electricity north west

Bringing energy to your door

SMART STREET

IET Retired Professional Group (M&WC Branch)

Thursday 13th April 2017

Stay connected...

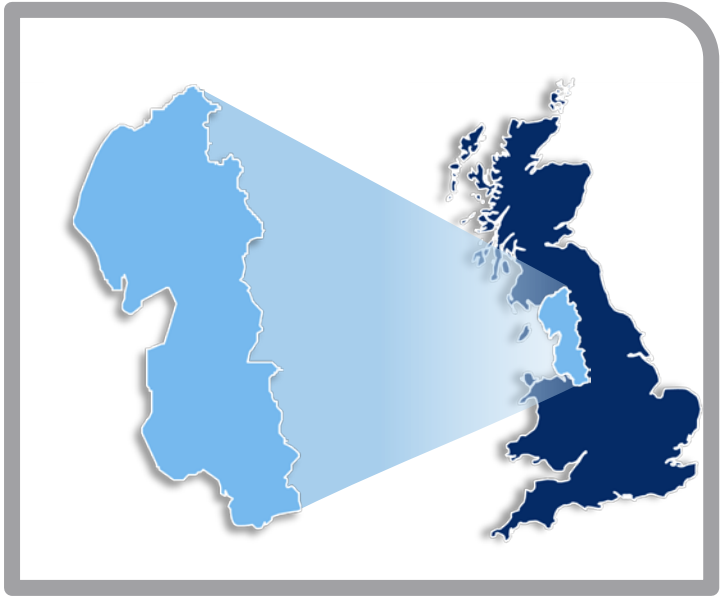
www.enwl.co.uk

Introducing ENW

4.9 million

2.4 million

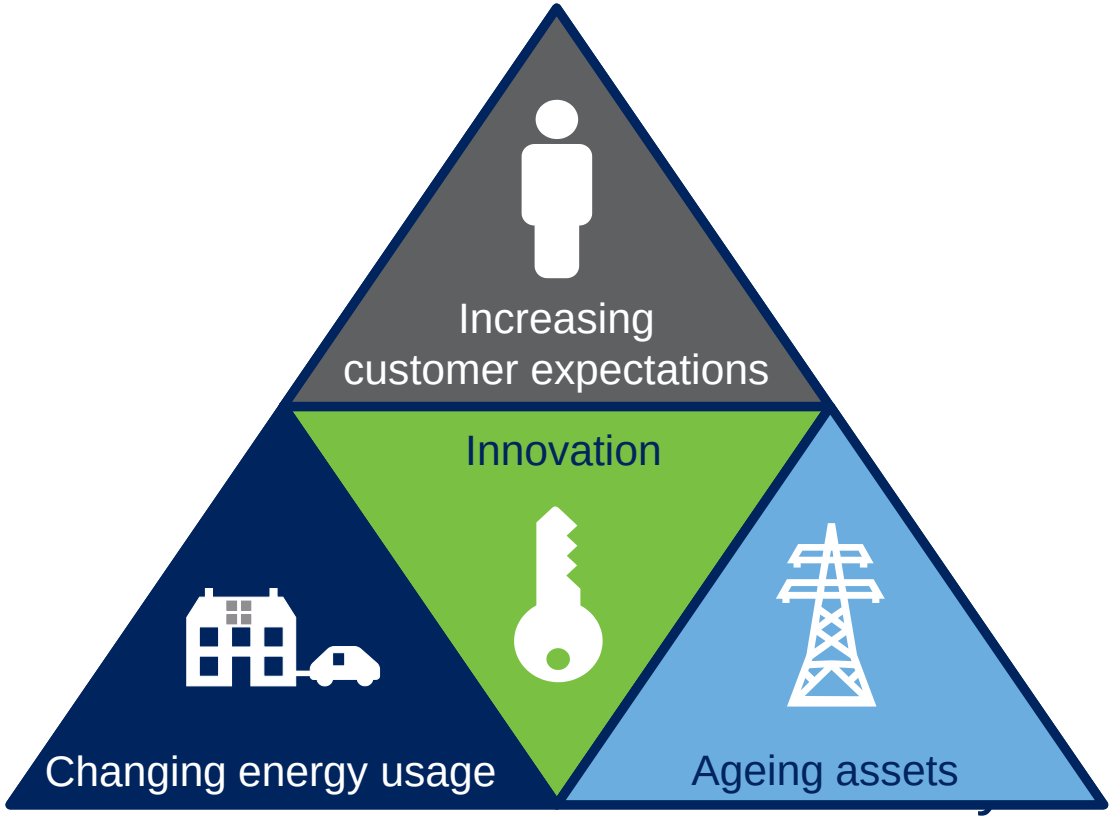
25 terawatt hours



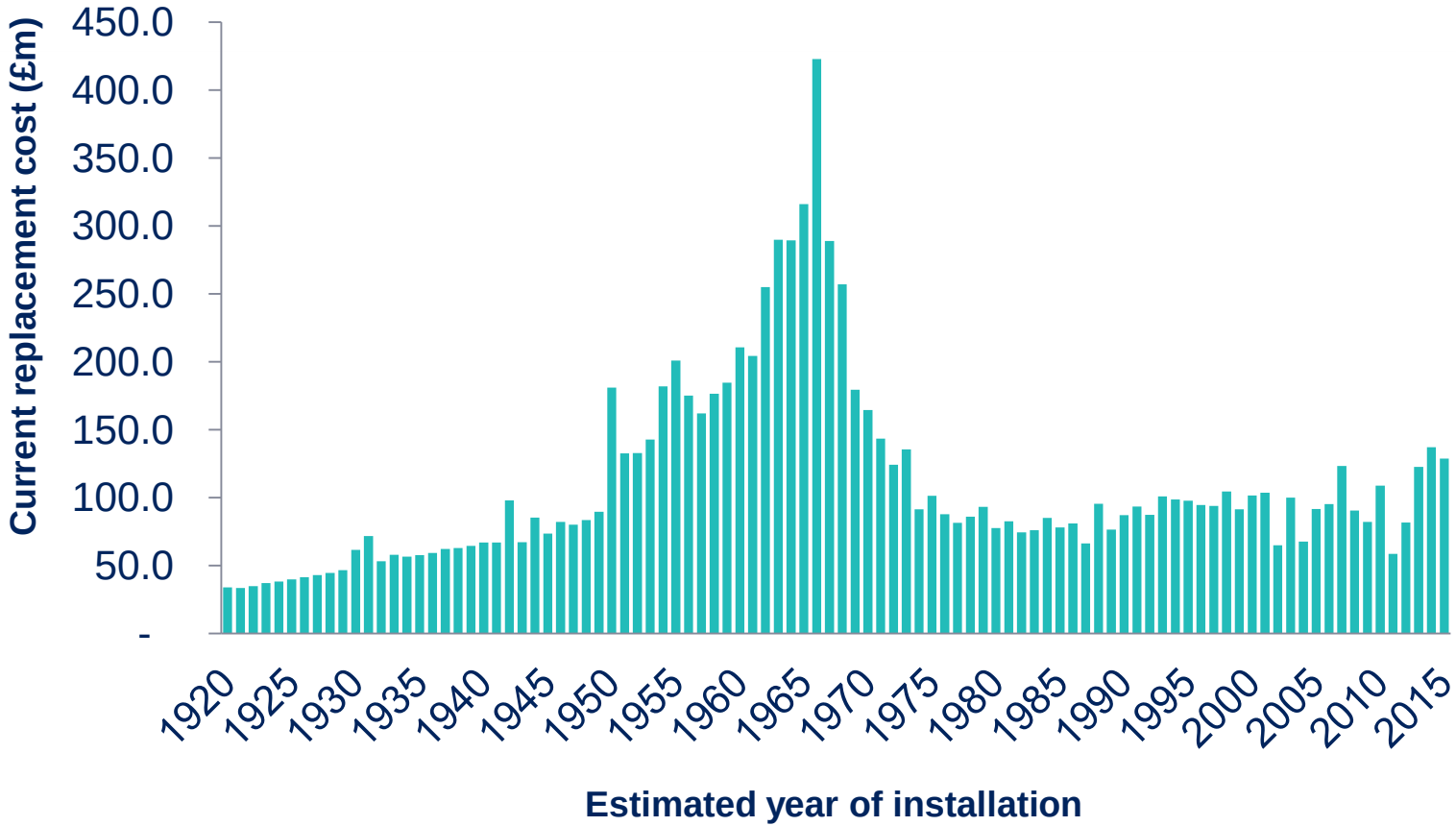
£12 billion of network assets

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

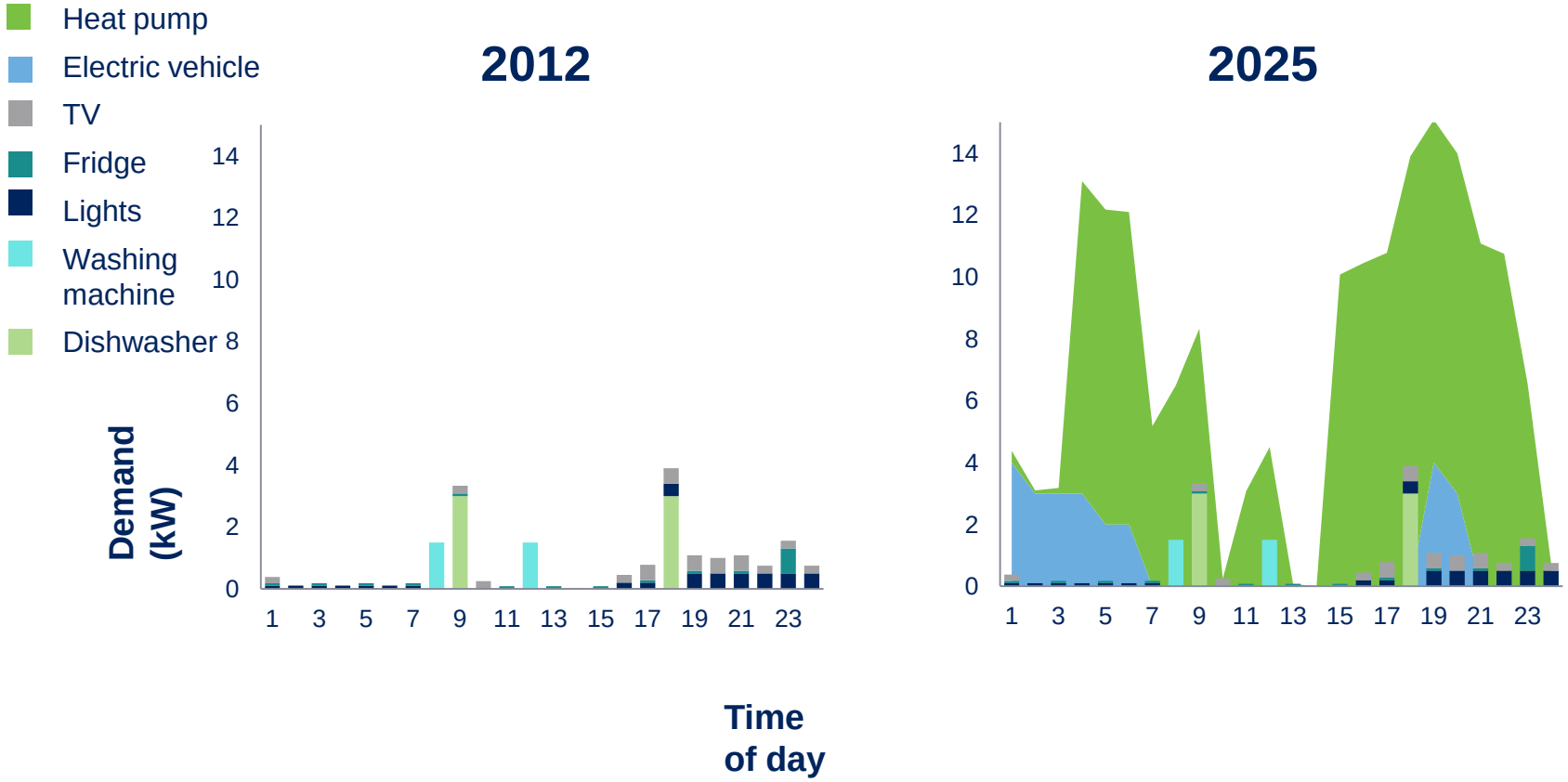
Challenges


Increasing
customer expectations
Innovation
Changing energy usage
Ageing assets

Aging Assets



Changing Demand



Themes

Safety & environmen	Network resilience	Capacity	Efficiency	Customer service	Commercial evolution
Strive to continuously improve safety and reduce impact on the environment	Improve network performance and reduce risk	Maximise the use of existing assets to increase demand and generation capacity	Provide our existing services at lower cost	Improve customer experience, offer new services and more choice	Change our role from network operator to system operator

