WESTERN POWER DISTRIBUTION

LOW CARBON HUB

CONNECTING RENEWABLE ENERGY IN LINCOLNSHIRE

INNOVATIVE DG CONNECTIONS

LCNI 2014 Tuesday 21st October

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Innovation & Low Carbon Networks Engineer

LCN Fund
Low Carbon Networks

Presentation Outline

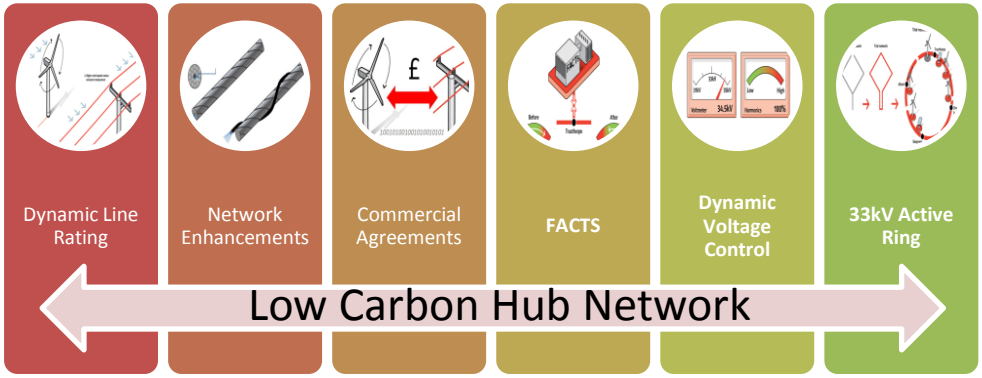
- Project Introduction
- Project Techniques
  - Dynamic Ratings
  - Network Enhancements
  - Commercial Agreements
  - FACTs
  - Dynamic Voltage control
  - 33kV Active Ring
- Learning & roll out of techniques

Project Introduction

Generation Connections – East Lincolnshire

East Lincolnshire is rich in renewable energy, however generation connections large and small can be prohibitively expensive as this triggers traditional network reinforcement.

All additional generation now triggers 132kV (thermal) network reinforcement and often 33kV reinforcement (voltage rise).



