Learning dissemination event

13 October 2015

LCN Fund
Low Carbon Networks

electricity north west
Bringing energy to your door

Steve Cox

Head of Engineering

LCN Fund
Low Carbon Networks

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Housekeeping

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Mobile phones	Breaks	Fire alarms	Main Q&A at end of day

Agenda

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SMART STREET

Introduction and overview

Technical update

Trial design

Customer engagement

Introducing Electricity North West

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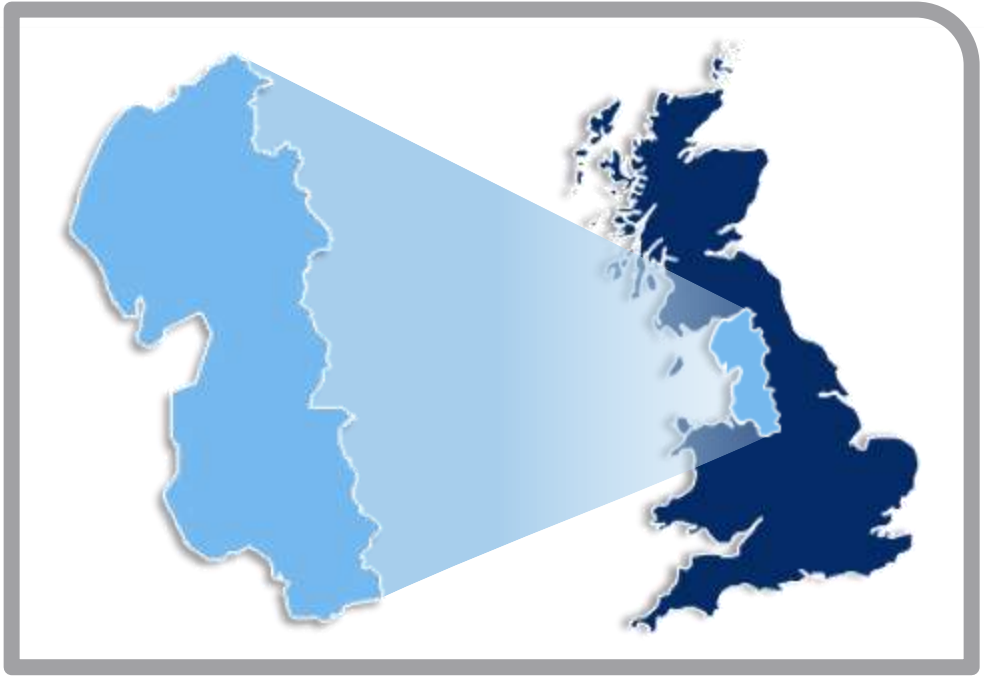
4.9 million

2.4 million

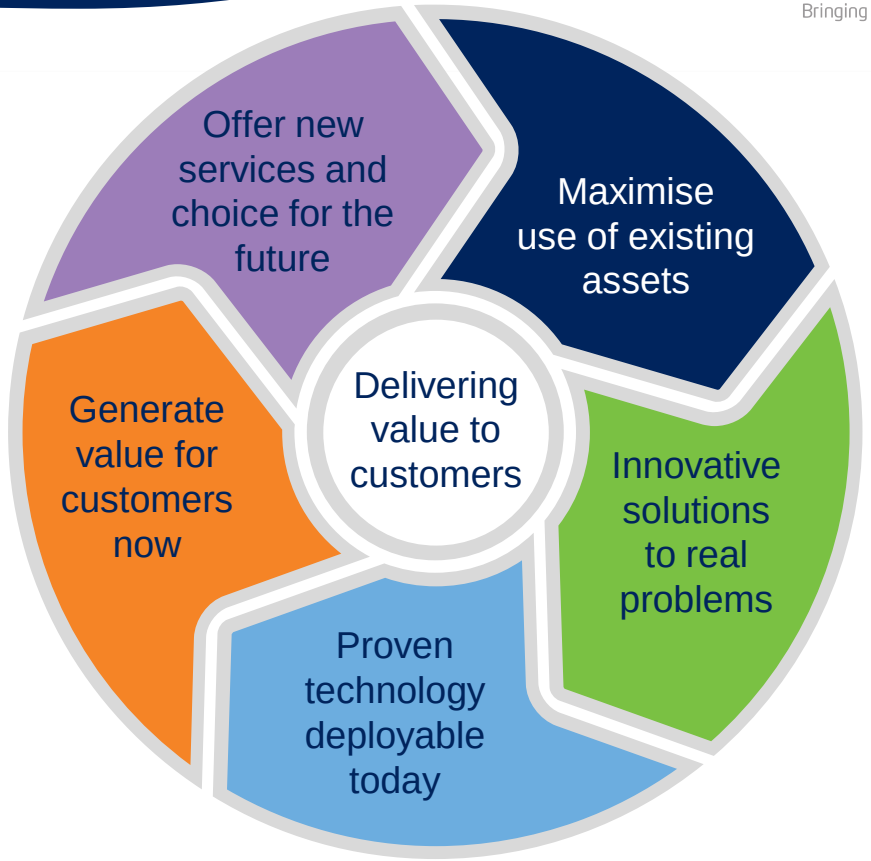
25 terawatt hours



£12 billion of network assets

56 000 km of network ● 96 bulk supply substations
363 primary substations ● 33 000 transformers

