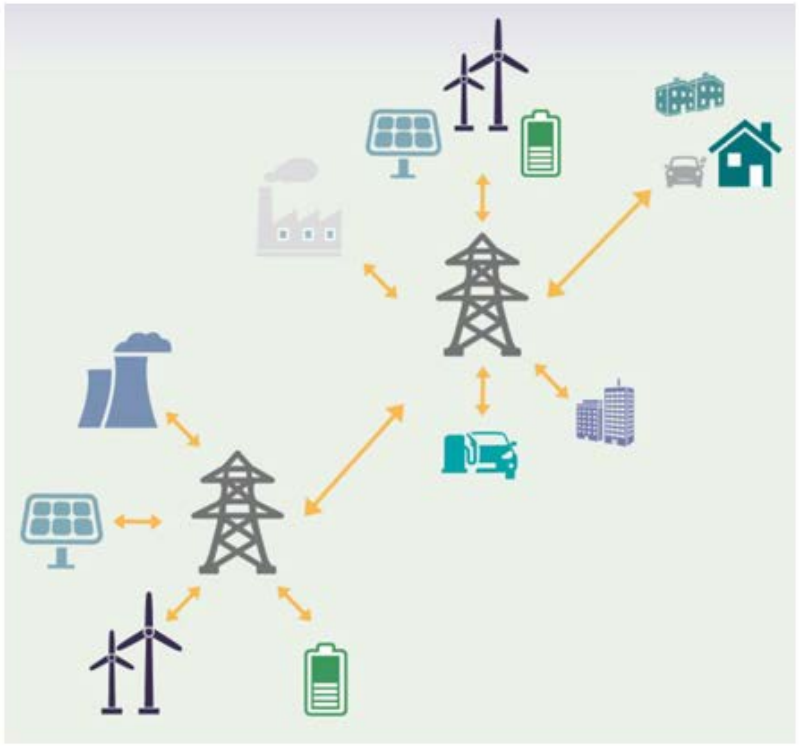
Jim Cardwell

Head of Trading and Innovation

Session Objectives

1. **Share our vision and plans** for the transition to DSO – *introducing more flexibility into the energy system*
2. **Seek views** on this way forward – *an opportunity for you to engage and shape the direction of our work*
3. **Establish a platform for ongoing meaningful dialogue** with all stakeholders – *clarifying often complex themes*

A changing system: the need for smart, flexible solutions



Our world is changing fast

UK sets ambitious new 2030s carbon target

Solar panel costs predicted to fall 10% a year

Solar Is Going to Get Ridiculously Cheap

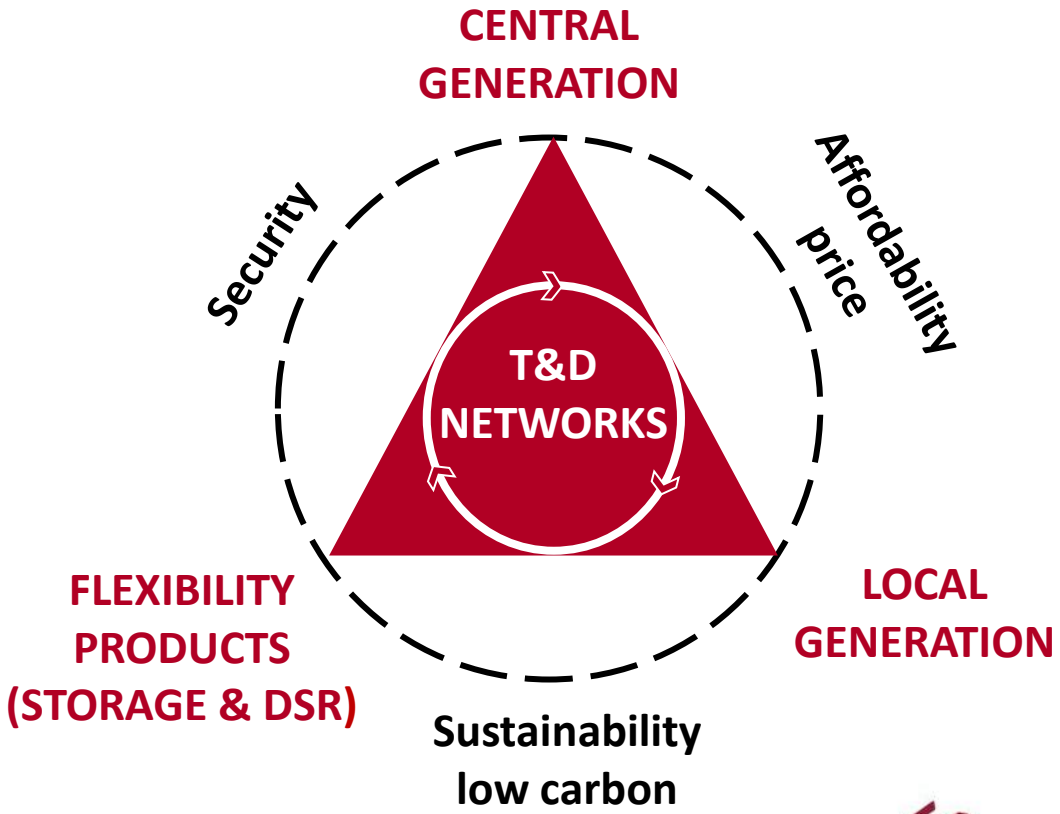
Capacity Market success evidence of 'crucial role' battery storage to play in UK grid

Electric cars will rule the future

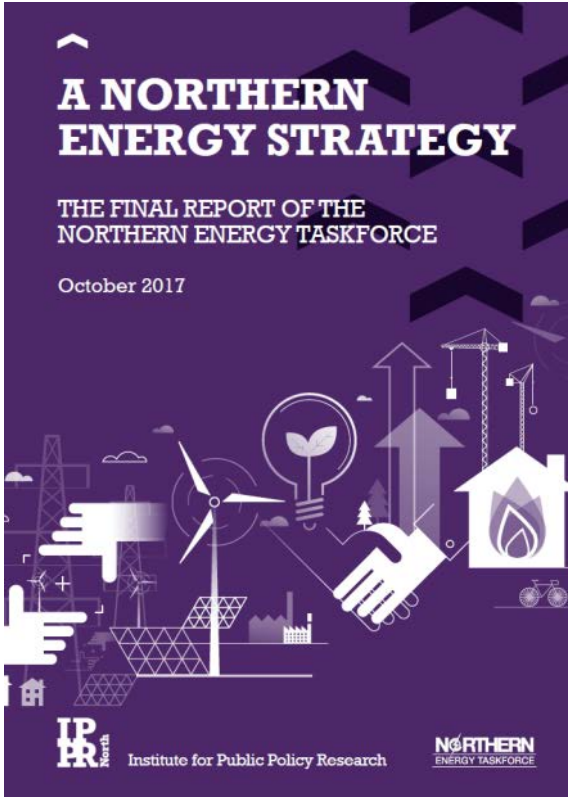
Some 147 Gigawatts of renewable electricity came online in 2015 - the largest annual increase ever and as much as Africa's entire power generating capacity.