Smart Street project overview

£11.5m, four-year innovation project

Started in Jan 2014 and finishes in Apr 2018

Quicker connection of LCTs

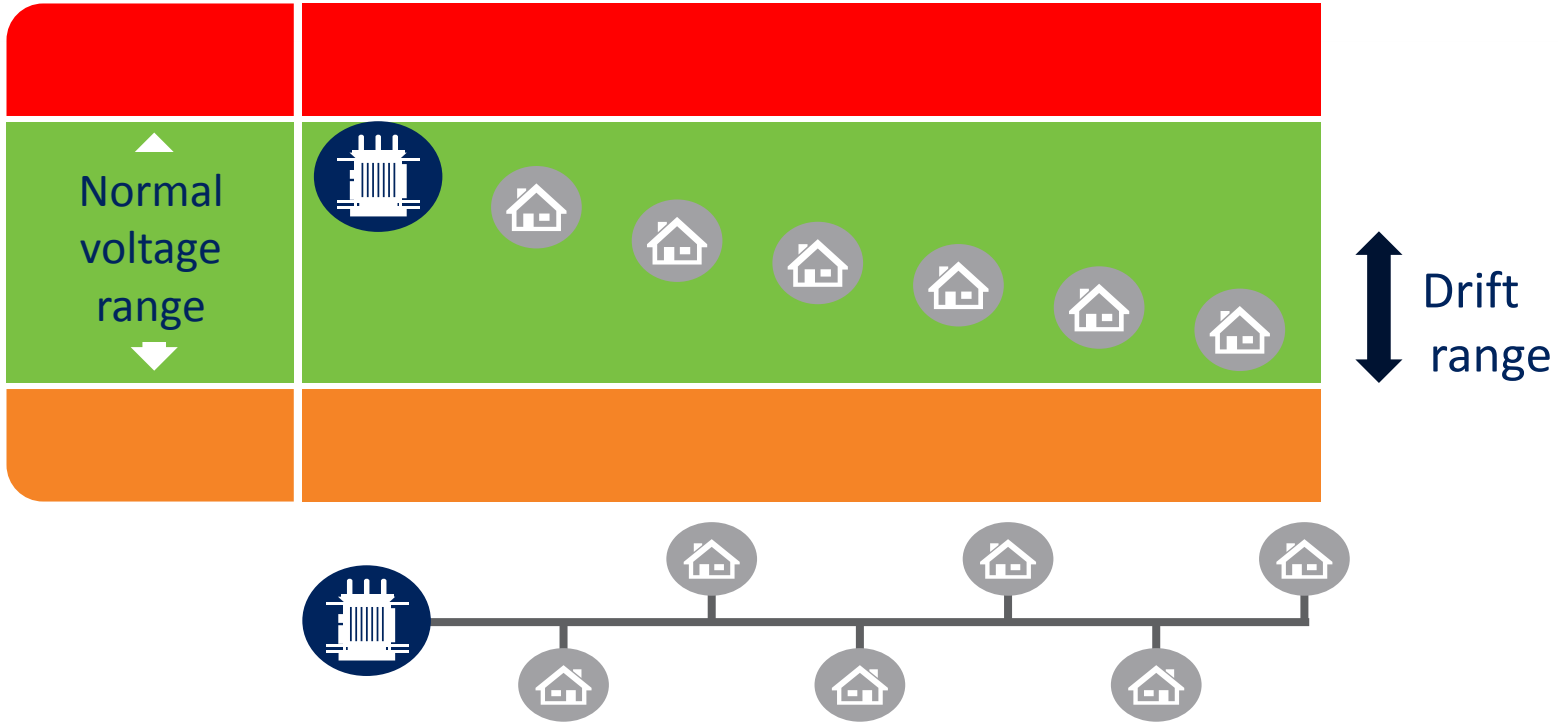
Lower energy bills

Improved supply reliability

Trials period Jan 2016 – Dec 2017

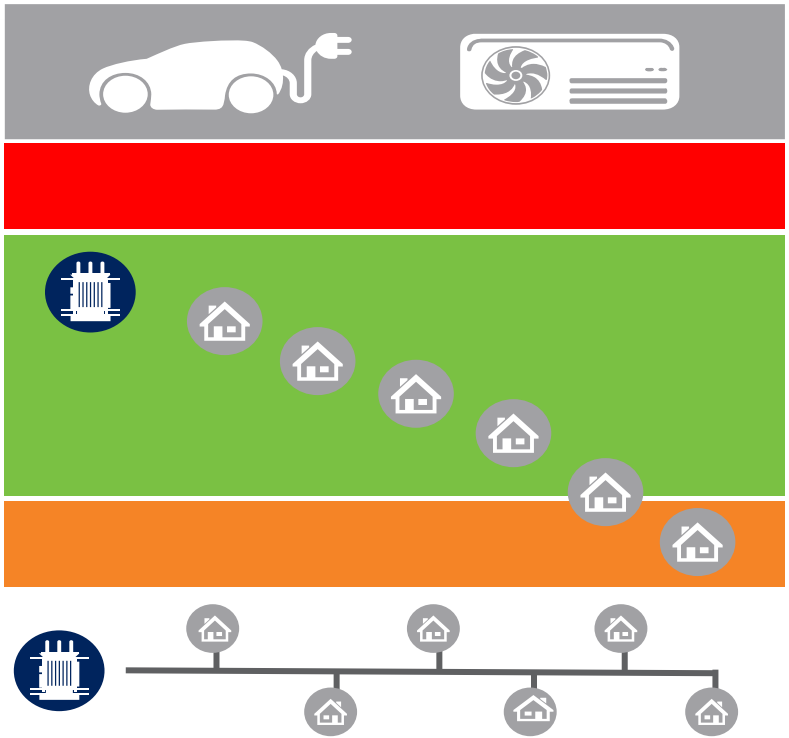
Extensive customer engagement programme throughout project