Our innovation strategy



Our smart grid development

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Leading work on developing smart solutions

Deliver value from existing assets

Customer choice

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Four flagship products (second tier) £36 million

C2C
Capacity to Customers

CLASS

SMART STREET

RESPOND

Kevin Hoban

Smart Street Project Manager

LCN Fund
Low Carbon Networks

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Smart Street project overview

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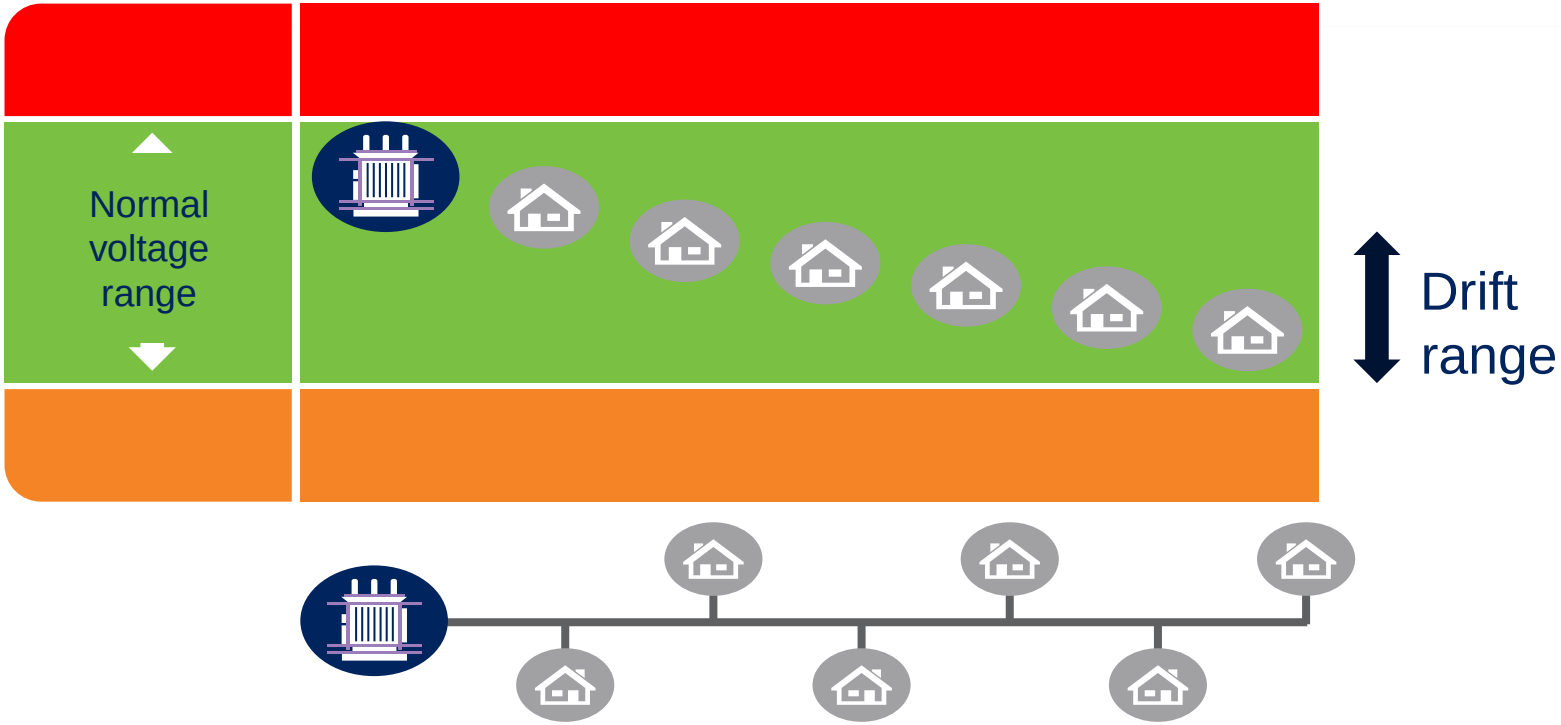
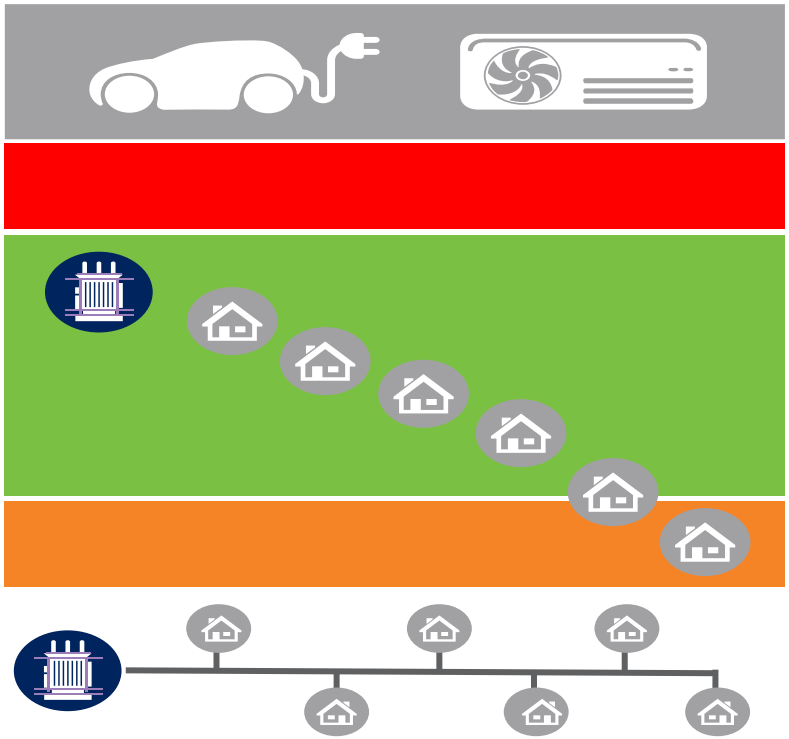
£11.5m, 4 year innovation project	Started in Jan 2014 and finishes in Apr 2018	Facilitates quicker cheaper connection of domestic LCTs	Trials period Jan 2016 – Dec 2017	Extensive customer engagement programme throughout project