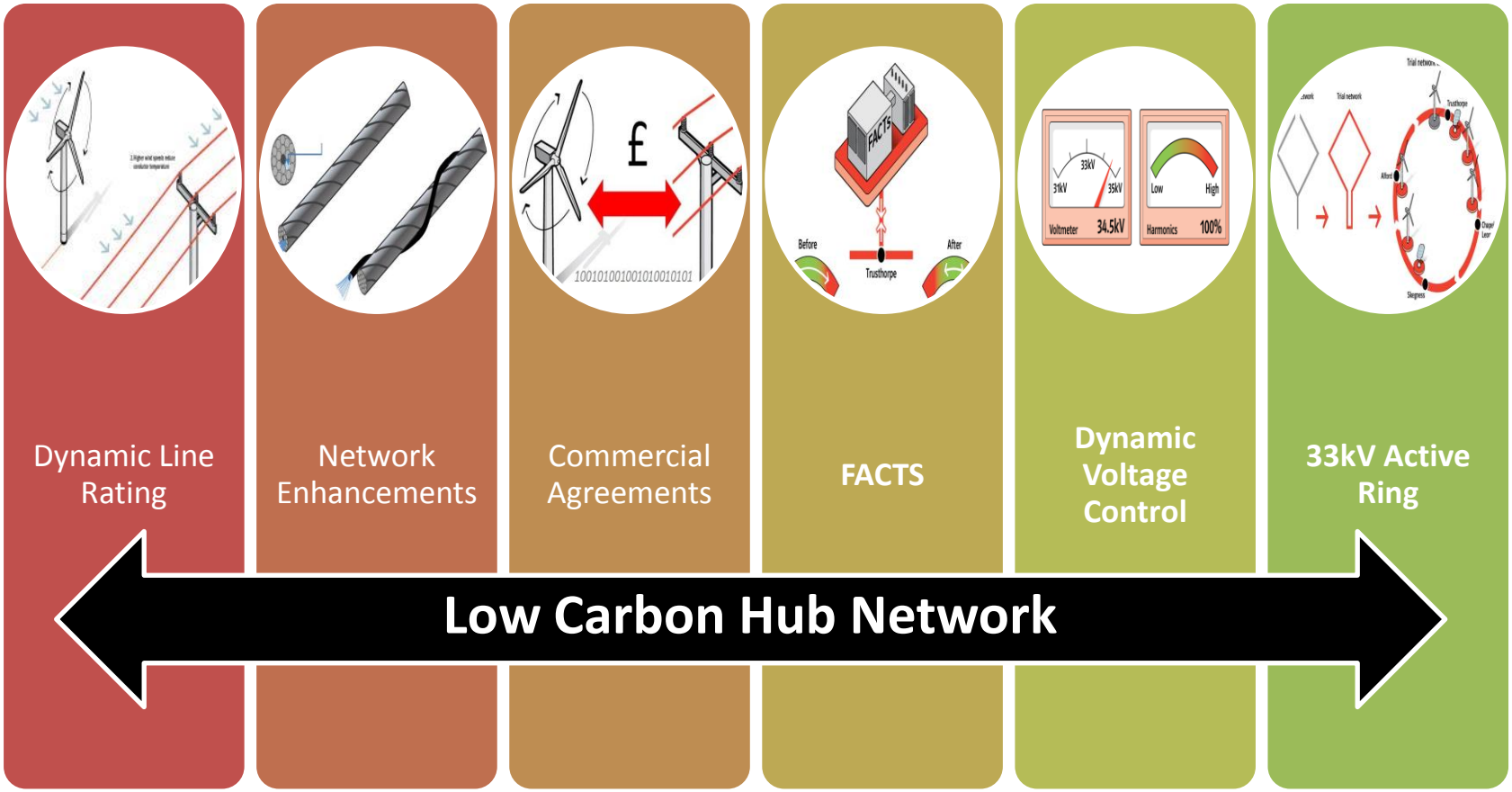
Lincolnshire Low Carbon Hub Techniques

Lincolnshire Low Carbon Hub location

Solution

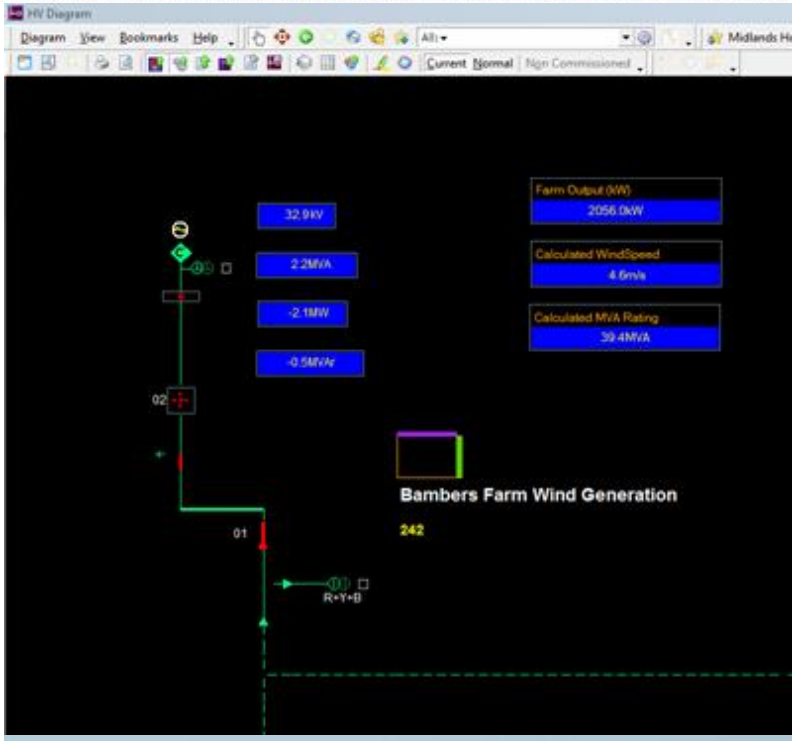
Using innovative techniques we are demonstrating how we can unlock network capacity, allowing more generation connections without excessive traditional network reinforcement (often new overhead lines or underground cables).