Renewable energy smashes global records in 2015

Networks taking centre stage



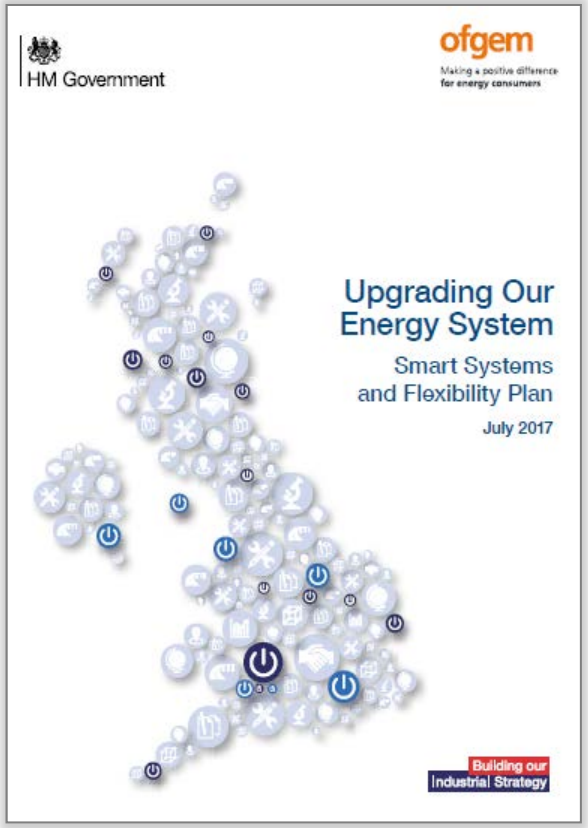
Delivering value for our stakeholders

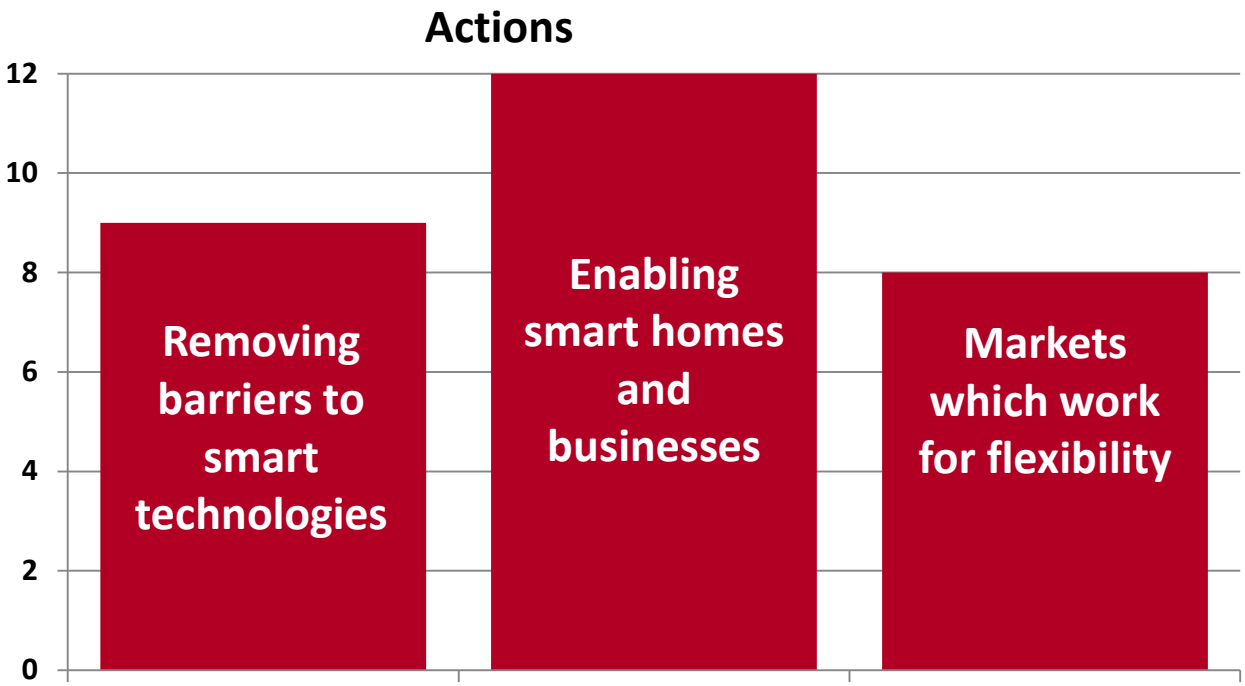


‘Our vision for the north of England is that by 2050 we will be the leading low-carbon energy region in the UK, with an energy economy worth £15 billion per annum and 100,000 green jobs providing affordable, clean energy for people and businesses across the North.’

IPPR North, Northern Energy Taskforce

Smart Systems and Flexibility plan





https://www.ofgem.gov.uk/system/files/docs/2017/07/upgrading_our_energy_system_-_smart_systems_and_flexibility_plan.pdf