Voltage profile

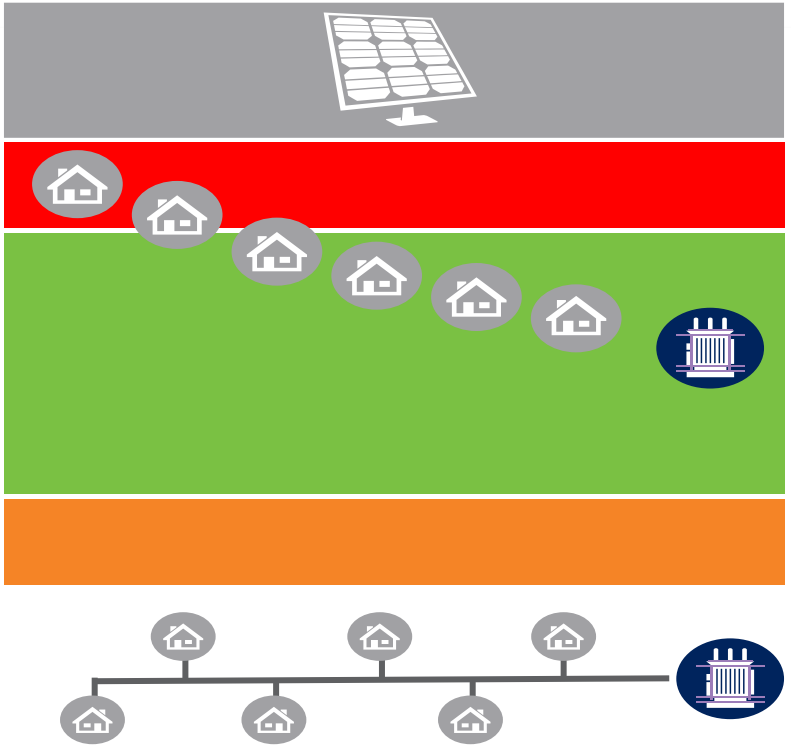


Historic networks have no active voltage regulation

Problem - LCTs create network issues

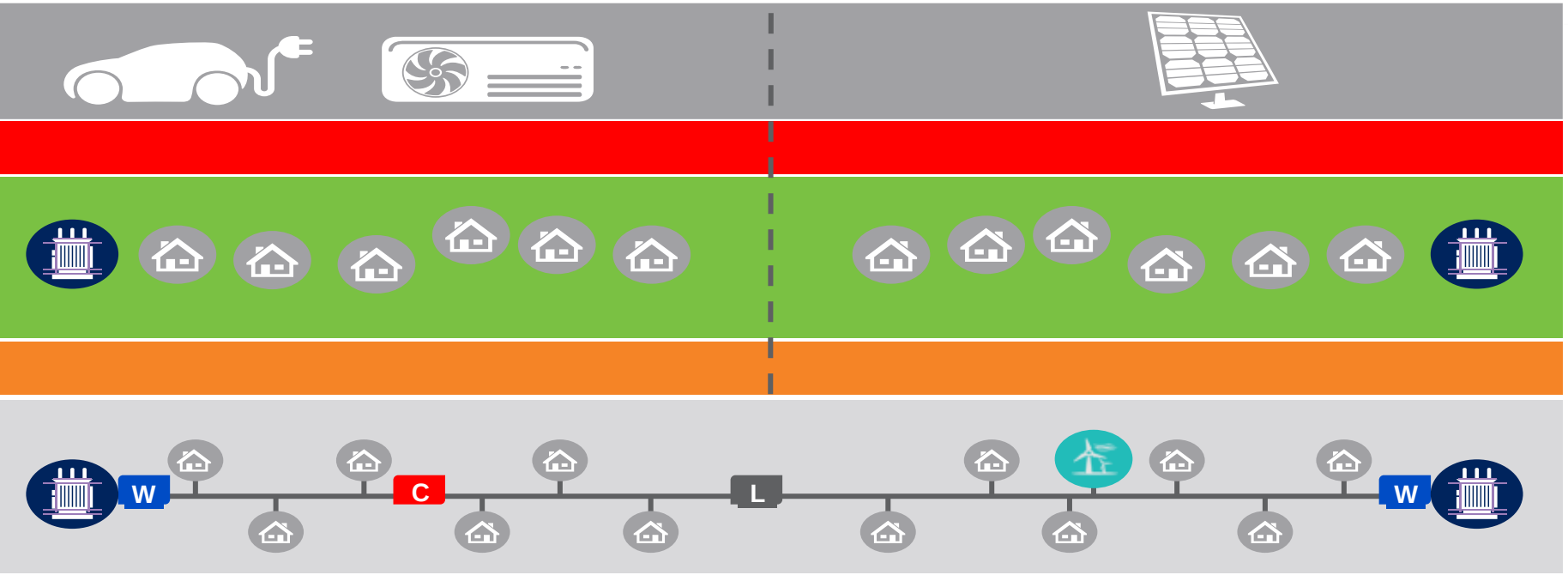


Drift range



LCTs rapidly surpass voltage and thermal network capacity

Smart Street – the first intervention



Low cost ● Quick fit ● Minimal disruption ● Low carbon ● Low loss ● Invisible to customers

Voltage stabilised across the load range ● Power flows optimised

Smart Street benefits

Now we can stabilise voltage
We can set the voltage level lower
This will lead to:

- Reduced demand
- Reduced customer energy consumption
- Maximised DG output

How much could customers save?		GB
Reinforcement savings via DUoS	£330 over 25 years	£8.6b over 25 years
Reduced energy consumption, 2013 (from CVR ≈ 3 - 7%)	£15 - £30 pa	£390 - £780m pa