Voltage profile

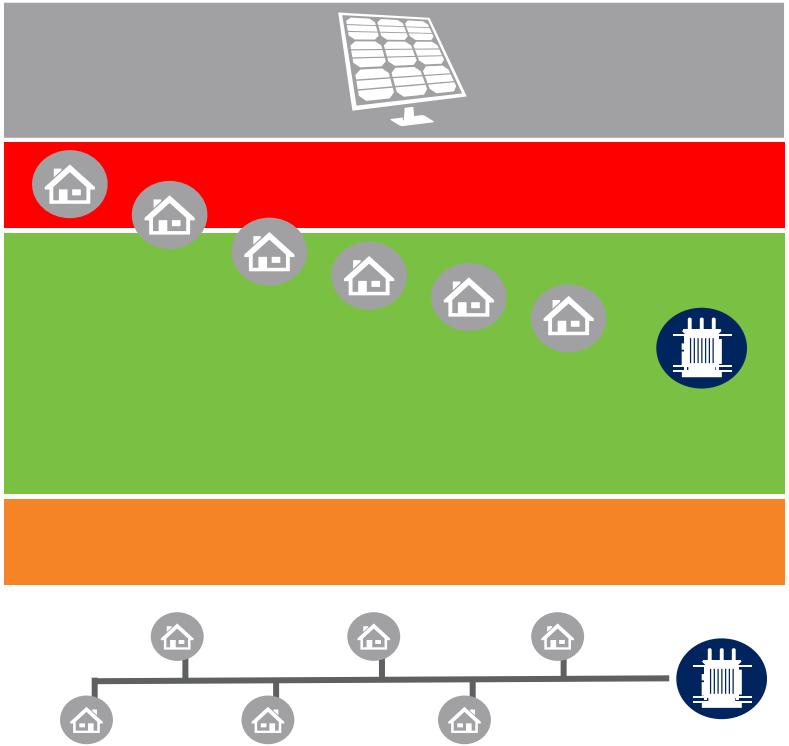


Historic networks have no active voltage regulation

Problem - LCTs create network issues

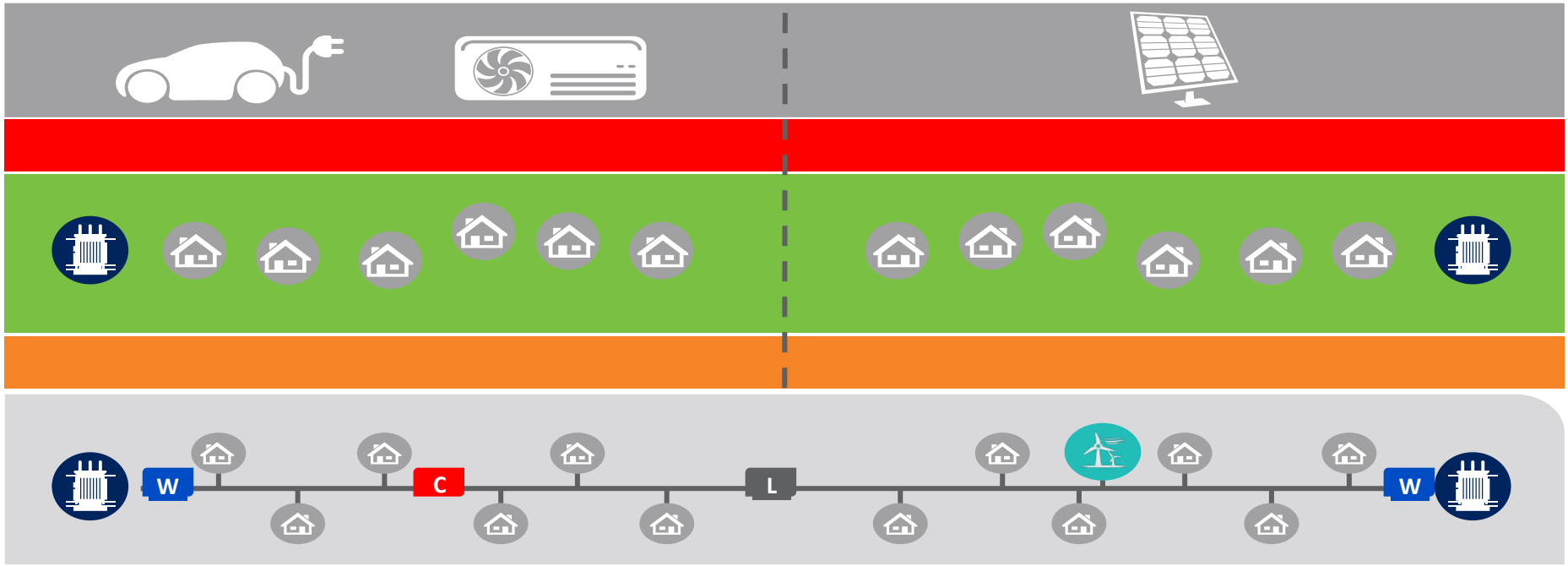


Drift range



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

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

KELVATEK

SIEMENS

TyndallManchester
Climate Change Research

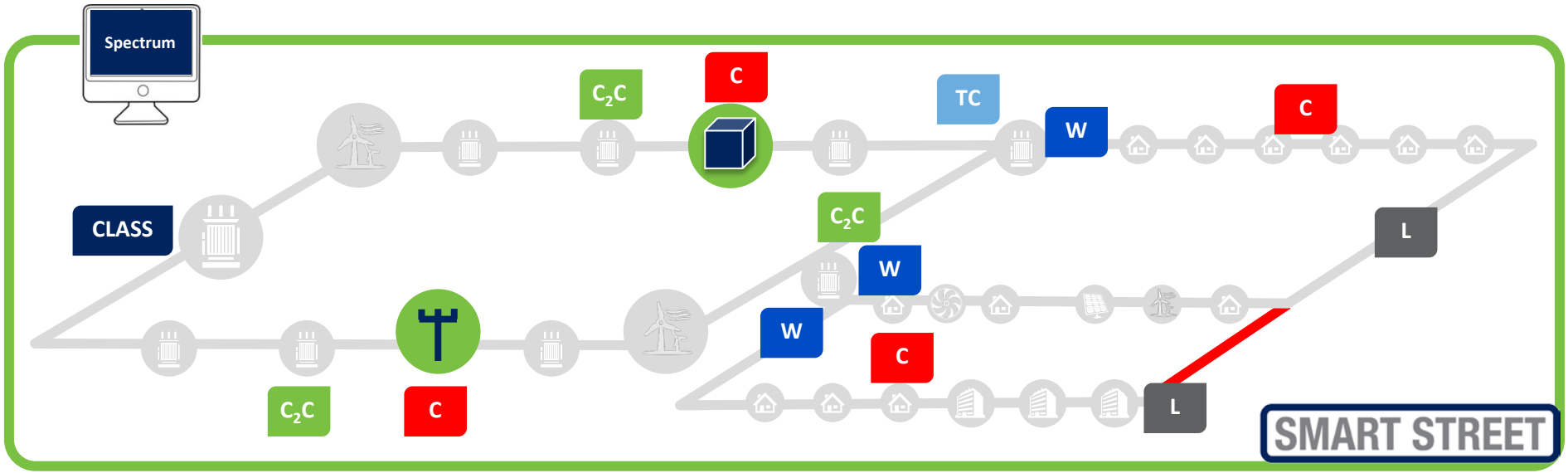