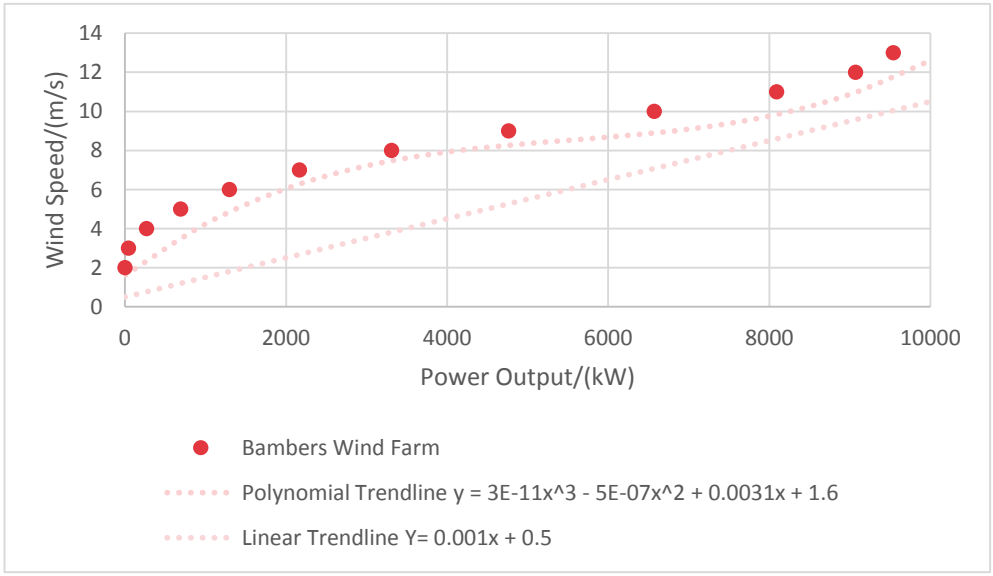
Project Techniques & Learning



Dynamic Line Ratings

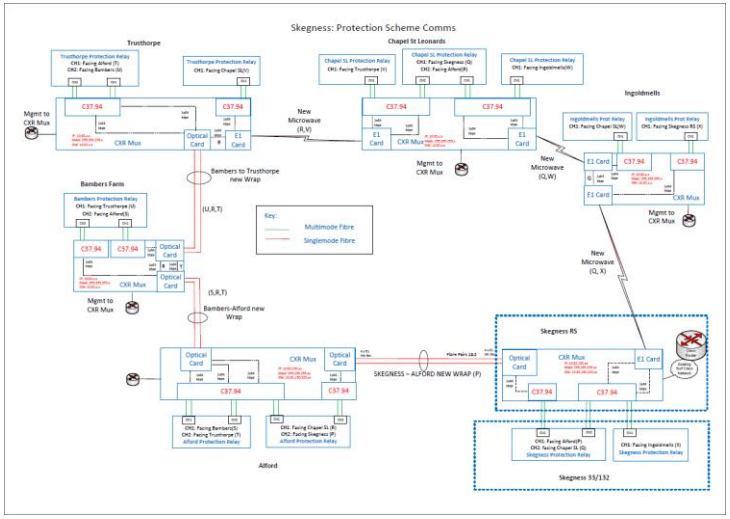
Investigating the use of generator output as a proxy for wind speed as a lower capital cost and more reliable alternative to installing weather stations or purchasing weather data from the Met office.





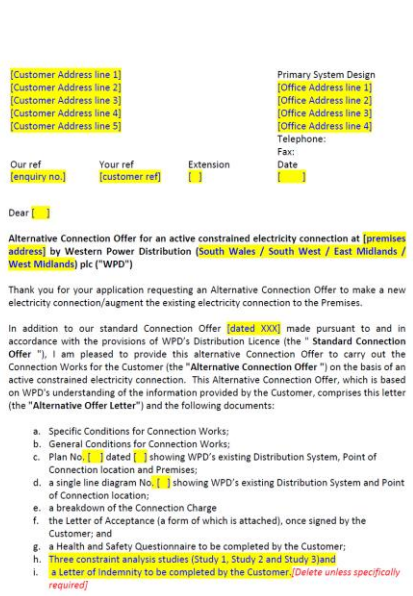
Network Enhancements

- New design standard for 33kV 300HDA
- Policy - wrapping fibre on new and existing Overhead lines
- Review of comms networks for protection
- 10.2km 33kV OHL rebuilt to new design standard



Commercial Arrangements

- Alternative Connection offer
- Alternative Connection agreement
- SGS ANM – Procured and installed
- Constraints analysis tool - built
- 23 connection offers
- 130.13 MW offers made
- 49.25MW accepted



[Customer Address line 1]
[Customer Address line 2]
[Customer Address line 3]
[Customer Address line 4]
[Customer Address line 5]