Maximise DG output (from maximising Feed In Tariff income)	£70 pa	£20m pa

Efficient network solutions ● Energy savings ● Carbon benefits

Smart Street trial areas

6 primary substations
11 HV circuits

38 distribution substations
163 LV circuits

Around 62,000 customers

3 selected primary substations in CLASS

Project partners

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KELVATEK

SIEMENS

TyndallManchester
Climate Change Research

tnei
enterprise with energy

MANCHESTER 1824
The University of Manchester

Queen's University Belfast

Impact Research

Damien Coyle

Smart Street Technology Engineer

LCN Fund
Low Carbon Networks

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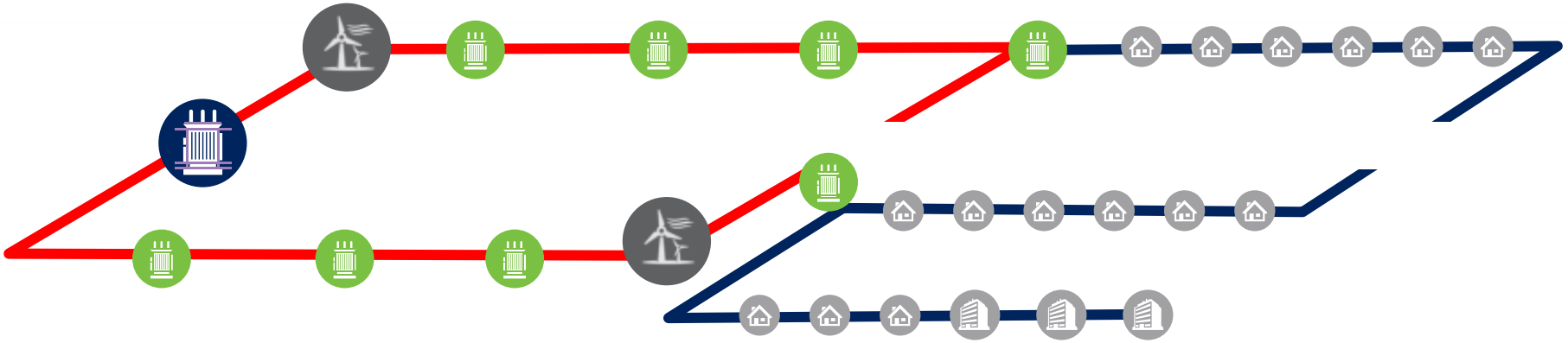
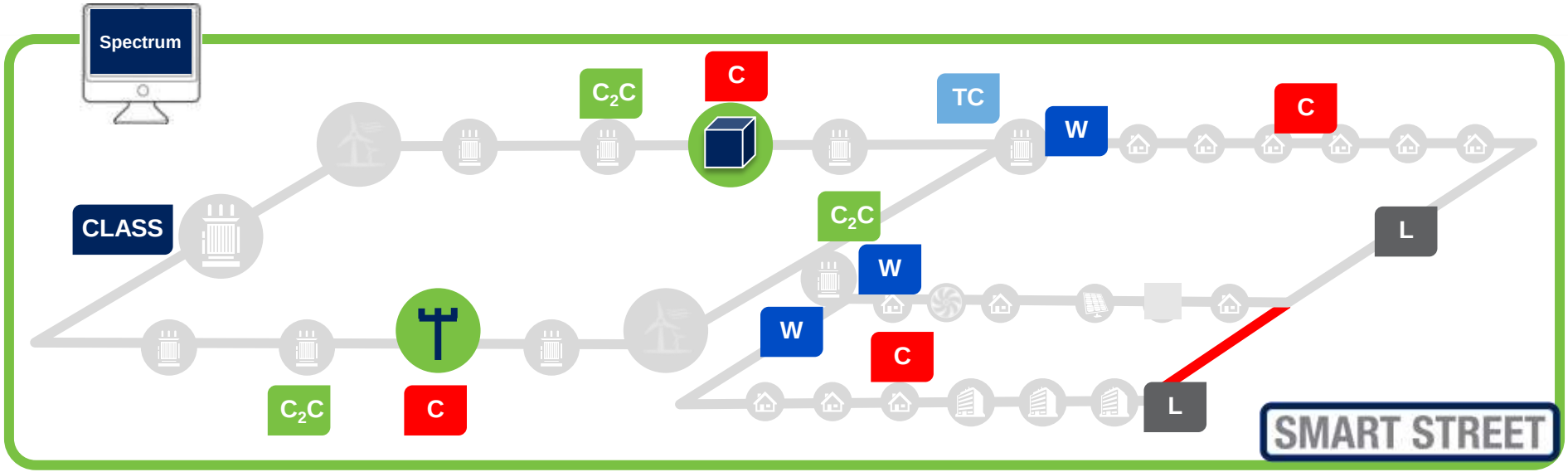
Existing radial network



