The Voice of the Networks

Energy Networks Association

Heat Pumps – An Electricity Network Perspective

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November 2018

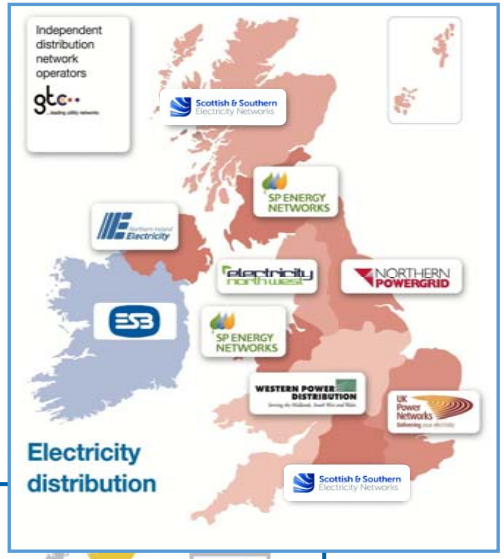
Agenda

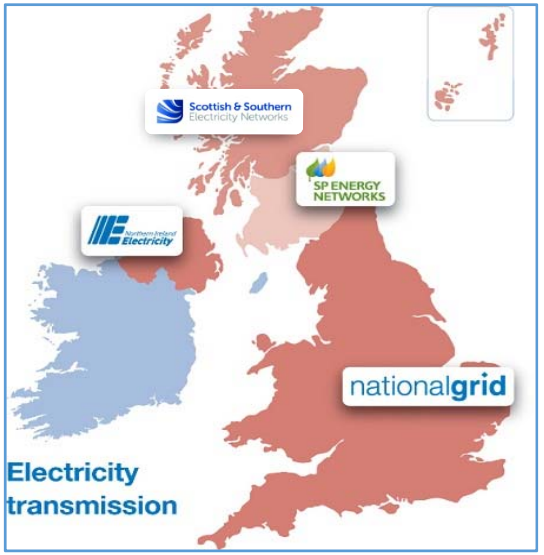
- Introduction to ENA
- Challenges to Networks & Policy Context
- Open Networks & Flexibility
- Heat Strategy
- Heat Pump Impacts on Networks
- Innovation Projects
- New HP Connection Process
- Next Steps
- Q&A