tnei
enterprise with energy

MANCHESTER 1824
The University of Manchester

Queen's University Belfast

Impact Research

Network reliability improvement



C_2C Capacity to Customers

C Capacitor

W WEEZAP

L LYNX

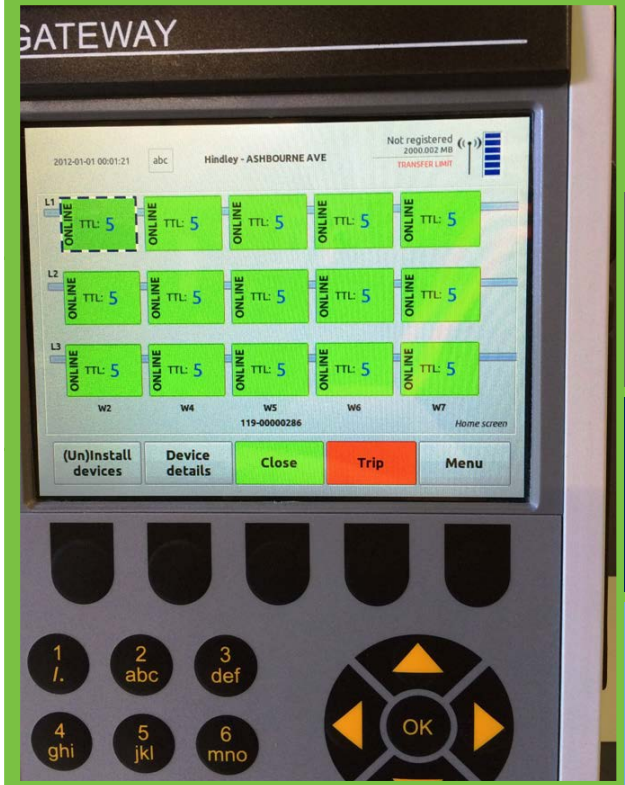
TC On-load tap changer

Builds on C_2C and CLASS ● Storage compatible ● Transferable solutions

The Smart Street System

Spectrum 5 (NMS)