Network limitations	Customer impact
Diversity between feeders is untapped	Customers' needs invisible to the network
Fuses unable to cope with cold load pick up	Demand and generation levels limited by passive voltage control systems
	Reliability driven by fix on fail

Network reliability improvement



C2C Capacity to Customers

C Capacitor

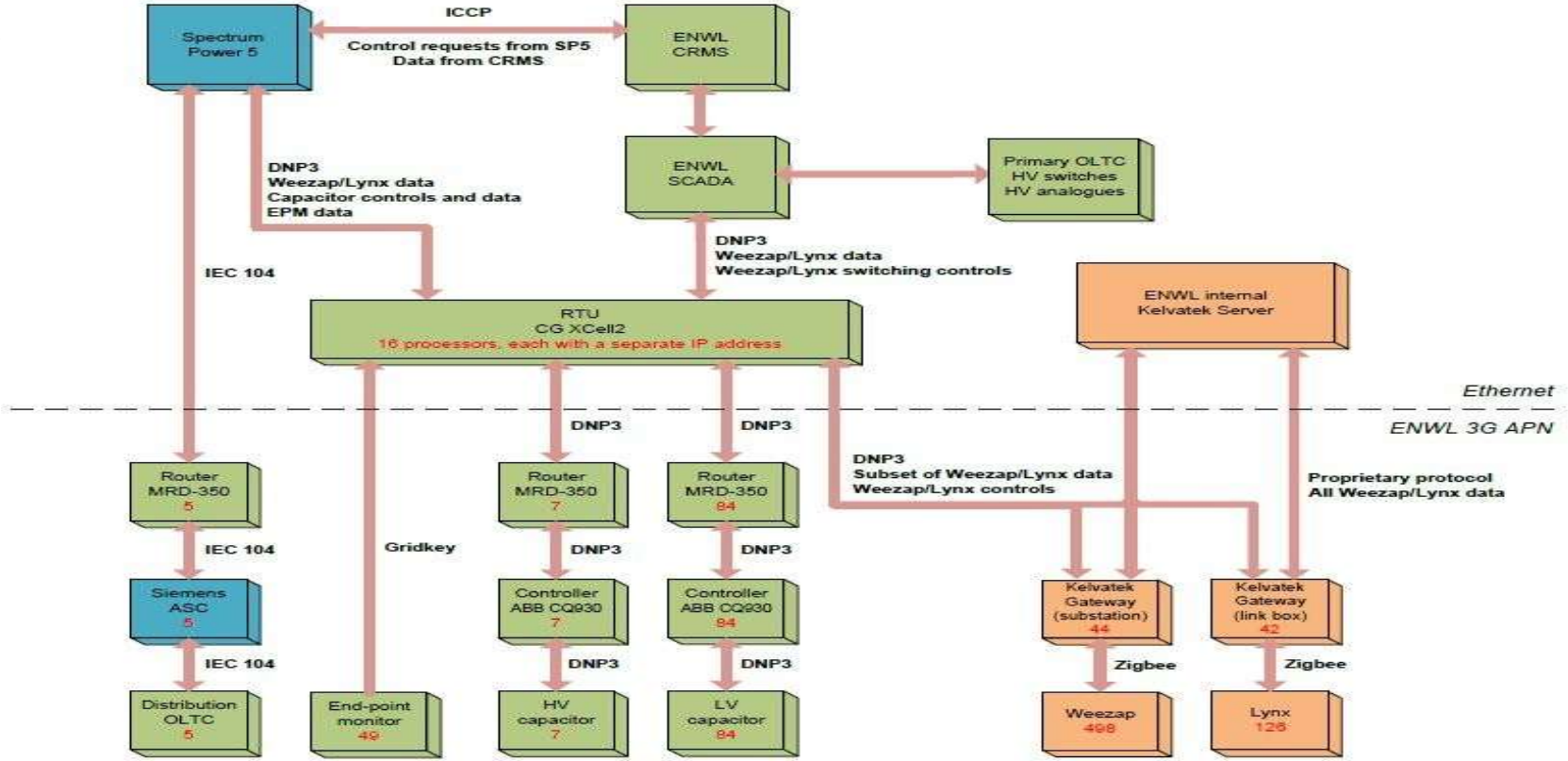
W WEEZAP

L LYNX

TC On-load tap changer

Builds on C_2C and CLASS ● Storage compatible ● Transferable solutions

System architecture



Distribution voltage regulated transformer

5 OLTCs

9 taps

Local or remote

HV capacitors

3 ground mounted HV capacitors	3 pole mounted HV capacitors
Secured within GRP housings in urban areas	Installed similar to pole mounted transformers