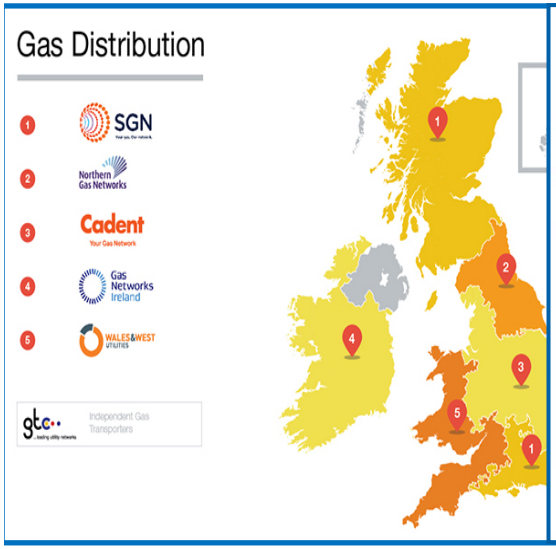
The Voice of the Networks

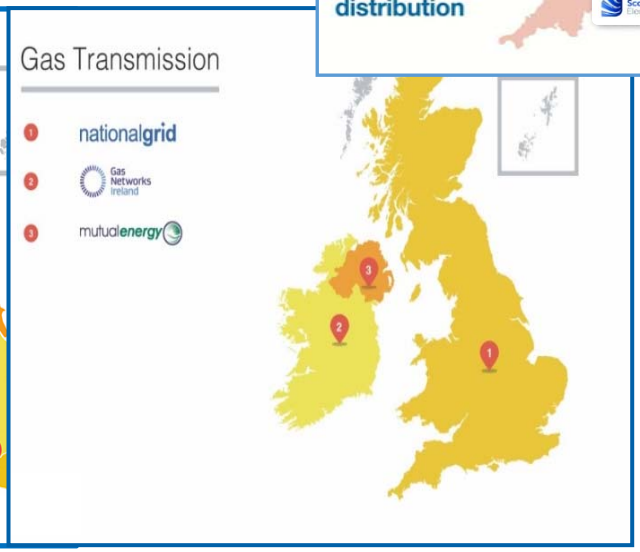
Introduction to ENA

- 29 million electricity customers
- 21.5 million gas customers





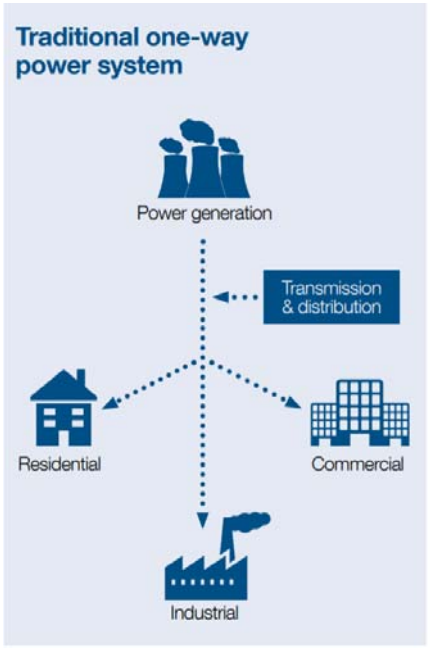


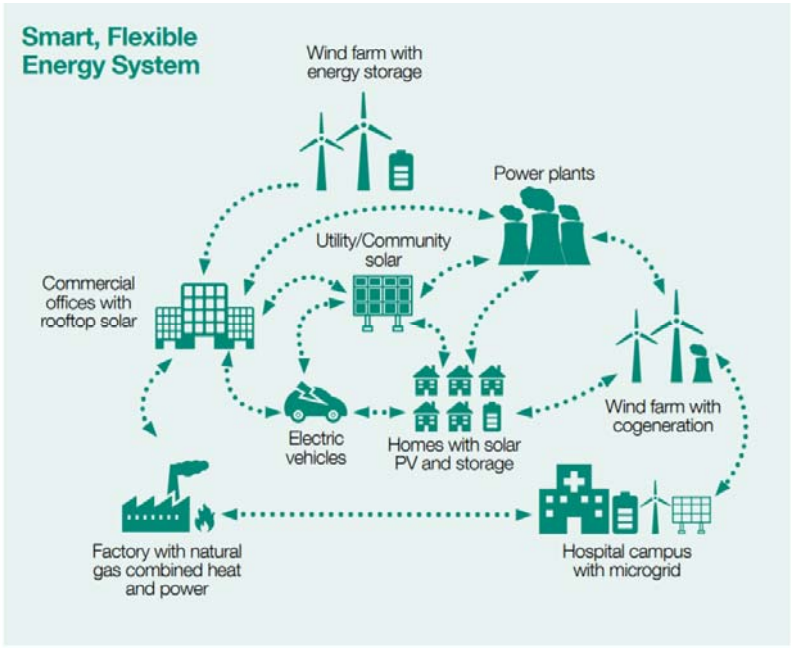


- 180,000 miles of gas network
- 519,304 miles of electricity network

Electricity Networks – The Challenge

- The Electricity Networks are facing unprecedented change as a result of decarbonisation, digitisation and decentralisation





Policy Context

- A number of European, National and Local Government policies are helping to drive this transition:
  - EU Decarbonisation targets (UK: 80% reduction in carbon emissions by 2050)
  - Clean Growth Plan
  - Clean Energy Package (EU)
  - Environmental Policies, for example clean air strategy
  - Road 2 Zero Transportation Strategy, including move to EVs and Hydrogen Transportation
  - Smart Meter Roll-out
  - Local Energy Plans
  - Reducing Customer Bills, including promoting faster switching
  - Industrial Strategy: Jobs and Growth
- Specifically on Smart Grids: Ofgem and BEIS Smart Systems and Flexibility Plan
  - Range of actions to deliver the smart, flexible energy system, including for Networks
  - Open Networks identified as key project to deliver the smart grid

Open Networks

ENA's Open Networks Project is a major energy industry initiative that will transform the way that both local Distribution Networks and national Transmission Networks will operate and work for customers.