Weezaps



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

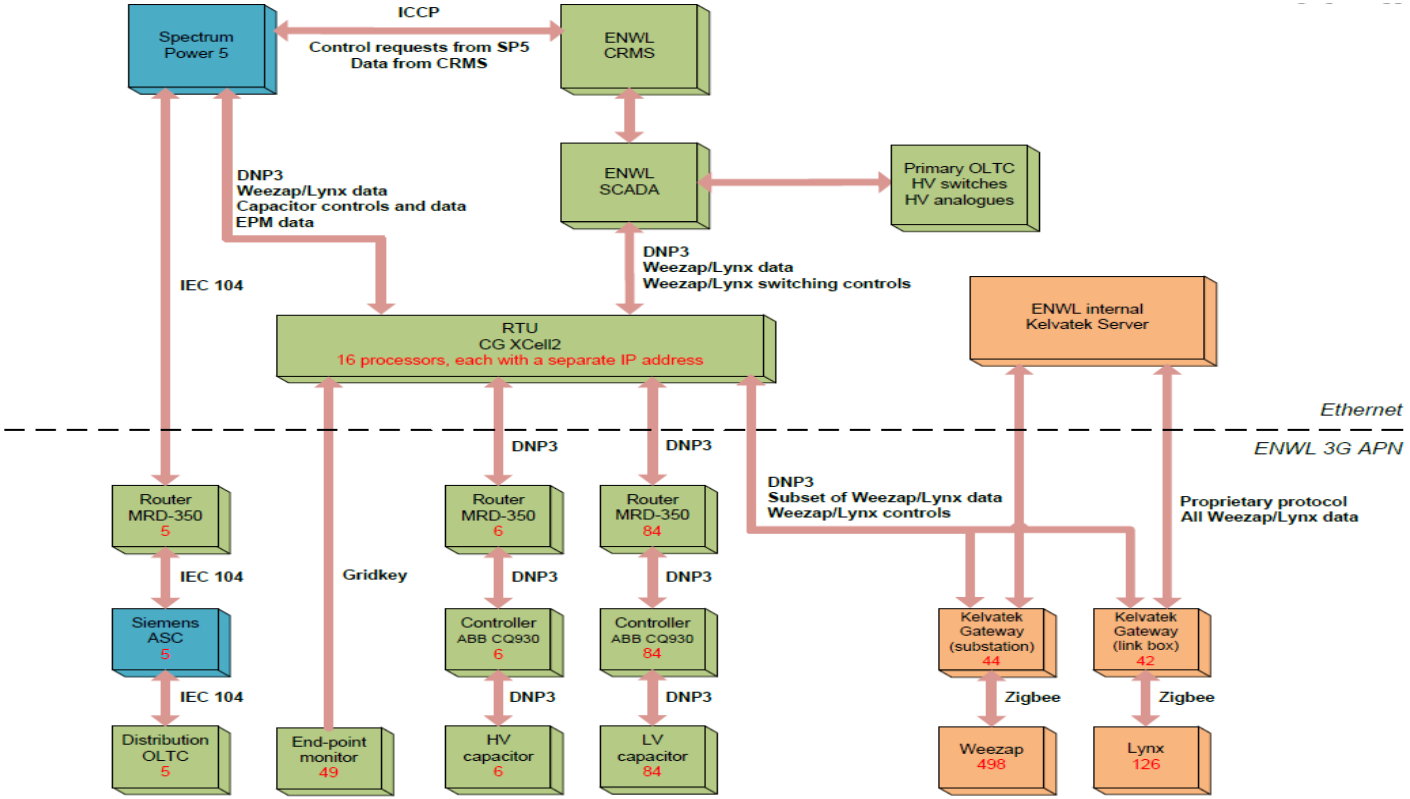
LV Vacuum switch

Allows active network meshing and un-meshing

Advanced monitoring capabilities

Ability to control the circuit locally or remotely

Data Architecture



LV Capacitors

84 LV capacitors

One on each closed ring

Multi staged

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

Distribution OLTC

5 OLTCs

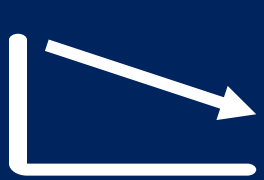
9 taps

Local or remote

Trials – 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

Research Workstreams



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

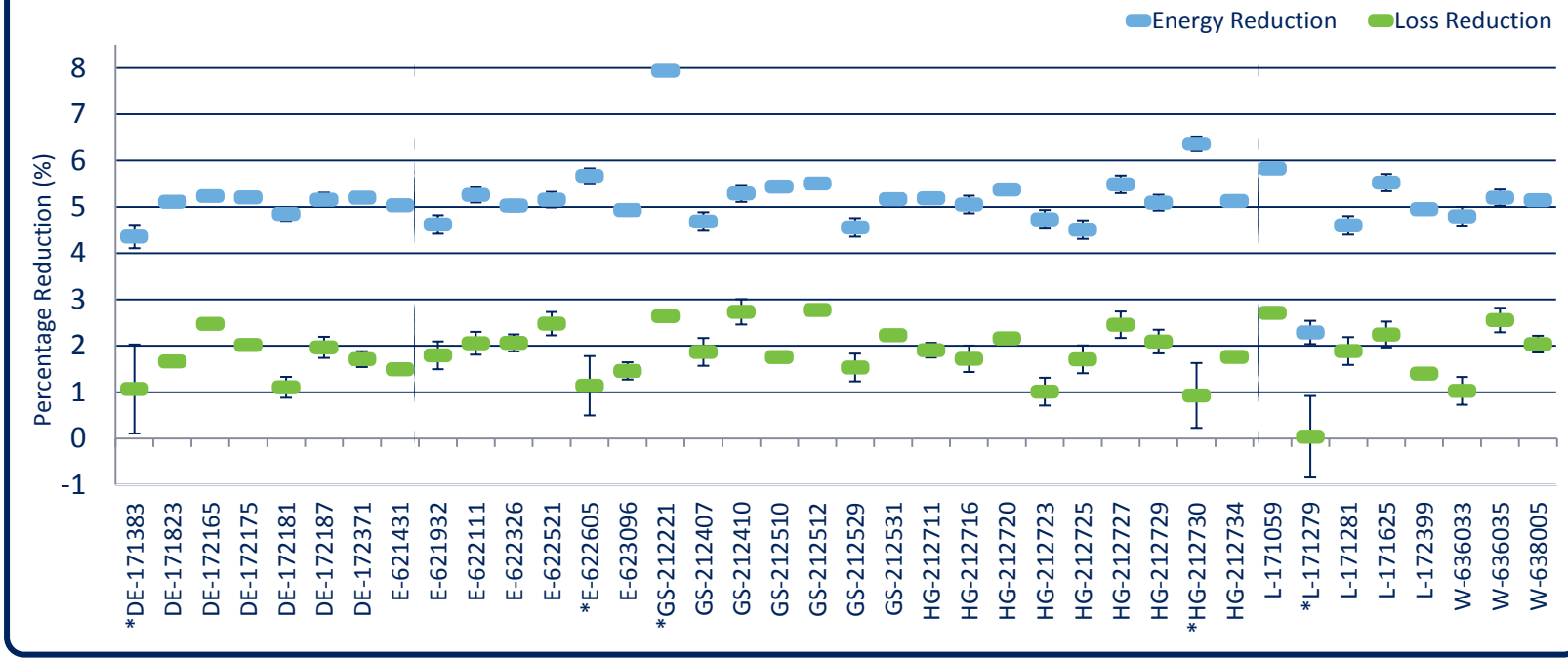
Queen's University Belfast

TyndallManchester Climate Change Research

tnei enterprise with energy

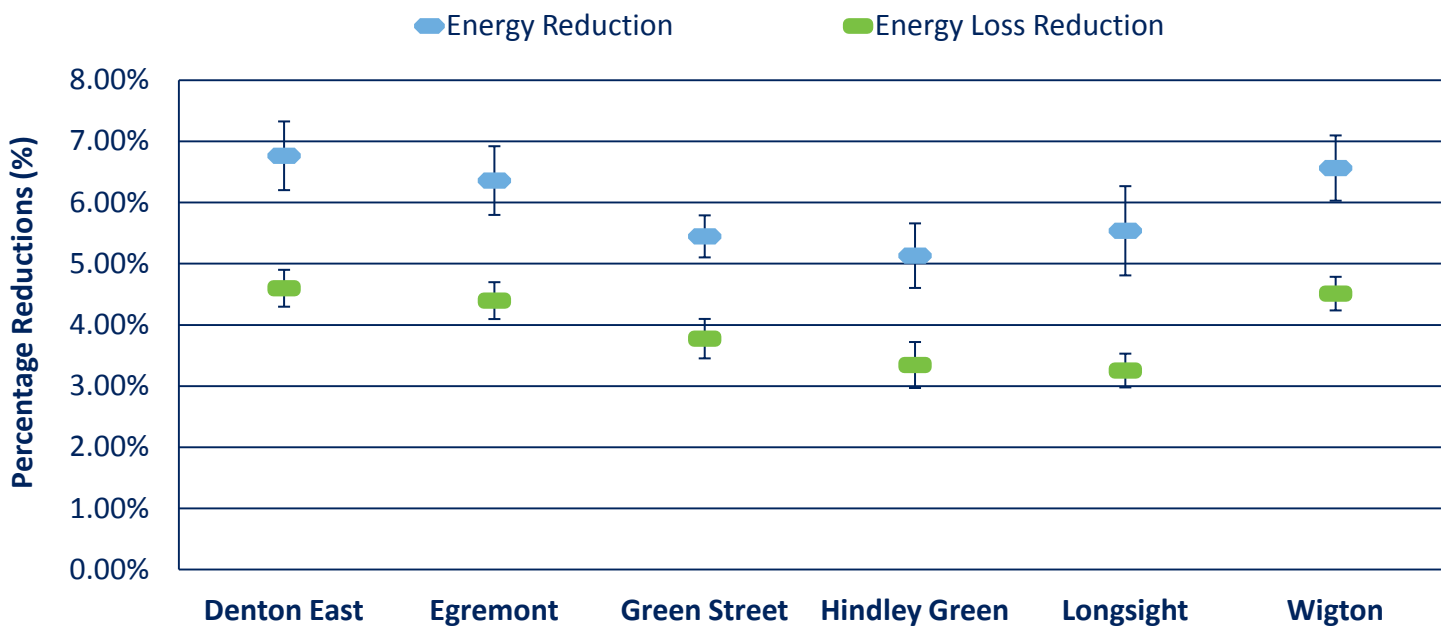
UoM simulation

