Innovation Learning Event

Wednesday 4 July 2018

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SMART STREET

Project update

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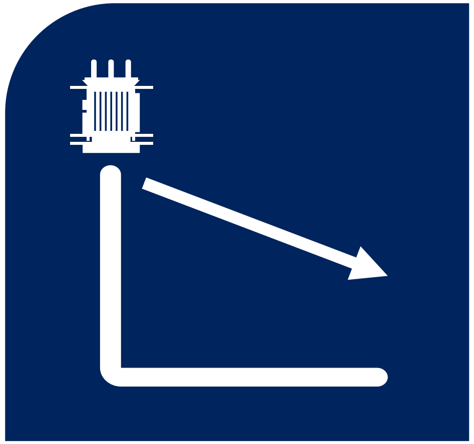
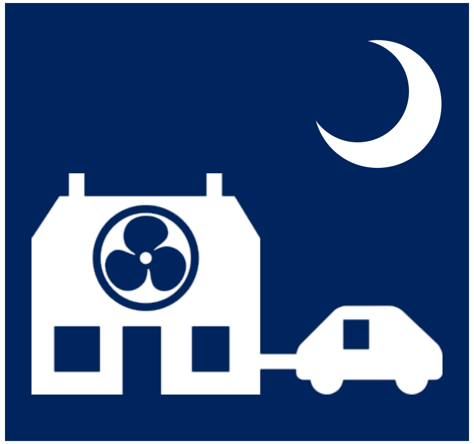
Background

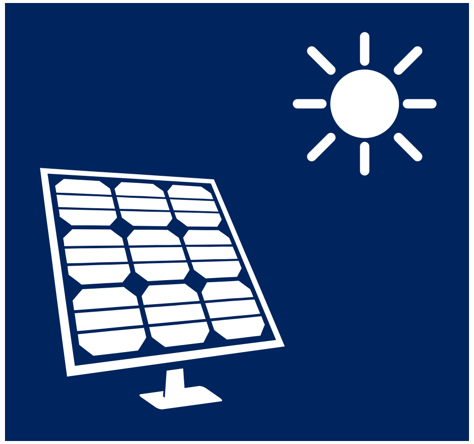


Historic networks have no active voltage regulation

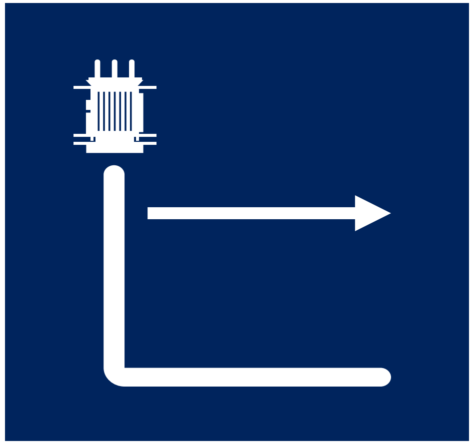


LCTs create network issues

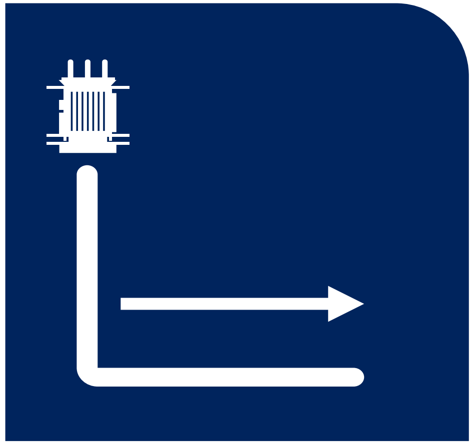
Customer demand could cause voltage to dip below statutory limits



Customer generation could cause voltage to exceed statutory voltage limits



Smart Street stabilises voltage across the load range and optimises power flows



Conservation voltage reduction

Stabilised voltage can be lowered making our network and customers' appliances more efficient

Project overview

£11.5m, four-year innovation project

Started in Jan 2014 and finished 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

Trial overview

Six primary substations
67,000 customers
11 HV circuits – five closable HV rings

Three pole-mounted HV capacitors
Three ground-mounted HV capacitors

38 distribution substations
Five OLTC transformers

Five substation capacitors
79 LV circuit capacitors

Overview of research workstream

Quantified the voltage optimisation and loss reduction techniques used in Smart Street	Proved the benefits of meshed networks and the effects on power quality	Quantified the cost benefits and carbon impact related to the Smart Street solution	TNEI provided research support and consultation for the duration of the trials

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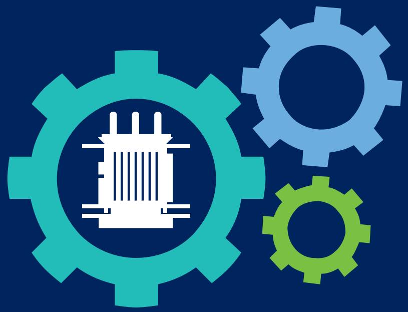
TyndallManchester Climate Change Research

tnei enterprise with energy

High level conclusions

Network benefits	Benefits from reduced losses and deferred reinforcement if ...	Customer benefits
		