Primary System Design
[Office Address line 1]
[Office Address line 2]
[Office Address line 3]
[Office Address line 4]
Telephone:
Fax:

Our ref	Your ref	Extension	Date
[enquiry no.]	[customer ref]	[ ]	[ ]

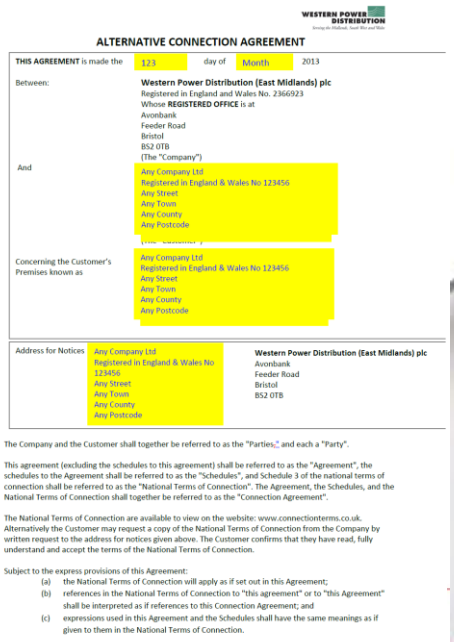
Dear [ ]

Alternative Connection Offer for an active constrained electricity connection at [premises address] by Western Power Distribution (South Wales / South West / East Midlands / West Midlands) plc ("WPD")

Thank you for your application requesting an Alternative Connection Offer to make a new electricity connection/augment the existing electricity connection to the Premises.

In addition to our standard Connection Offer [dated XXX] made pursuant to and in accordance with the provisions of WPD's Distribution Licence (the " **Standard Connection Offer** "), I am pleased to provide this alternative Connection Offer to carry out the Connection Works for the Customer (the "**Alternative Connection Offer** ") on the basis of an active constrained electricity connection. This Alternative Connection Offer, which is based on WPD's understanding of the information provided by the Customer, comprises this letter (the "**Alternative Offer Letter**") and the following documents:

a. Specific Conditions for Connection Works;
b. General Conditions for Connection Works;
c. Plan No. [ ] dated [ ] showing WPD's existing Distribution System, Point of Connection location and Premises;
d. a single line diagram No. [ ] showing WPD's existing Distribution System and Point of Connection location;
e. a breakdown of the Connection Charge
f. the Letter of Acceptance (a form of which is attached), once signed by the Customer; and
g. a Health and Safety Questionnaire to be completed by the Customer;
h. Three constraint analysis studies (Study 1, Study 2 and Study 3)and
i. a Letter of Indemnity to be completed by the Customer.*[Delete unless specifically required]*



WESTERN POWER DISTRIBUTION

ALTERNATIVE CONNECTION AGREEMENT

THIS AGREEMENT is made the 123 day of Month 2013

Between: **Western Power Distribution (East Midlands) plc**
Registered in England and Wales No. 2366923
Whose **REGISTERED OFFICE** is at
Avonbank
Feeder Road
Bristol
BS2 0TB
("The "Company")

And Any Company Ltd
Registered in England & Wales No 123456
Any Street
Any Town
Any County
Any Postcode

Concerning the Customer's Premises known as Any Company Ltd
Registered in England & Wales No 123456
Any Street
Any Town
Any County
Any Postcode

Address for Notices: Any Company Ltd
Registered in England & Wales No 123456
Any Street
Any Town
Any County
Any Postcode

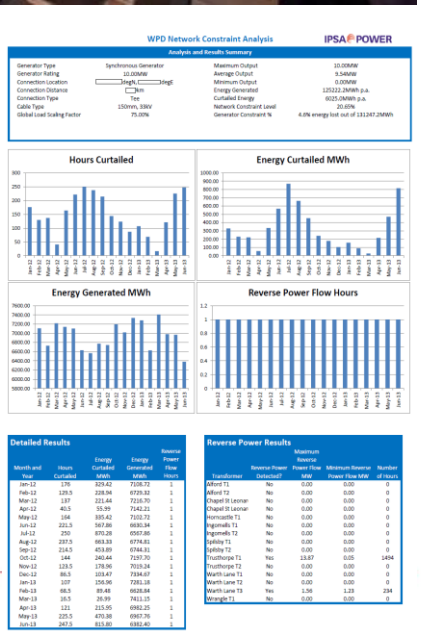
Western Power Distribution (East Midlands) plc
Avonbank
Feeder Road
Bristol
BS2 0TB

The Company and the Customer shall together be referred to as the "Parties," and each a "Party".