What customers will see – LV capacitors in street furniture

84 LV capacitors

One on each closed ring

Multi staged

WEEZAP

World leading LV vacuum circuit breaker

Advanced measurement and protection capability

Safe LV interconnection, live monitoring and control

Improves supply reliability and restoration through fault management and detection

LYNX

KELVATEK

LV switch

Allows active network meshing and un-meshing

Advanced monitoring capabilities

Ability to control the circuit locally or remotely

Technology – Spectrum

Measures, optimises and responds

CVR and losses benefits unlocked

Oversees network and customer needs

Builds on CLASS smart voltage control

Technology – monitoring

Gridkey monitoring device

Measures voltage at LV cable end

Data storage one minute intervals

Technology overview

84 LV capacitors installed

43 Lynx systems
498 Weezaps

50 end-point controllers installed

Spectrum 5 installed on network

Next steps → Commission system → Briefing and training → Go live!

Dan Harber

Trials & Research Engineer

LCN Fund
Low Carbon Networks

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Agenda

Trial network overview

Test regimes

Proposed test schedule

Research overview

Smart Street site selection

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Stage 1		Stage 2		Stage 3	
Initial circuit screening		Circuit classification		Circuit simulation and refined circuit selection	
Use of existing CLASS and C_2C assets	Avoided areas scheduled for asset replacement works	Circuit types & customer types Low carbon technology uptake	Physical & electrical constraints LV inter-connection	HV network modelling in IPSA / DINIS	Identification of any thermal, voltage or fault level issues

Smart Street site selection

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Stage 4				Stage 5	
Network design methodology				Final site selection	
Detailed combined HV & LV network modelling	Applied a range of meshing scenarios	Varied capacitor sizes and locations Altered transformer tap settings	Modified the demand profile Developed rules based methodology based on results	Final circuits selected	Rules based design methodology applied

Trial overview

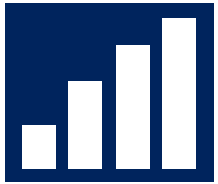
6 primary substations
62,000 customers
11 HV circuits – 5 closable HV rings

3 pole mounted HV capacitors
3 ground mounted HV capacitors

38 distribution substations
5 OLTC transformers

5 substation capacitors
79 LV circuit capacitors

Trial design

	Two years Two weeks on, two weeks off
	One year's worth of Smart Street data
	To be designed to avoid placebo affect
	Five trial regimes to test full effects

Five trial techniques
LV voltage control
LV network management and interconnection
HV voltage control
HV network management and interconnection
Network configuration and voltage optimisation

Test regimes

Smart Street trial	Test regime
LV voltage control	1. On-load tap changing distribution transformer only
	2. On-load tap changing distribution transformer and capacitor(s) on LV circuits
	3. Capacitors at distribution substation only
	4. Capacitors at distribution substation and on LV circuits
	5. Capacitor(s) on LV circuits only
LV network management & interconnection	1. LV radial circuits
	2. LV interconnected circuits
HV voltage control	1. Voltage controllers at primary substation only
	2. Voltage controllers at primary substation and capacitor(s) on HV circuits
HV network management & interconnection	1. HV radial circuits
	2. HV interconnected circuits
Network configuration & voltage optimisation	1. Losses reduction
	2. Energy consumption reduction

Proposed test schedule

	TRIAL 1 - LV VOLTAGE CONTROL	TRIAL 2 – LV INTERCONNECTION	TRIAL 3 - HV VOLTAGE CONTROL	TRIAL 4 - HV INTERCONNECTION
WEEK 1	OFF	OFF	OFF	OFF
WEEK 2	OFF	OFF	OFF	OFF
WEEK 3	EQUIPMENT TESTED IN ISOLATION	ON	EQUIPMENT TESTED IN ISOLATION	ON
WEEK 4	COMBINED TESTING	ON	COMBINED TESTING	ON
WEEK 5	OFF	OFF	OFF	OFF
WEEK 6	OFF	OFF	OFF	OFF
WEEK 7	EQUIPMENT TESTED IN ISOLATION	ON	COMBINED TESTING	ON
WEEK 8	COMBINED TESTING	ON	EQUIPMENT TESTED IN ISOLATION	ON

Trial 5: The optimisation will be applied during the trial on periods where week 4 allows for full optimisation

Overview of research workstream

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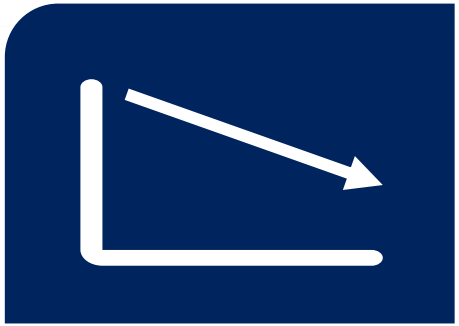
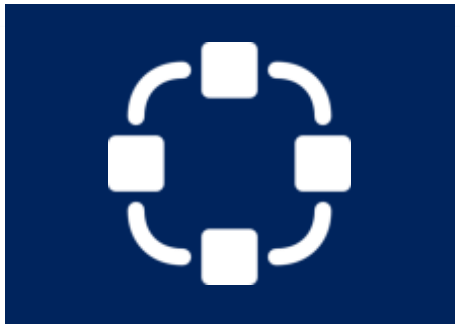