The Open Networks Project will help customers connect and realise value; as well as reducing cost for consumers through more cost effective planning

The Open Networks Project is a key initiative to deliver Government policy set out in the Ofgem and BEIS Smart Systems and Flexibility Plan, the Government's Industrial Strategy and the Clean Growth Plan.

We are taking a 'learn-by-doing' approach; we are using innovation funding to trial and test aspects of the various future electricity system options.

The need for Flexibility

- In GB, approximately 30GW of DER is connected to the distribution networks
- In 2017, renewables accounted for approx. 30% of average generation in the UK
- Decarbonisation of heat and transportation is critical to the UK's carbon targets
- Electric vehicles & Heat Pumps are expected to significantly help with this decarbonisation
- In September 2018, there were approximately 178,000 plug-in EVs in the UK
- 22,000 Heat Pumps installed in 2017

The need for Flexibility (2)

- Open Networks is looking at the range of options for enabling Flexibility to help solve the congestion associated with these changes
- This includes transitioning to the DSO and enabling local Flexibility Markets
- At the top level demand that is flexible will be rewarded, demand that is not will be penalised. The Charging Futures Forum (CFF) is considering mechanisms and charging arrangements; lead by Ofgem
- Flexibility will have value to the local Prosumers through local balancing. The DSO will model and monitor for new congestion, manage that congestion and reinforce where required
- Whole system planning is fundamental, new organisations will be required to ensure the correct energy solution is provided in each area
- Join the mailing list to stay updated: opennetworks@energynetworks.org