This agreement (excluding the schedules to this agreement) shall be referred to as the "Agreement", the schedules to the Agreement shall be referred to as the "Schedules", and Schedule 3 of the national terms of connection shall be referred to as the "National Terms of Connection". The Agreement, the Schedules, and the National Terms of Connection shall together be referred to as the "Connection Agreement".

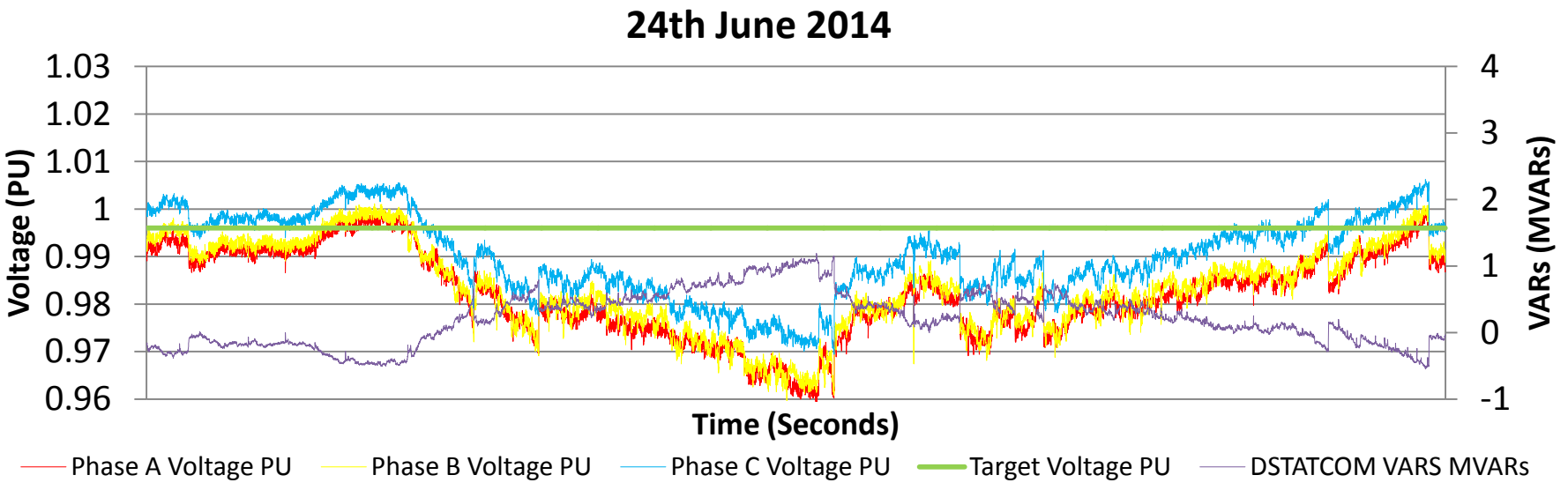
The National Terms of Connection are available to view on the website: www.connectionterms.co.uk. Alternatively the Customer may request a copy of the National Terms of Connection from the Company by written request to the address for notices given above. The Customer confirms that they have read, fully understand and accept the terms of the National Terms of Connection.

Subject to the express provisions of this Agreement:
(a) the National Terms of Connection will apply as if set out in this Agreement;
(b) references in the National Terms of Connection to "this agreement" or to "this Agreement" shall be interpreted as if references to this Connection Agreement; and
(c) expressions used in this Agreement and the Schedules shall have the same meanings as if given to them in the National Terms of Connection.

