Active Optimisation of LV Networks

MEEPS Workshop
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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

<table>
<thead>
<tr>
<th>Normal voltage range</th>
</tr>
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<tbody>
<tr>
<td>Historic networks have no active voltage regulation</td>
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</table>

Drift range
Problem - LCTs create network issues

LCTs rapidly surpass voltage and thermal network capacity
Smart Street – the first intervention

- Voltage stabilised across the load range
- Power flows optimised
- Low cost
- Quick fit
- Minimal disruption
- Low carbon
- Low loss
- Invisible to customers

Voltage stabilised across the load range • Power flows optimised
The Smart Street System

Spectrum Power 5 (NMS)
Network reliability improvement

Builds on C2C and CLASS

- Storage compatible
- Transferable solutions

C2C: Capacity to Customers
C: Capacitor
W: WEEZAP
L: LYNX
TC: On-load tap changer

SMART STREET

Spectrum
Aims

Quantification of CVR benefits

Validation of optimisation techniques

Identify potential power quality and customer side impacts
## Trials – test regimes

<table>
<thead>
<tr>
<th>Smart Street trial</th>
<th>Test regime</th>
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</thead>
<tbody>
<tr>
<td><strong>LV voltage control</strong></td>
<td>1. On-load tap changing distribution transformer only</td>
</tr>
<tr>
<td></td>
<td>2. On-load tap changing distribution transformer and capacitor(s) on LV circuits</td>
</tr>
<tr>
<td></td>
<td>3. Capacitors at distribution substation only</td>
</tr>
<tr>
<td></td>
<td>4. Capacitors at distribution substation and on LV circuits</td>
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<tr>
<td></td>
<td>5. Capacitor(s) on LV circuits only</td>
</tr>
<tr>
<td><strong>LV network management &amp; interconnection</strong></td>
<td>1. LV radial circuits</td>
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<tr>
<td></td>
<td>2. LV interconnected circuits</td>
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<tr>
<td><strong>HV voltage control</strong></td>
<td>1. Voltage controllers at primary substation only</td>
</tr>
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<tr>
<td><strong>Network configuration &amp; voltage optimisation</strong></td>
<td>1. Losses reduction</td>
</tr>
<tr>
<td></td>
<td>2. Energy consumption reduction</td>
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</tbody>
</table>
Successful operation of OLTC and LV capacitor banks

W/C 14/3/2016

OLTCs only

14/06/2016 – 24/06/2016

Use of LV meshing & OLTCs

19/07/2016 – 01/08/2016

HV and LV meshing

09/08/2016 – 22/08/2016

HV meshed circuits only

W/C 22/08/2016
Smart Street summary

First example of centrally controlled LV network
Range of intervention solutions

Combine into one end-to-end system
Optimisation

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

Challenge
Learning

SMART STREET

Benefit

Lower energy bills
More reliable supply
Reinforcement savings

Carbon Footprint

CO₂

£
Outcomes to date

~25GB of data recorded so far

Trial area networks modelled

Predicted 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
For more information

Please contact us if you have any questions or would like to arrange a one-to-one briefing about our innovation projects.

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