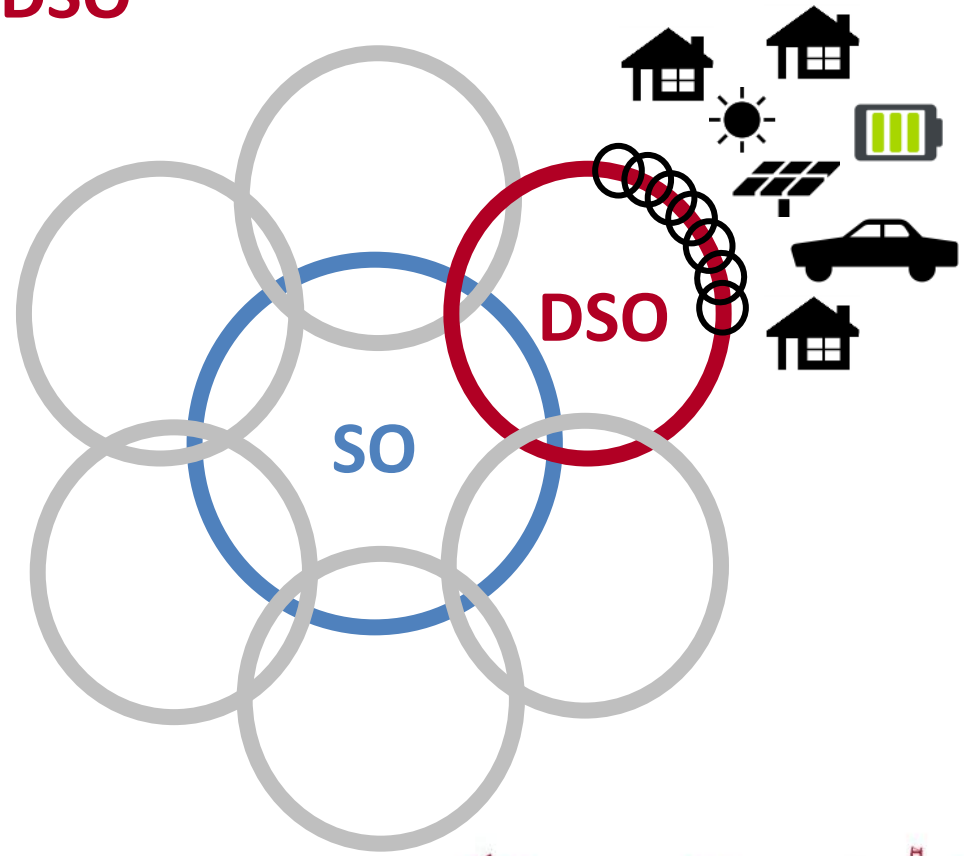
Our DSO vision

- Transition is required to a ***customer-led*** actively managed (and probably semi-autonomous) network…
- …where we are providing a cost-efficient, non-discriminatory and technology neutral physical trading platform…
- …for third parties in our region to participate in the electricity markets.

DSO must provide a compelling value proposition for customers and stakeholders

Our next steps from DNO to DSO

- Responsible for keeping the network stable and power supplies reliable.
- Regional DSOs of sufficient size and capacity to be accountable.
- Interconnection boosts physical and cyber security resilience.
- Provide the physical trading platform for other parties in the Energy Market.
- Market maker for distribution grid services.
- Enabler to access transmission grid services market.



From network services to customer services

1950s-1970s
Passive networks
Passively resilient
High headroom

1980s-2010s
Active networks
Active resilience
Medium headroom

2020s on
Semi-autonomous networks
Smart resilience
Economically optimised headroom

Smart grid hardware, remote control — **TECHNOLOGY** — Machine learning, Artificial Intelligence

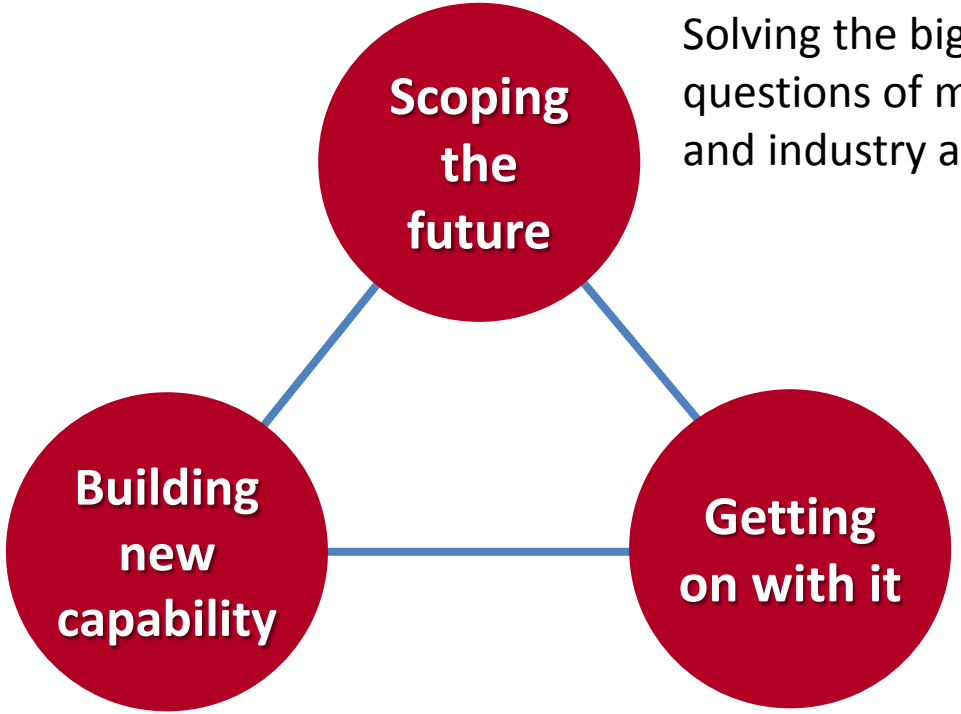
Flexible connections — **MARKETS** — Open markets for grid services

GRID INVESTMENT - to maximise utility value

Taking forward our whole system thinking

Customer-Led Network Revolution	InTEGReL	ena energynetworks association	NORTHERN POWERGRID
Smarter solutions to connect more low-carbon generation, heat and transport	Whole energy system optimisation through collaboration with Northern Gas Networks and Newcastle University	Open Networks collaboration delivering enhanced whole electricity system optimisation	• Customer-Led Distribution System in the context of a wider market for network and energy services • System losses being considered in the context of low marginal cost generation • Delivering fair societal outcomes