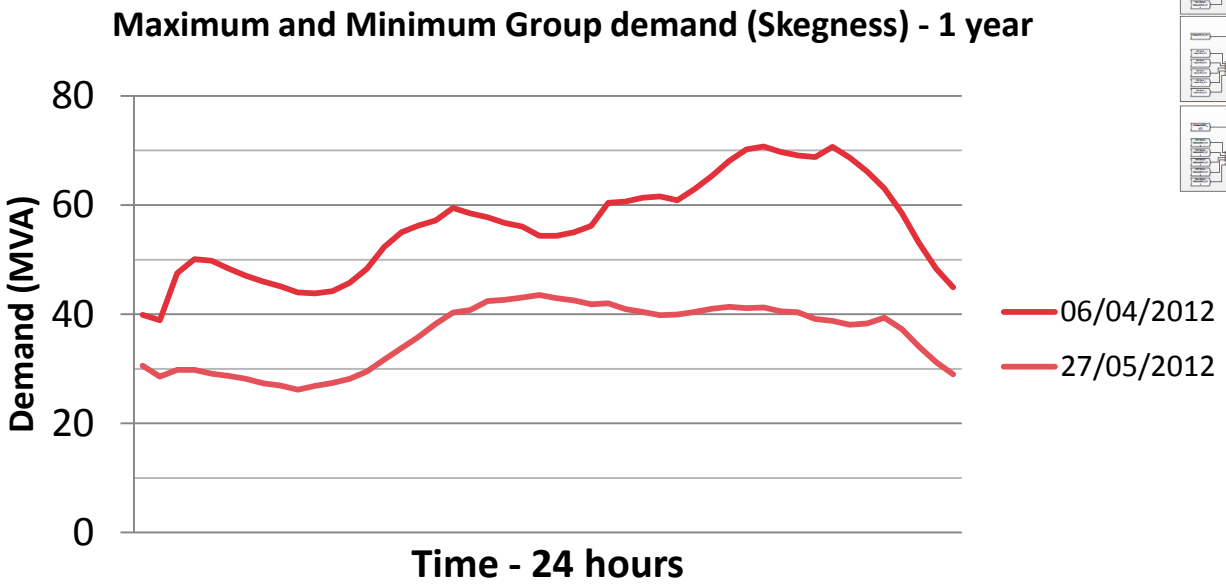


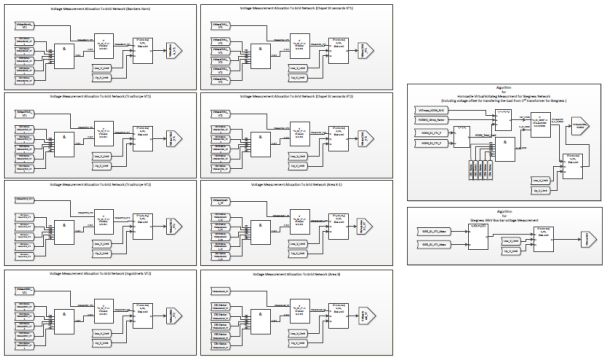
FACTS

Equipment	
Transformer Weight, Length, Width, Height	5MVA – 33,000/480/480 14,750kg, 3.5m x 2.81m x 3.1m
DStatcom steady state rating DStatcom transient rating Weight, Length, Width, Height	3 x 1.25 MVAr 9.9MVAr (2 seconds) 14,062kg, 8.23m x 2.44m x 2.9m
Measured steady state sustained performance	±3.84MVAr
Impact on network voltage	+ 3.75MVAr = 3% voltage rise -3.75MVAr = 5% voltage drop
Speed of response	3-6mS