Percentage reductions on LV networks



UoM simulation

Energy and losses reductions on HV networks

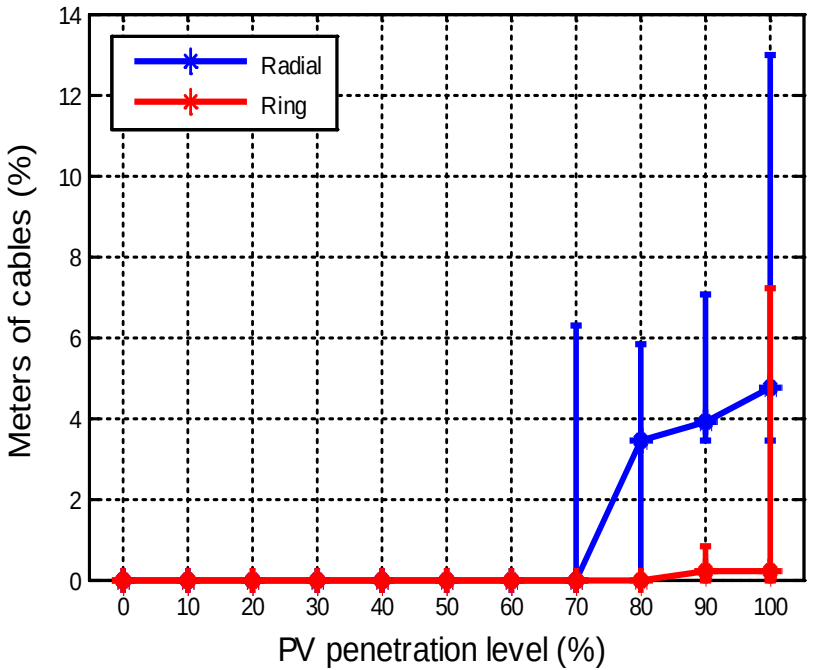


Ring operation

Improvement of overloaded cables

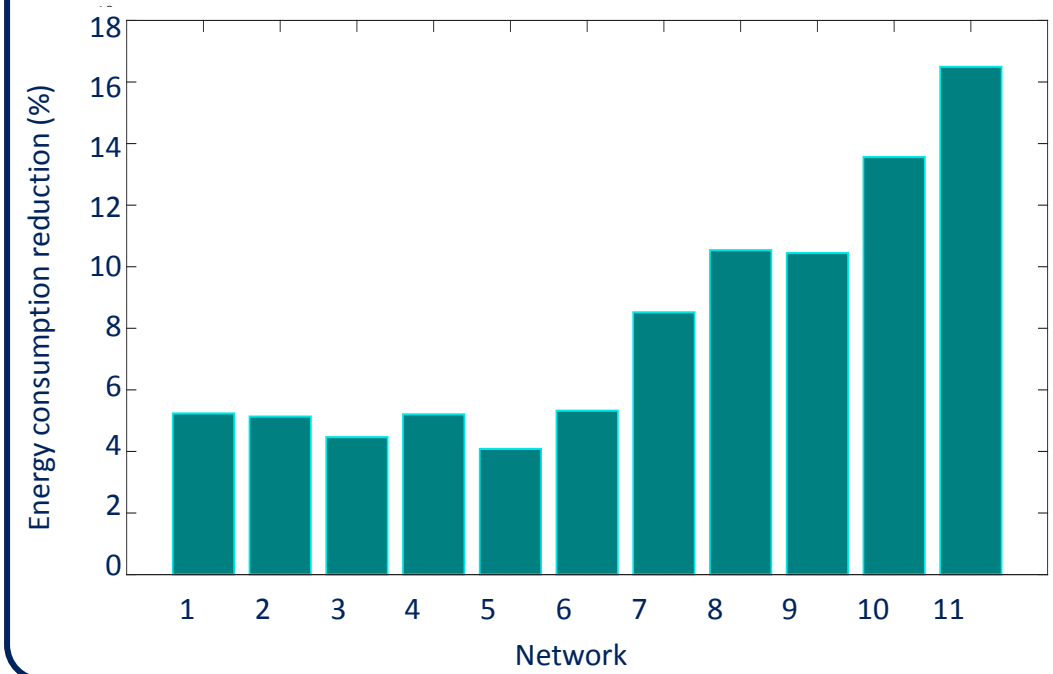
Dependent on customer mix

~20% Reduction in losses



QUB simulation

Energy consumption reduction

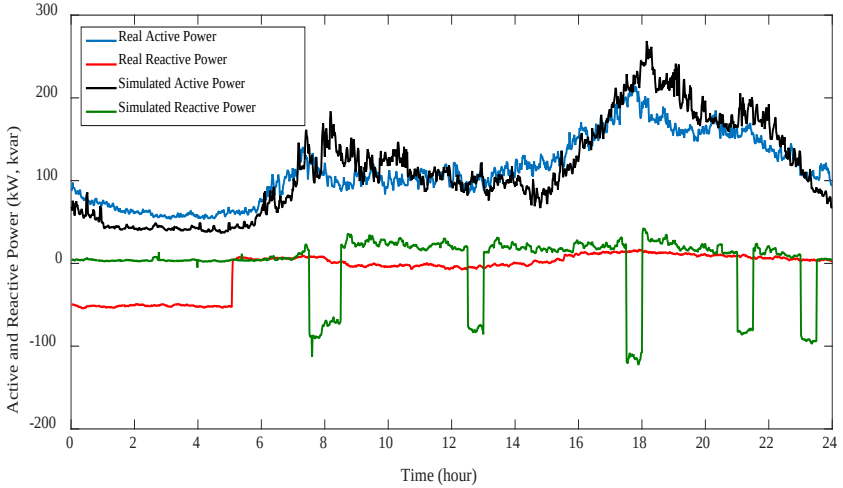


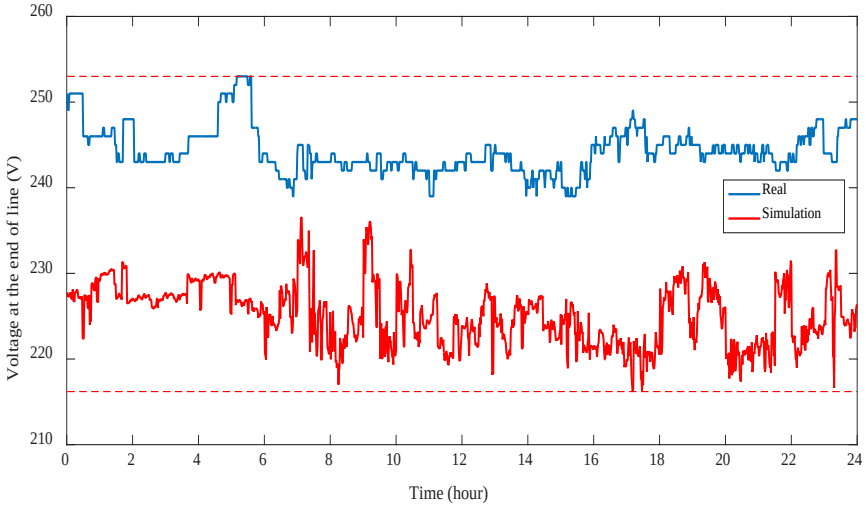
11 networks only

5 with OLTC

6 heavily loaded

Trial results





UoM results

		Voltage reduction	Energy reduction	Losses reduction
UoM simulated results	HV	5.50%	5.97%	3.98%
	LV	4.88%	5.12%	1.83%
QUB results	LV		8%	4%
Trial data	LV		8.7%	

Outcomes to date

~25GB of data recorded so far	Trial area networks modelled	Calculated CVR factor of 1.10 for LV and 1.01 for HV networks	Analysis techniques indicate optimisation algorithm is close to optimal	Ring operation modelled and compared to radial

Still to come

Effects of voltage reduction on lighting and domestic appliances under investigation

Carbon impact being studied

Analysis of trials data ongoing

Smart Street summary

Combine into one end-to-end system

Optimisation

Challenge

Learning

First example of centrally controlled LV network

Range of intervention solutions

SMART STREET

Faster LCT adoption

Less embedded carbon

Re-usable technology

Optimise energy and losses

Carbon Footprint

Benefit

Lower energy bills

More reliable supply

Reinforcement savings

Any Questions?

For more information

	www.enwl.co.uk/innovation
	innovation@enwl.co.uk
	0800 195 4141
	@ElecNW_News
	linkedin.com/company/electricity-north-west
	facebook.com/ElectricityNorthWest
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