Alleviate network issues Facilitate energy savings Reduce network losses	Smart Street investment costs low Demand growth and LCT uptake uncertain	Economic benefits per customer independent on network type

High level conclusions

Optimisation benefits (energy)	Optimisation benefits (losses)	Trade off between loss and energy consumption reduction	Carbon benefits
6-8% voltage reduction 5.5 – 8.5% energy reduction All networks similar energy reduction	Up to 15% loss reduction Rural network has highest loss reduction	Does exist but depends on load composition Energy consumption dominates Total energy reduction independent of weightings applied	Electricity system emissions reductions of 7% to 10% may be possible with a full application of Smart Street

Overall impact of Smart Street trials

Perception of power quality

Perceptions driven by exposure to power cuts

Minimal differences re frequency and/or duration

On balance positive changes

Experience of SDIs

Not spontaneously associated with a reduction in power quality

Do not negatively impact customers’ power quality perceptions

Fault data

SDIs were generally linked to network faults unassociated with the trials or with equipment installation

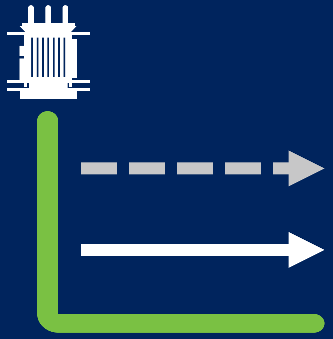
Smart Street benefits

Generally customers perceived the Smart Street project to have positive or at least neutral implications

The hypothesis

Customers in the trial area have not perceived any changes in their electricity supply when the Smart Street method is applied