WP1 will look to quantify the voltage optimisation and loss reduction techniques used in Smart Street



WP2 will look to produce the design and operation policies required to convert UK networks into optimal meshed configurations

WP3 will research the cost benefits and carbon impact related to the Smart Street solution

TNEI will provide research support and consultation for the duration of the trials

MANCHESTER 1824

Queen's University Belfast

TyndallManchester
Climate Change Research

tnei
enterprise with energy

Customer engagement

Kate Quigley
Susie Smyth

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Customer impact and objectives

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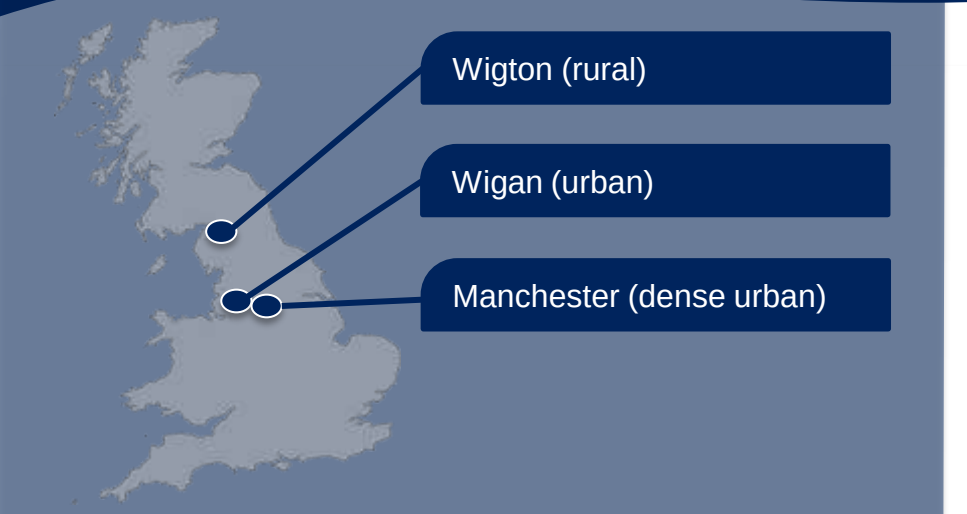
Pre-trial		During/post-trial	
			
Customers have seen increased activity while equipment is installed	Occasional planned supply interruptions due to equipment installation	Higher number of faults of shorter duration during trial period	Possible change in voltage
Objective: To engage with customers and explain impact of Smart Street trial		Objective: To prove that customers will not perceive a change to their electricity supply	

Customer research methodology

"Customers in the trial area will not perceive any changes in their electricity supply when the Smart Street method is applied"

Potential customer impacts	Installation of street cabinets A relatively higher number of faults of a shorter duration Planned supply interruptions due to equipment installation Possible change in voltage

Engaged customer panel methodology



- Wigton (rural)
- Wigan (urban)
- Manchester (dense urban)

Cross section of customers

Two meetings x three areas = 6 focus groups (to date)

30 customers recruited across 3 groups

ECP recommendations

Should we communicate with customers on trial circuits?	Yes
Why should we do so?	Important public information about our customers' electricity supply
What format should the leaflet take?	A simply worded leaflet
What should it say?	Our role as DNO, benefits of Smart Street, priority service register, contact details
When should it be delivered?	Delivered before start of equipment installation in September 2014
To whom should it be delivered?	All customers on trial circuits

ECP recommendations

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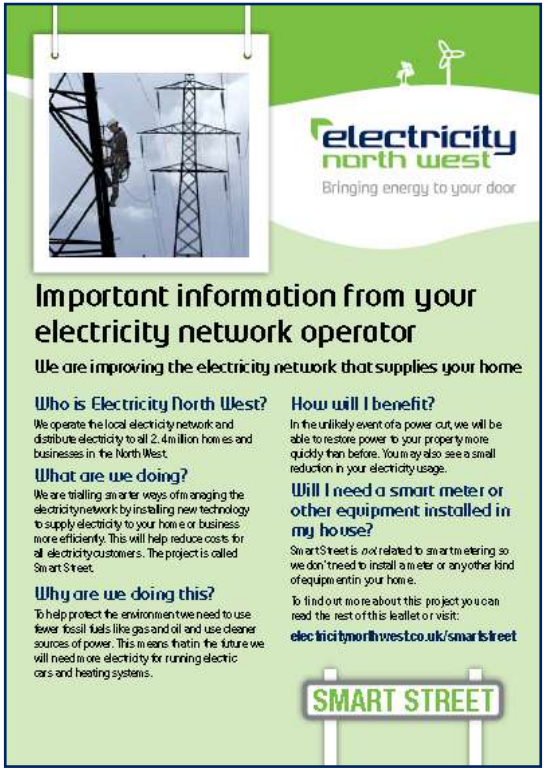

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Important information from your electricity network operator

We are improving the electricity network that supplies your home

Who is Electricity North West?

We operate the local electricity network and distribute electricity to all 2.4 million homes and businesses in the North West.

What are we doing?