Our DSO strategy

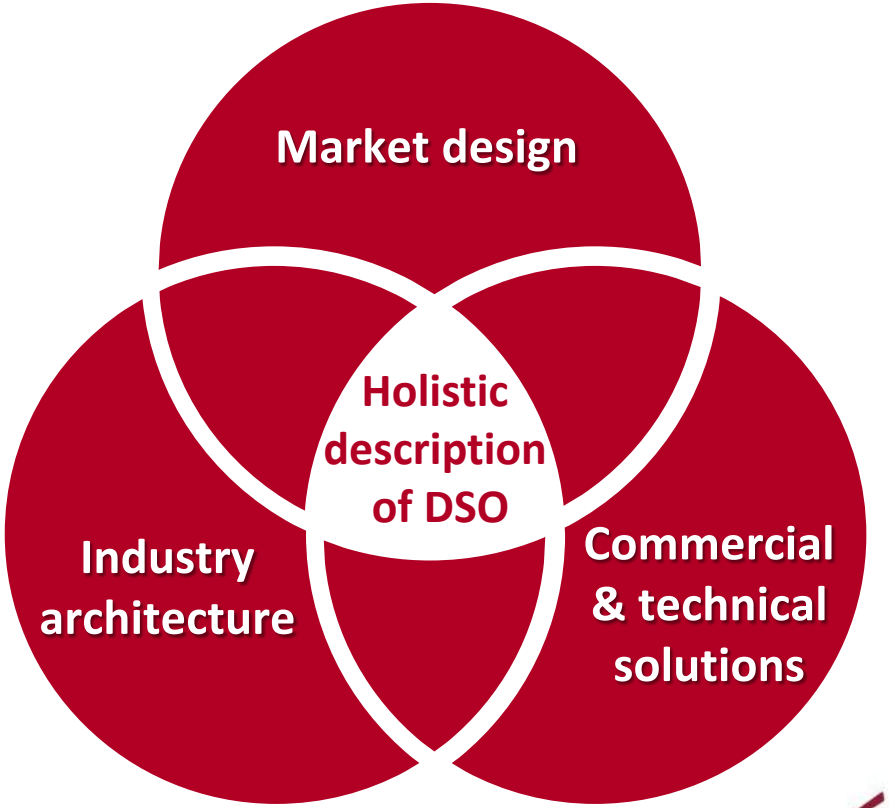


Solving the big open questions of market design and industry architecture

Providing new infrastructure and processes

Low regrets steps to demonstrate and learn

Scoping the future: Customer-Led Distribution System



Scoping the future: electric vehicles

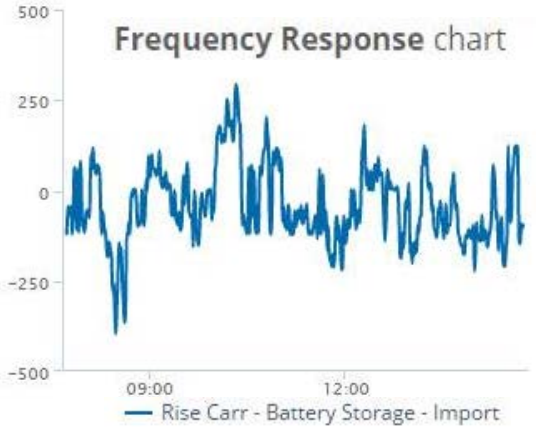
- To enable a successful transition we need to understand what customers want and develop solutions with the motor industry
- Vehicle to grid is one of the technologies to turn a grid problem into an opportunity
- Strategic collaboration between Nissan and Northern Powergrid also considering second life battery uses
  - Grid and domestic target lower customer bills and improved grid resilience

Image from CNET.com

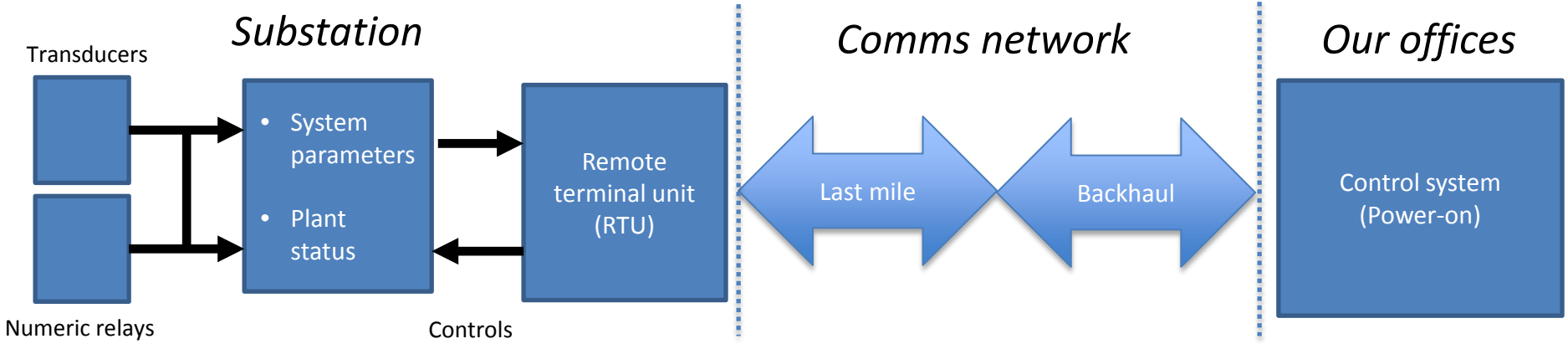
Getting on with it: example - battery trading

- Storage offers flexibility by smoothing intermittent generation or contributing to more active local balancing by the DSO.
- Value stacking through aggregator Kiwi Power:
  - Dynamic firm frequency response to the GB system operator
  - Triad services to an energy supplier
- Practical low-regrets innovation through a ‘learning by doing’ approach.
- Revenues earned used for innovation projects.