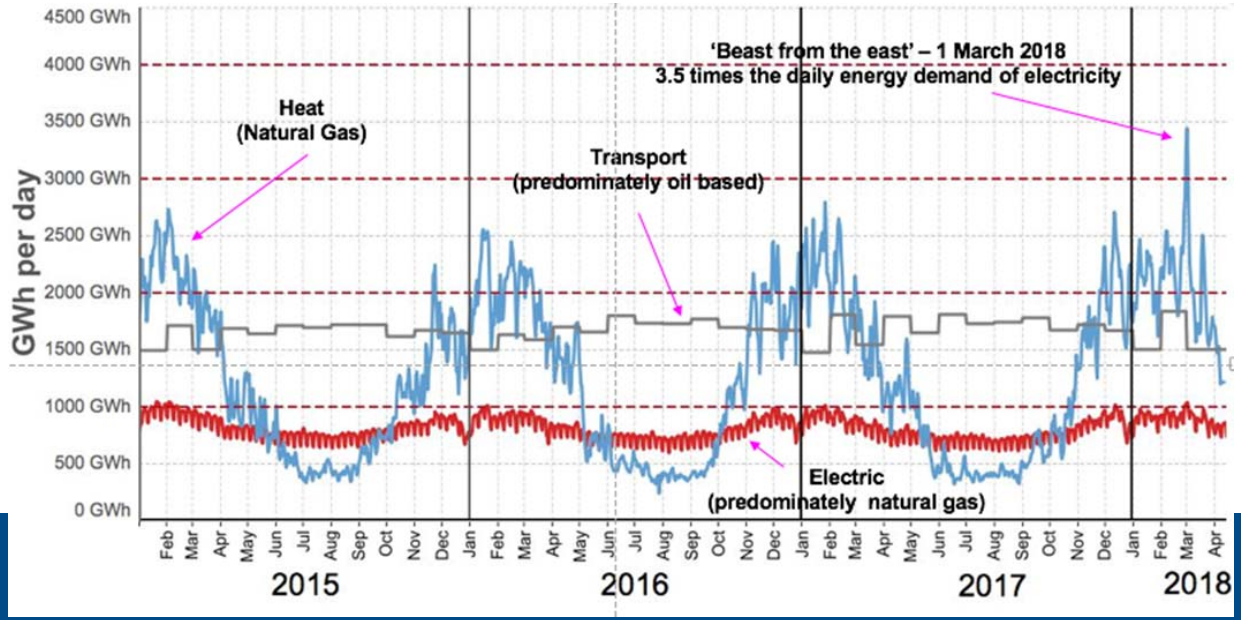
Heat Strategy

- We support the Heat Pump roll-out and want to prepare the networks to ensure they can safely and reliably meet the increase in electricity demand required to support Heat Pumps
- We are working with Ofgem to develop clear triggers, uncertainty mechanisms and incentives for appropriate investment ahead of need.
- Decarbonising heat is one of the biggest challenges facing the industry, and there is a lot of uncertainty over how to do it
- ENA understands the challenges of decarbonising heat given the large peak demand and seasonal storage requirements
- ENA supports a whole energy system approach, where a combination of green gas, electrification (eg: Heat Pumps) and hydrogen help towards decarbonisation
- Heat Pumps have an extremely important role to play, particularly initially with respect to new builds and off gas-grid connections

Heat Pumps - Impact on Networks

- There are two main challenges when integrating Heat Pumps into the Electricity Networks:

1. National/Transmission:
    - Integrating additional Heat Pump demand with new and existing demand coming from electrification of transportation is a significant challenge; additional generation will be required
    - The national demand peak will likely increase
    - Seasonal Storage



Heat Pumps - Impact on Networks (2)

2. Local/Distribution:

- The local demand profile on LV circuits is very different to the national demand profile
- Heat Pumps have a very different load curve to normal home appliances
- Distribution networks are designed assuming each house uses on average 1.5-2kW (ADMD)
- Immersion or ‘Boost’ Elements can significantly increases the local load
- Power quality

- We are undertaking modelling to understand the impacts of Heat Pumps and Electric Vehicles on Electricity Networks under different scenarios

Heat Pump Innovation

- We are taking a ‘learn by doing approach’ – we are already undertaking a range of developments that will benefit customers and reduce the cost of future network investment whilst maintaining secure supplies
- We are undertaking Innovation Projects to understand how to decarbonise heat and how Heat Pumps effect the networks:
  - FREEDOM Hybrid Heat Pumps
  - Off-gas grid solutions
  - 3 Phase Supplies
  - Network modelling, including effect of Electric Vehicles