We are trialling smarter ways of managing the electricity network by installing new technology to supply electricity to your home or business more efficiently. This will help reduce costs for all electricity customers. The project is called Smart Street.

Why are we doing this?

To help protect the environment we need to use fewer fossil fuels like gas and oil and use cleaner sources of power. This means that in the future we will need more electricity for running electric cars and heating systems.

How will I benefit?

In the unlikely event of a power cut, we will be able to restore power to your property more quickly than before. You may also see a small reduction in your electricity usage.

Will I need a smart meter or other equipment installed in my house?

Smart Street is *not* related to smart metering so we don't need to install a meter or any other kind of equipment in your home.

To find out more about this project you can read the rest of this leaflet or visit:

electricitynorthwest.co.uk/smartstreet

SMART STREET

ECP lessons learned

- Leaflet must look official to differentiate from junk mail
- Focus on customer benefits not company's or regulatory
- Most appealing benefit to customers is cost-saving on bill
- Customers sceptical of cost-saving promises unless they are quantified
- Info should be simple, positive & informative with summary at the start
- "What to do in a power cut" info considered negative and irrelevant
- Don't have pre-conceived ideas about customer information preferences

Progress and next steps

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Customer engagement plan submitted to Ofgem and approved

Go live of the Smart Street website and social media forums

Engaged customer panels held and lessons learned published

Customer leaflet designed and distributed to customers on trial circuits

Customers affected by new street furniture installations notified

Technology installation enquiries / complaints resolved

Customer Contact Centre briefed before trial go live

Successful technical installation as a result of well planned customer engagement activities

Next steps

Engagement with vulnerable customers

Further ECPs to gauge customer perception & acceptability of trials

Produce report of customer research findings

Ongoing engagement with customers during trial

Steve Cox

Head of Engineering

LCN Fund
Low Carbon Networks

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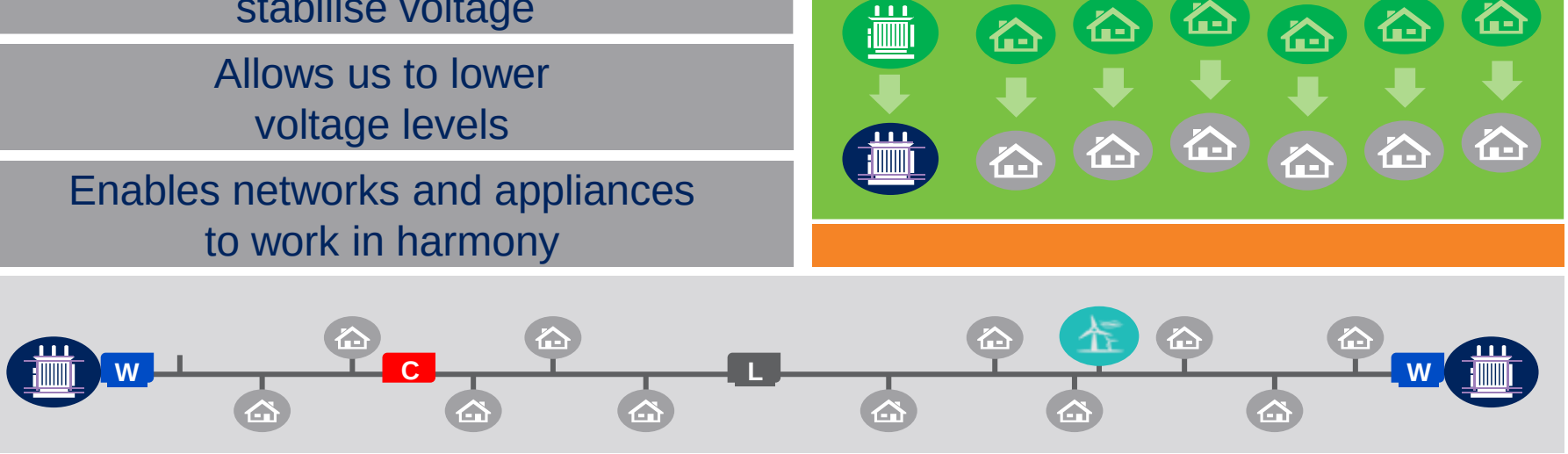
Smart Street overview

New controllable switching devices stabilise voltage

Allows us to lower voltage levels

Enables networks and appliances to work in harmony



Low cost ● Quick fit ● Minimal disruption ● Low carbon ● Low loss ● Invisible to customers ● Faster connection of low carbon technologies

Smart Street summary

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- Faster LCT adoption
- Less embedded carbon
- Re-usable technology
- Optimise energy and losses

Carbon Footprint

Low Risk

- First example of CVR
- First example of centrally controlled LV network
- Range of intervention solutions

SMART STREET

- Combine into one end-to-end system
- Network optimisation

Challenge

Benefit

- Lower energy bills
- More reliable supply
- Reinforcement savings

Next steps

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Dec 2015	Jan 2016	Jan 2018	Apr 2018
System commission	Start of trials	ECP and customer research	Project closedown
Integrate and optimise Smart Street system on network	Trials will run for 2 years in conjunction with research deliverables	Qualitative research with customers on trial circuits	Project findings and final dissemination event for all stakeholders

Knowledge sharing and dissemination

QUESTIONS & ANSWERS

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