Customer-Led Network Revolution
2.5MW battery at Rise Carr

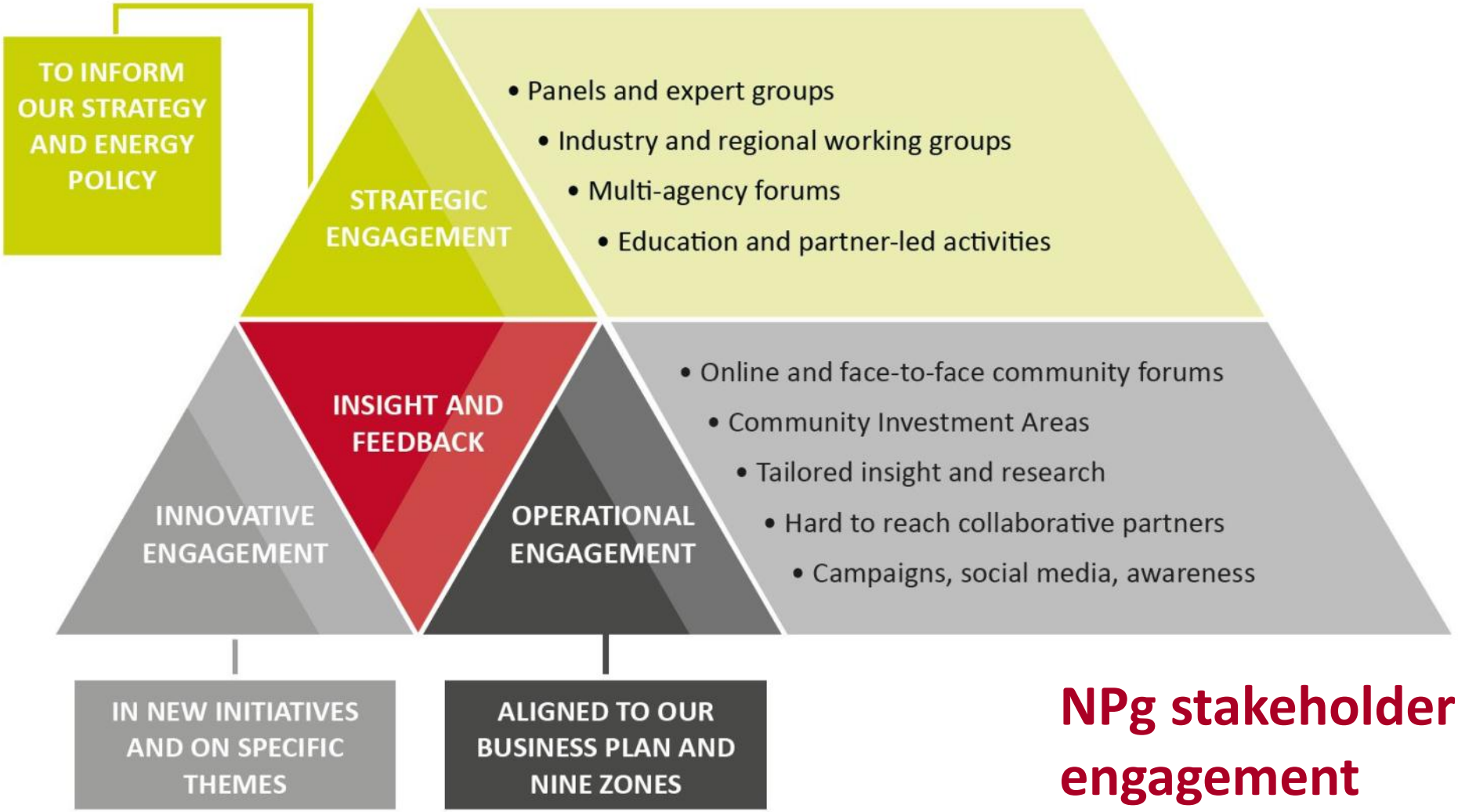


Building new capability: example - smart grid enablers



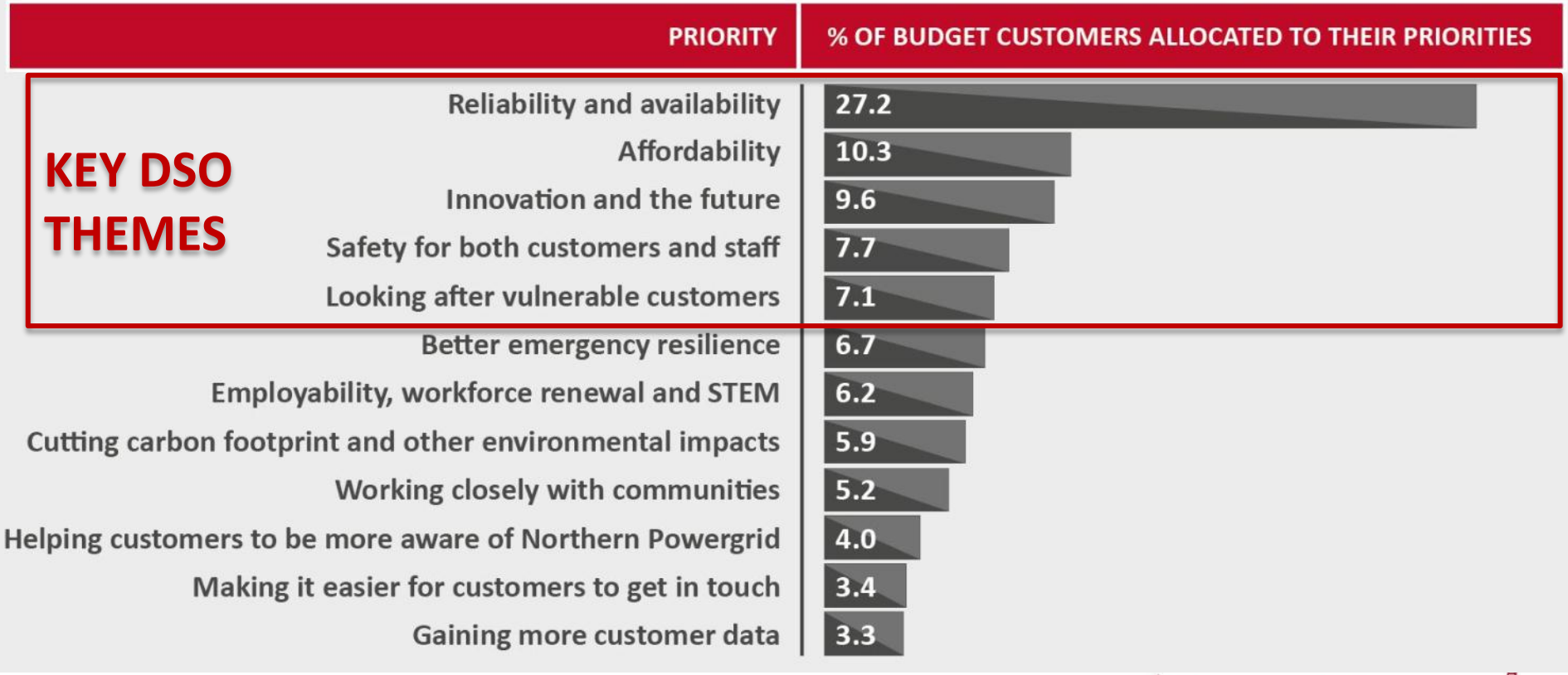
- **Substation monitoring** - Upgrade all automatic voltage control (AVC) relays.
- **Substation RTU** – Replace time-expired RTUs with more flexible modern equivalents.
- **Comms network** – Replace the last mile radio links with modern IP radio equipment.