Outcomes



Monitored and actively optimised

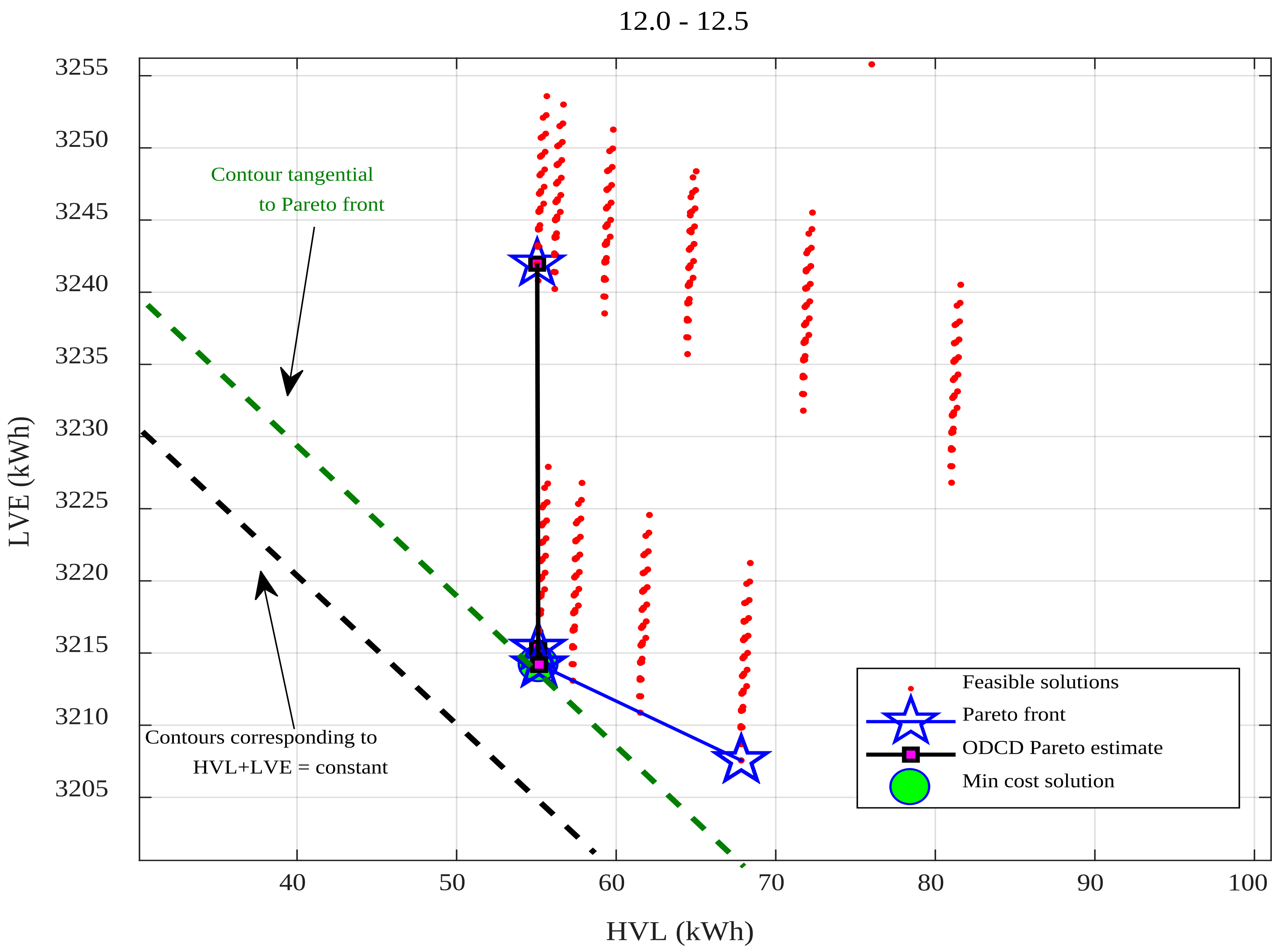
LV network

Proven that techniques save energy

Potential deferment of reinforcement

Associated carbon equivalent savings

Losses vs energy savings



Meshing

Reduces voltage issues

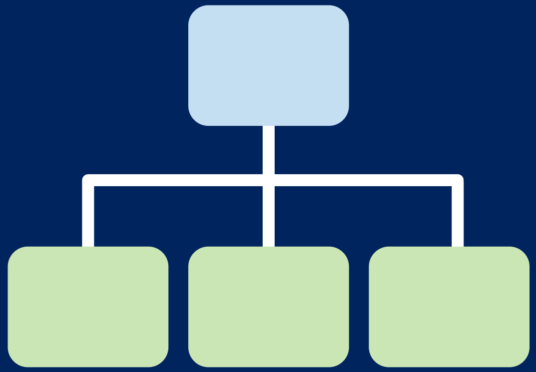
Improves asset utilisation

Reduces losses

Increases fault levels

No benefit to permanent connection – only mesh at beneficial times

Learning points – system



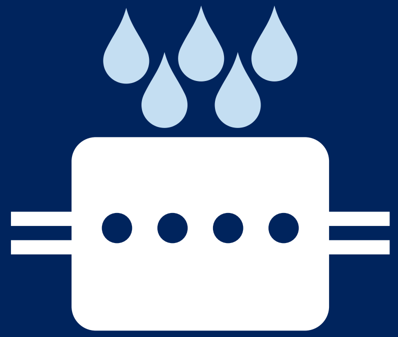
System architecture

Integration with existing SCADA system

Use of single line diagram

Learning points

Communications



Water ingress

Cabinet design and location

Enclosure size

Carbon impact

Reduction of approx 5% at HV level

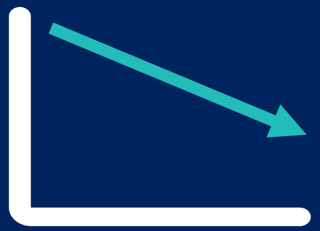
Reduction of 7 – 10 % at LV level (network dependent)

Significant merit in reducing UK carbon emissions, particularly through reducing network losses and customer energy use

Lessons learned

- Comms reliability
- OLTC ‘safe’ setpoint
- Capacitor banks too large
- Capacitor banks better suited to rural networks
- BAU solution would need a four wire model
- LV volt drop not as expected
- Consider OLTC option in ENA technical specifications

Policy changes

LV Design	OLTC	Connections	Monitoring
			
Voltage drop not as severe as expected	Electricity North West specification modified to allow for use of OLTCs	Update connection process for LCTs	Fit monitoring to identify clusters

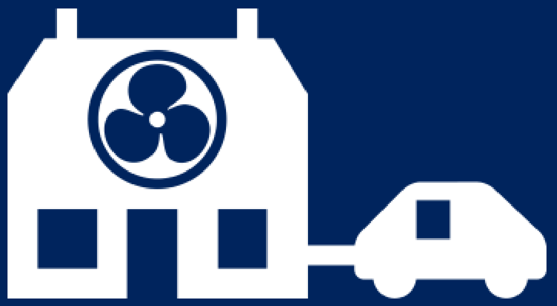
Technology

Lynx housing to be redesigned

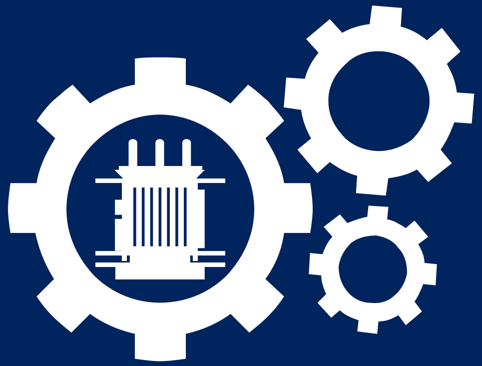
Monitored network being retained

Integration with new NMS

Further developments



Capacitors potentially useful if loads increase



Full network optimisation

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Thank you for your time and attention