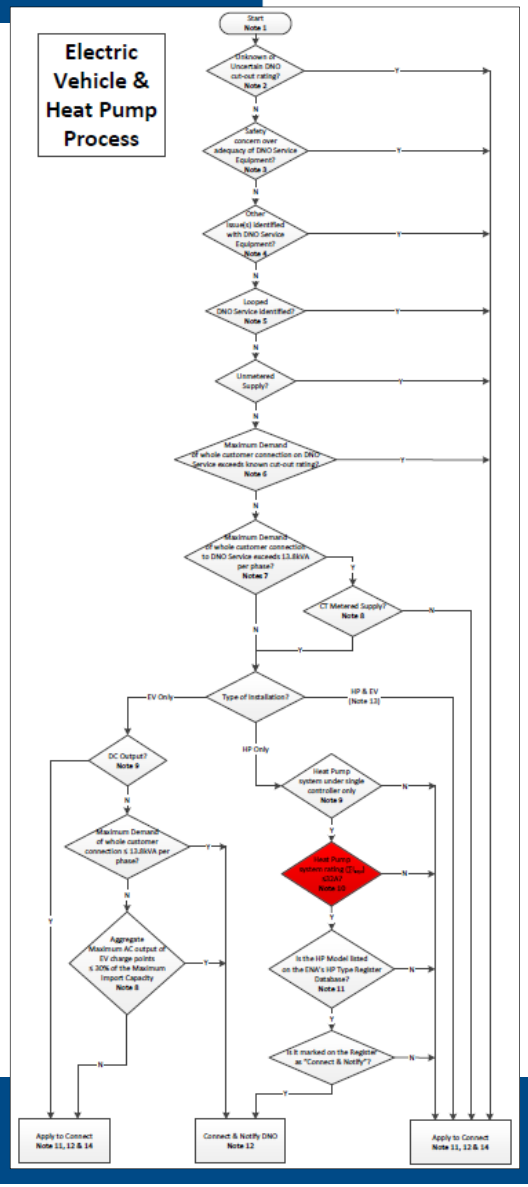
Heat Pump Connections

- It is essential DNOs have visibility of where the Heat Pumps are connected, to better understand the increased demand, as well as ensure the network is fit for purpose
- ENA has an existing notification process for connection of HPs to DNO networks; commonly known as ‘Form A, B and C’
- After consultation with our stakeholders, we made the decision to update this form and associated connection process for Heat Pumps
- Connection of Heat Pumps involve similar issues to that of Electric Vehicles, and hence in consultation with our stakeholders we have created a combined application form, and associated process, for connection of Heat Pumps and Electric Vehicles to DNO networks
- This will be the ‘entry point’ to the DNOs for connecting a HP or EV, regardless of size, type, location or voltage

Heat Pump Connections (2)

- The application form captures details such as:
  - Owner, location, MPAN, max demand, capacity, connection type, PQ details, etc
  - There will be a form for single installations, and a spreadsheet for multiple installations

- The process will help installers:
  - To identify when an installation is ‘Connect & Notify’ vs ‘Apply to Connect’
  - Understand the difference between commercial and residential connections
  - Understand safety implications



Heat Pump Connections Database

- We realise that some technical details for Heat Pumps are difficult to obtain, for example the Power Quality details:
  - As such Heat Pumps will have an online database associated with the process, which captures this data
  - We want to work with industry and its representative bodies (BEAMA, GSHP/HP Associations) to populate this database and ensure that it is kept up to date with new devices

	Heat Pump Ty	Phas	System Input Rating (A)	System Input Rating (kVA)	Module	Module Input Rating (A)	Module Input Rating (kVA)	CE Declaration of Conformity Document	Standards Cited on CE Declaration of Conformity: Harmonic Standards	Standards Cited on CE Declaration of Conformity: Voltage Fluctuation/ Flicker Standards
3	Air Source	1	21.30	4.90	Heat pump	8.79	1.90	1583.CE DoC_AE050JXYDEH_150603_Rev00.pdf	EN 61000-3-12	EN 61000-3-11
4										
5	Air Source	1	27.52	6.33	Heat pump	18.64	4.03	1584.CE DoC_AE090JXYDEH_150227_Rev00.pdf	EN 61000-3-12	EN 61000-3-11
6										
7	Air Source	1	34.65	7.97	Heat pump	22.99	4.97	1585.CE DoC_AE160JXYDEH_150227_Rev00.pdf	EN 61000-3-12	EN 61000-3-11
8										
9	Air Source	1	41.48	9.54	Heat pump	30.25	6.54	1585.CE DoC_AE160JXYDEH_150227_Rev00.pdf	EN 61000-3-12	EN 61000-3-11
10										
11	Air Source	1	44.30	10.19	Heat pump	33.26	7.19	1585.CE DoC_AE160JXYDEH_150227_Rev00.pdf	EN 61000-3-12	EN 61000-3-11
12										
13	Air Source	1	53.35	12.27	Heat pump	29.00	6.27	023508,WH-MXC12G6E5,WH-MXC09G3E5,MRD-D14008-01,DoC.PD	EN 61000-3-12	EN 61000-3-11
14	Air Source	1	53.35	12.27	Back-up heater	26.09	6.00	023508,WH-MXC12G6E5,WH-MXC09G3E5,MRD-D14008-01,DoC.PD	EN 61000-3-12	EN 61000-3-11
15										
16	Air Source	1	53.35	12.27	Heat pump	29.00	6.27	023508,WH-MXC12G6E5,WH-MXC09G3E5,MRD-D14008-01,DoC.PD	EN 61000-3-12	EN 61000-3-11
17	Air Source	1	53.35	12.27	Back-up heater	26.09	6.00	023508,WH-MXC12G6E5,WH-MXC09G3E5,MRD-D14008-01,DoC.PD	EN 61000-3-12	EN 61000-3-11
18										
19	Air Source	1	42	9.96	Whole system	42.00	9.96			
20										
21	Air Source	1	55	12.65	Whole system	55.00	12.65			
22										
23	Air Source	1	64	14.52	Heat pump	25.00	5.52			
24	Air Source	1	64	14.52	Back-up heater	26.00	6.00			
25	Air Source	1	64	14.52	Boost heater	13.00	3.00			
26										
27										
28										