£83m investment that, as a minimum, pays for itself by 2031



NPg stakeholder engagement

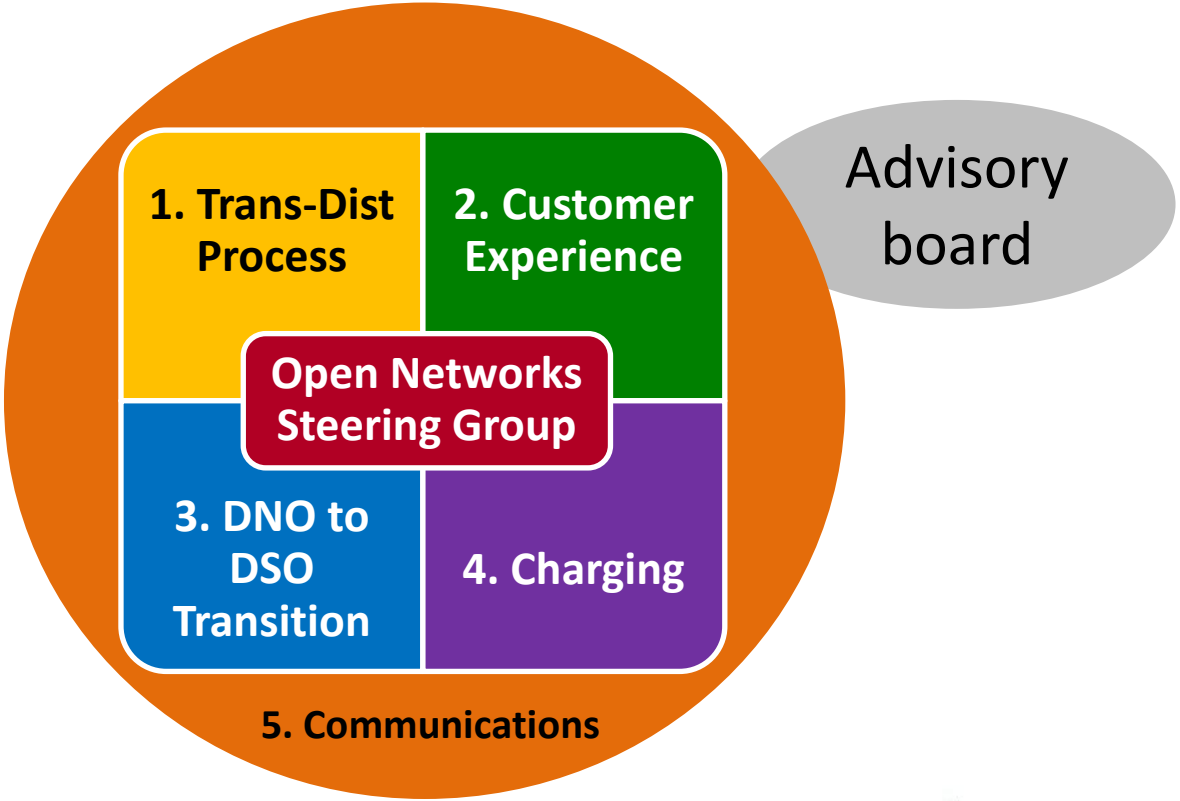
Customer priorities



Delivering for society

- Network charging regimes are rightly under the microscope by Ofgem
- We must avoid ‘free riders’ - particularly if those left to pick up the bill are already fuel poor
- The charging reforms must look at who receives the system benefits and who picks up the costs
- One focus of our innovation work is to ensure that everyone benefits from the transition to a smarter more flexible energy system

Open Networks project collaboration



http://www.energynetworks.org/electricity/futures/open-networks-project/

Customer-Led Distribution System

Liz Sidebotham

Commercial Development Manager

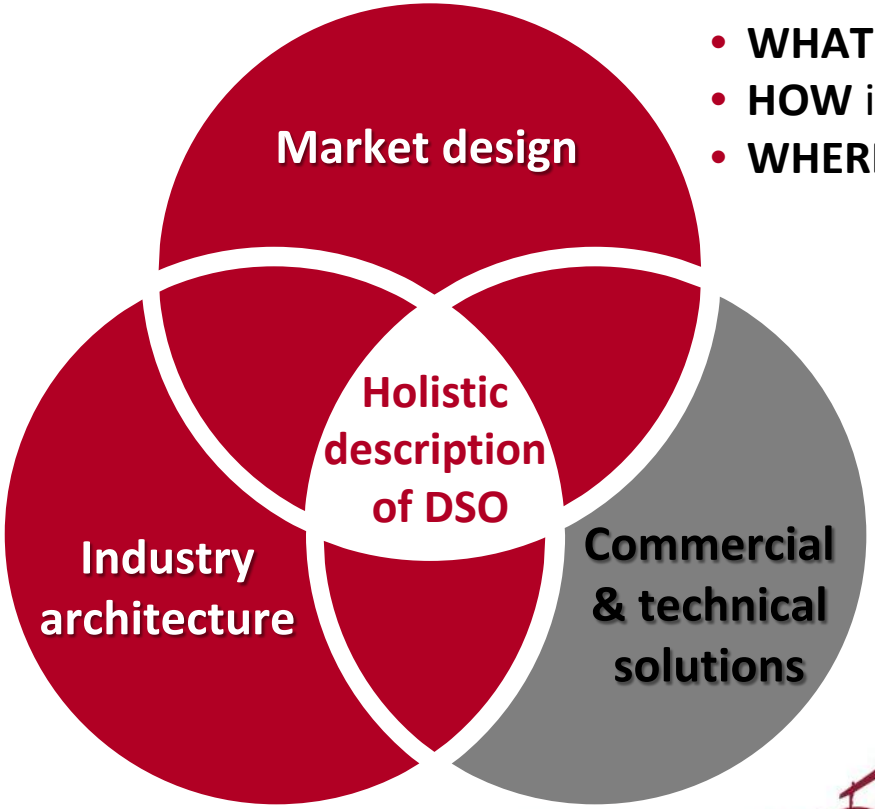
Looking to the future

- Our vision is to be the best energy company in serving our customers while delivering sustainable energy solutions.
- We will do this by providing the platform that enables current and future customers to receive safe, secure, affordable and environmentally sustainable supplies of energy, with fairness and equity.
- We maintain and build our business by creating and marketing a compelling value proposition for our customers.
- Our Customer-Led Distribution System (CLDS) project will help us understand how to do this.

Customer-Led Distribution System: Scoping the future

Solving the big open questions of market design and industry architecture

- **WHAT** is traded?
- **HOW** it is traded?
- **WHERE** it is traded?



- **WHAT** are the functions?
- **WHO** does **WHAT?**
- **WHAT** information is exchanged?

- **HOW** the functions could be executed

Customer-Led Distribution System: Objectives

To identify and demonstrate the most appropriate market design and industry structure that will:

- Enable the optimisation of network and distributed energy resources.
- Enable 3rd party providers to realise maximum value of distributed energy resources through market-enabled energy and network products.
- Enable the uncertainty and complexity of the supply system to be substantially reduced by distributed and coordinated market and network solutions.

Customer-Led Distribution System: Approach

- Bring together a group of leading minds to provide cost efficient desktop studies and laboratory modelling and emulation.
- To collaborate with others to extend their demonstration projects through quick and low cost laboratory studies.
- Provide quantified evidence for customers, the industry and policy makers on different DSO options.
- Develop the economic evidence base for the investments needed for a DSO that truly delivers for customers.

Customer-Led Distribution System: Project timing

Year 1: Design	**Industry Structure** for an efficient and coordinated energy system	**Market Design** for energy products from DERs
Year 2: Evaluation	**How to co-ordinate DERs and optimise** to address energy and network problems	**Laboratory demonstration** of energy markets and DER co-ordination
Year 3: Route to value	**Pathways** for commercial and technical developments	Quantify **the value to customers and stakeholders** from introducing energy markets to distribution sector

Scoping the future: Customer-Led Distribution System

- **Examining the future structure of the distribution sector with customer front and central:**
  - Accommodating large volumes of DERs at least cost.
  - Deliver value to DERs that thrive in a flexibility market.
- **Identify and demonstrate**:
  - The most appropriate market design - what is traded, and how and where it is traded
  - Industry structure - roles of each party and the relationships between the parties
- **A virtual demonstrator** - using laboratory modelling and emulation to provide low cost extension of practical demonstrations.
- **Provide the quantified evidence base for the changes required.**

Reducing our carbon footprint – distribution losses

Phil Jagger

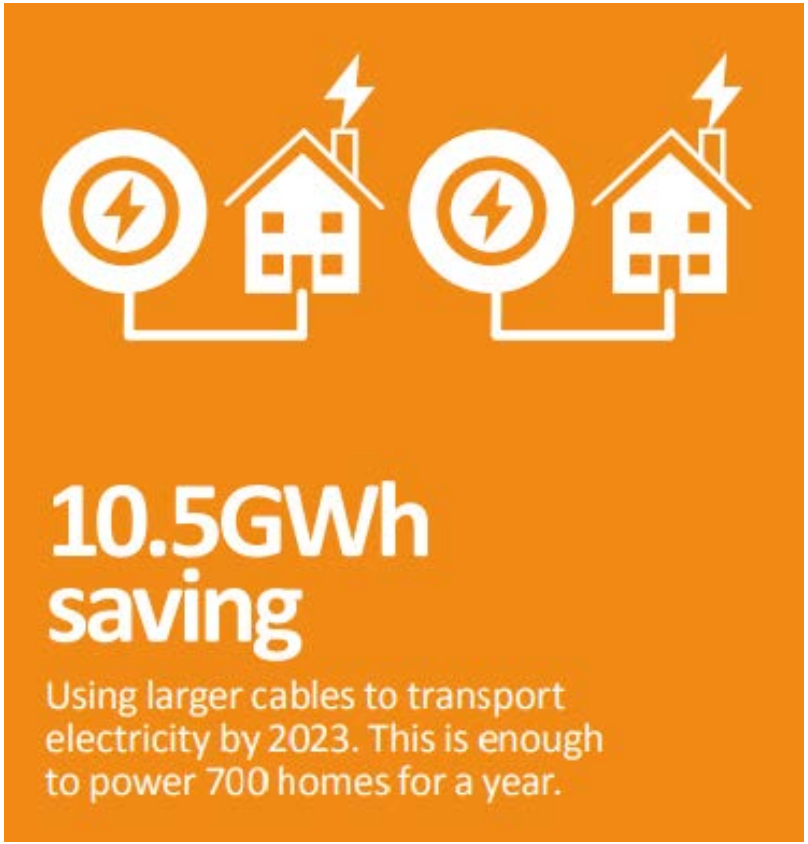
Smart Grid Development Engineer

The impact on our customers

- Inefficiencies in the system (5-6%)
- Technical (Iron and Copper)
- Non-technical (Theft)
- 0.8MT of CO_2
- Difficult to measure
- Future losses increases likely but economic from whole system view
- £100m/yr (£20 per customer)

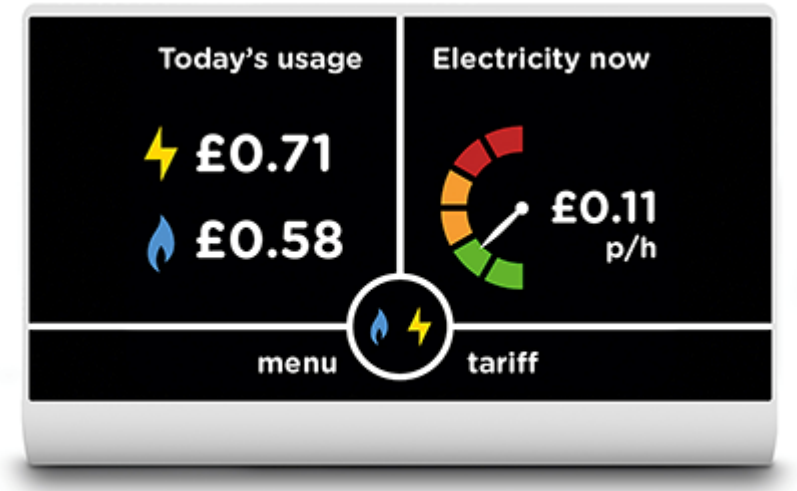
Getting on with it

- ‘Strategy for losses’ and ‘Losses Discretionary reward’ published
- Cable upsizing
- Low loss transformers
- Voltage reduction
- Understanding losses on customer side of meter
- Understanding feasibility of re-use of waste heat
- Training



Scoping the future

- Consultation on:
- Our Losses Strategy
- Our Losses Discretionary Reward Submission
- Ideas for Market based services for losses management
- Expert group forum in 2018



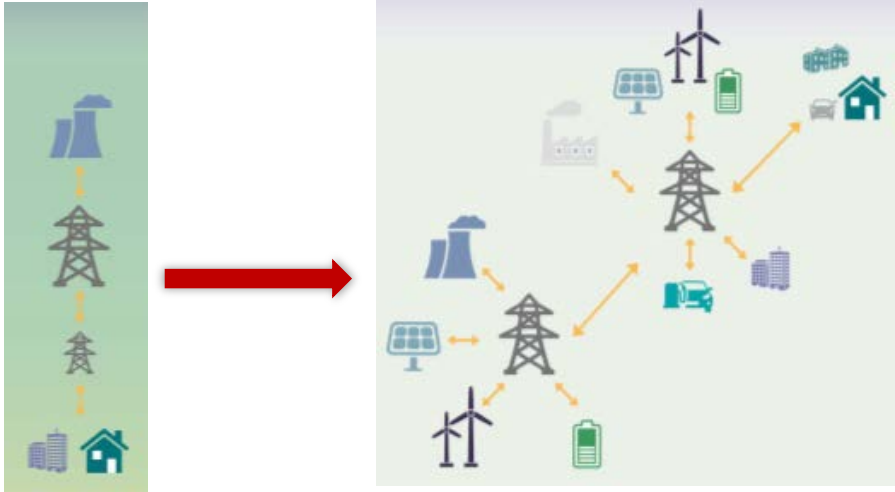
Distributed storage and solar study

Paris Hadjiodysseos

Smart Grid Development Engineer

Background

- Electricity generated centrally
- Networks were designed with a top-down approach in mind
- Distributed Generation has changed the power flow dynamics
- Think how to manage the network better!