	EMC Test Report Document	For Connection Design Purposes, Cu: Class A limits of IEC 61000-3-2?	For Connection Design Purposes, Cu: Technical Requirements of IEC 61000-3-3?	Unconditional Connection?	Manufacturer's Documentation	Manufacturer's Documentation Declaration: In accordance with EN 61000-3-12	S_{sc} min 3-phase	S_{sc} min single-phase	In accordance with EN 61000-3-11	Zmax (Ω)
3	EMC test report 5kW CEC2014-0235_성적서.pdf	Yes	Yes	Yes		Equipment complying with IEC 61000-3-12			Equipment complying with IEC 61000-3-3 technical requirements	
4										
5	CEC2014-0236-TEST.PDF	No	Yes	No		Equipment complying with IEC 61000-3-12			Equipment complying with IEC 61000-3-3 technical requirements	
6										
7	EMC test report 12 14 16 kW CEC2014-0237_성적서.pdf	No	Yes	No		Equipment complying with IEC 61000-3-12			Equipment complying with IEC 61000-3-3 technical requirements	
8										
9	EMC test report 12 14 16 kW CEC2014-0237_성적서.pdf	No	Yes	No		Equipment complying with IEC 61000-3-12			Equipment complying with IEC 61000-3-3 technical requirements	
10										
11	EMC test report 12 14 16 kW CEC2014-0237_성적서.pdf	No	Yes	No		Equipment complying with IEC 61000-3-12			Equipment complying with IEC 61000-3-3 technical requirements	
12										
13	WH-MXC12G6E5,WH-MXC09G3E5,TUEV,18005177_001,EMC-report.pdf	No	Yes	No		Equipment complying with IEC 61000-3-12 subject to minimum short-circuit power	1700	567	Equipment complying with IEC 61000-3-3 technical requirements	
14	WH-MXC12G6E5,WH-MXC09G3E5,TUEV,18005177_001,EMC-report.pdf	Yes	No	No		Equipment complying with IEC 61000-3-12			Requires Zsource≤Zmax	0.207
15										
16	WH-MXC12G6E5,WH-MXC09G3E5,TUEV,18005177_001,EMC-report.pdf	No	Yes	No		Equipment complying with IEC 61000-3-12 subject to minimum short-circuit power	1250	417	Equipment complying with IEC 61000-3-3 technical requirements	
17	WH-MXC12G6E5,WH-MXC09G3E5,TUEV,18005177_001,EMC-report.pdf	Yes	No	No		Equipment complying with IEC 61000-3-12			Requires Zsource≤Zmax	0.207
18										
19					EEDEN09-720 - 03/2009	Equipment complying with IEC 61000-3-12			Requires Zsource≤Zmax	0.29
20										
21					EEDEN09-720 - 03/2009	Equipment complying with IEC 61000-3-12			Requires Zsource≤Zmax	0.17
22										
23						Equipment complying with IEC 61000-3-12 subject to minimum short-circuit power	85[illegible]		Equipment complying with IEC 61000-3-3 technical requirements	
24						Equipment complying with IEC 61000-3-12			Requires Zsource≤Zmax	0.236
25						Equipment complying with IEC 61000-3-12			Requires Service Current Capacity≥100A per phase	0.464
26										
27										
28										

HP Connections – Next Steps

- We will ‘soft launch’ shortly with a cross-over period of 2-3 months
- The launch will coincide with a ‘road show’ in the UK. Installers will be invited to attend, to learn about the new process as well as discuss issues that have arisen with the installation process
- The next steps will be to create a digital interface (eg: a web-app and/or API), whereby installers can digitally submit the required information, rather than the manual forms
- The database will initially be a spreadsheet, but we want to turn it into a digital database that manufacturers can log into, similarly to the G59 equipment database
- Through the ENA Service Terminations Issues Group (STIG) we are working to solve some of the issues around access and upgrade of DNO and Meter Equipment

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Thank You – Any Questions?

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