Scoping the future

- 2015: 32 PVs (2.7kW - 3.68kW)
  - Connected 27
- 2016: 40 Batteries (2-3 kWh)
  - 31 with PVs
  - 9 on their own
- Can we turn these into green?
- Provide customers with cheaper electricity through time shifting

Getting on with it!

DS3 Project

- 3 year NIA funded community project focusing on social housing
- £300k - batteries, monitoring & data analysis

What's in it for customers

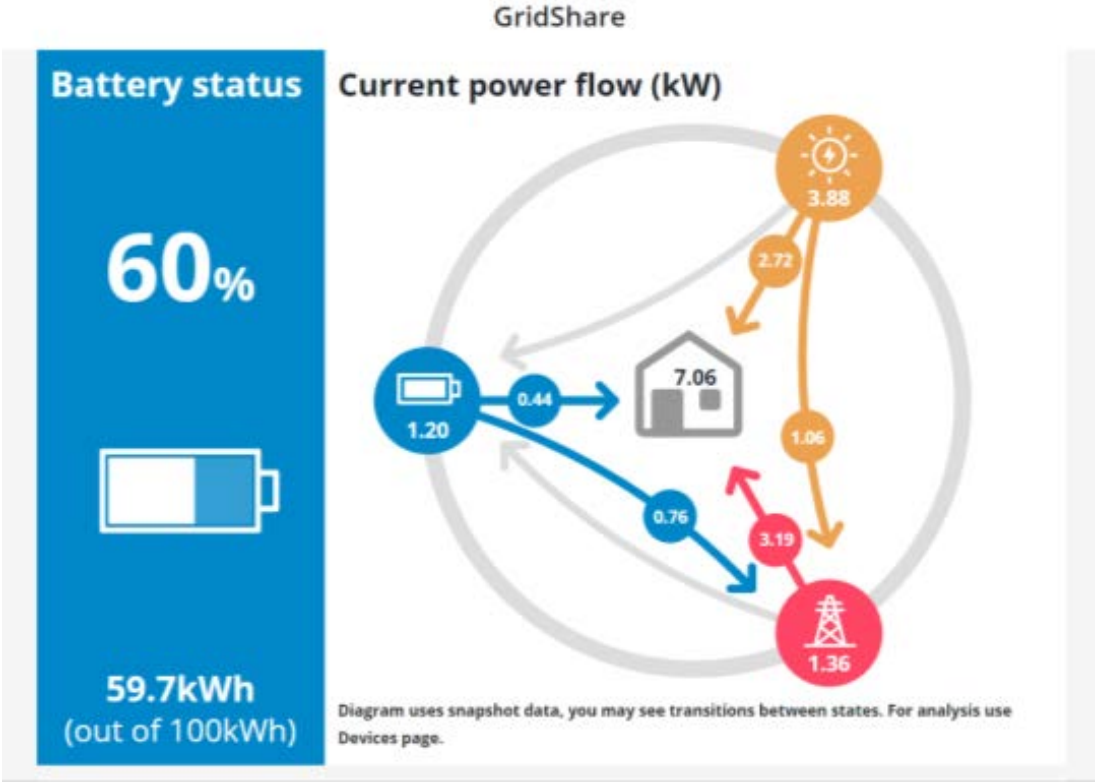
- Aims to reduce electricity bills
- Reduce reinforcement works

What's in it for Northern Powergrid

- 2030: 70-80% of rooftop PV installed with storage
- Understand impact of PV & Storage on network design
- Absorb excess generation & supply peak load

Building new capability

- Increase capacity
- Avoid reinforcement
- Dynamic control
- Behind the meter Vs network owned batteries
- Design Policies



Q&A

Patrick Erwin, Jim Cardwell, Iain Miller,
Liz Sidebotham, Paris Hadjiodysseos, and Phil Jagger

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Panel session and discussion

Jason Brogden – ENA

Chris Harris - RWE npower

Emma Bridge - CEE

Derek Lickorish – NEA

Mark Drye – NPg


TEAM POWERGRID
PROUD TO PLAY AN ESSENTIAL ROLE IN KEEPING THE POWER FLOWING TO ALL THE HOMES AND BUSINESSES WE SERVE
NORTHERN POWERGRID
MAKING EVERY CONTACT COUNT
DELIVERING A 10/10 SERVICE
FOR EVERY STAKE HOLDER WHOEVER THEY ARE
THROUGH OUR CUSTOMER PLEDGES
ACROSS OUR BUSINESS PRIORITIES AND SOCIAL
TEAM POWERGRID
NORTHERN POWERGRID
I PLEDGE TO...
NORTHERN POWERGRID

Event close and next steps

Patrick Erwin

Policy & Markets Director

Our DSO vision

- Transition is required to a ***customer-led*** actively managed (and probably semi-autonomous) network…
- …where we are providing a cost-efficient, non-discriminatory and technology neutral physical trading platform…
- …for third parties in our region to participate in the electricity markets.

DSO must provide a compelling value proposition for customers and stakeholders

Do you feel better informed about the issues influencing DSO?

1. Yes
2. Unsure
3. No

Do you agree with Northern Powergrid's DSO vision and direction of travel?

1. Yes
2. Unsure
3. No

Do you support Northern Powergrid's losses approach?

1. Yes
2. Unsure
3. No

Join the Customer-led discussion and debate

Today, we ask you to:

- ✓ **Join our DSO Community**
- ✓ **Register for our DSO Regional Event – 24 January 2018 - York**
- ✓ **Contribute to our Losses Consultation**
  - ✓ **Join our Losses Expert Group**
- ✓ **Register your interest in our stakeholder panel for a regular strategic discussion on Northern Powergrid performance, plans and priorities**
- ✓ **Help us to think through how we have meaningful discussion with our customers – via our feedback form**

Visit our innovation website and continue the debate:

www.northernpowergrid.com/innovation

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