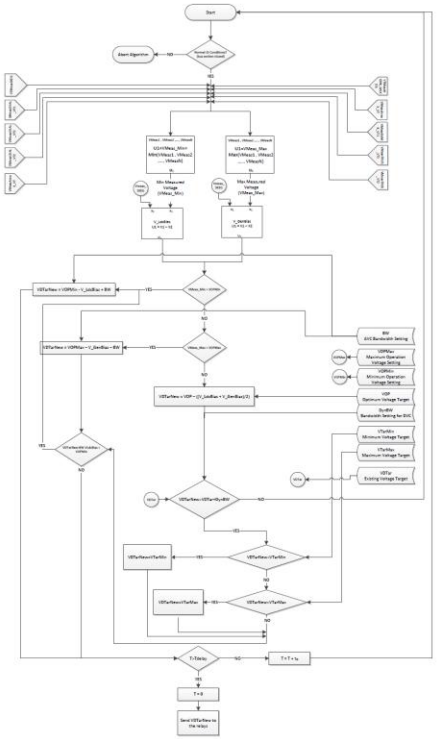


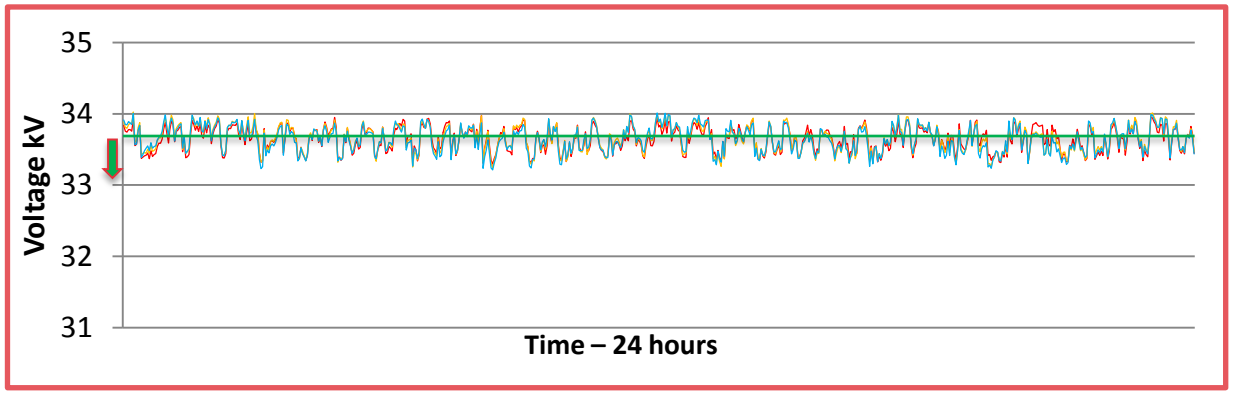
Dynamic Voltage Control





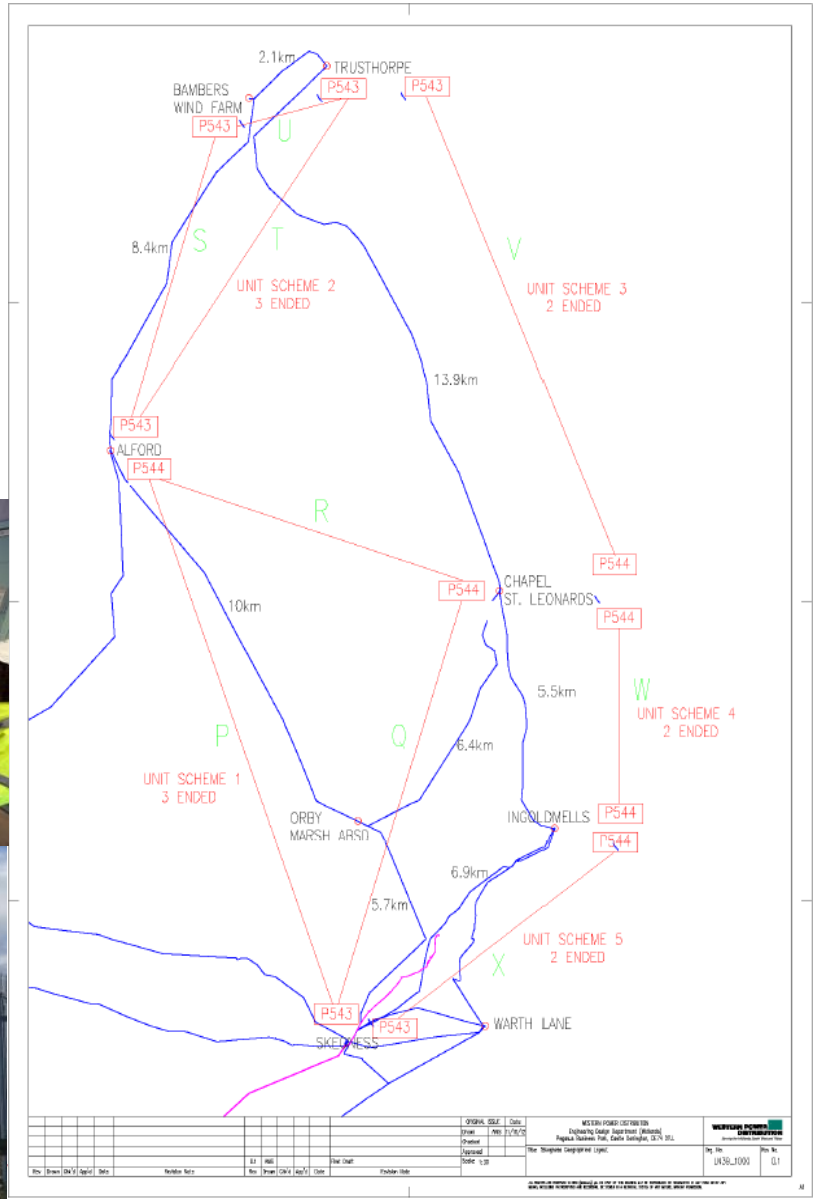
DVC Algorithm V6



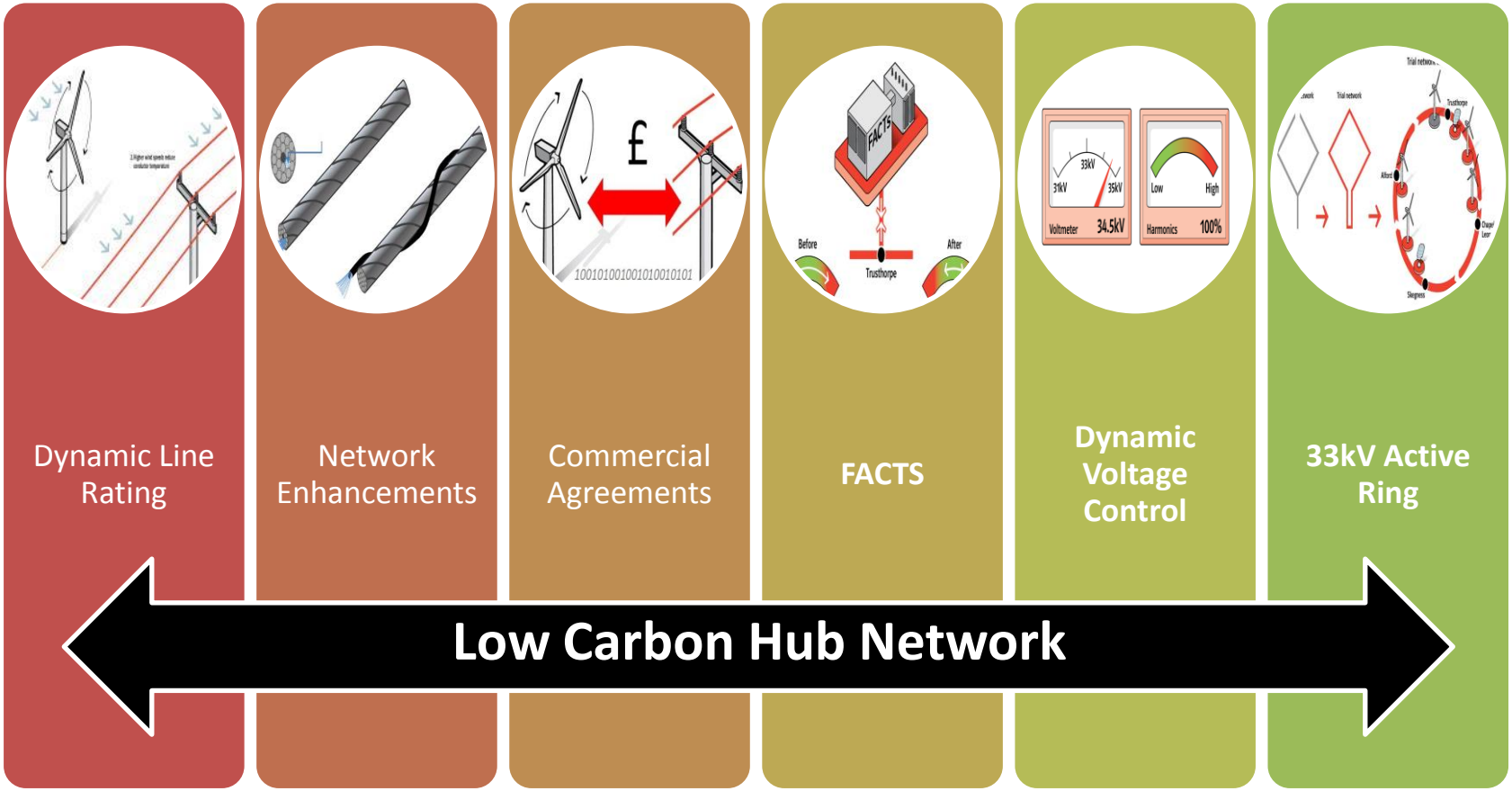


33kV Active Ring

- Skegness – Protection upgrades
- Alford – Site and protection upgrades
- Bambers Wind Farm - Protection upgrades
- Trusthorpe - Site and protection upgrades
- Chapel St Leonards- Site and protection upgrades
- Ingoldmells - Site and protection upgrades



Roll Out of Techniques



THANKS FOR LISTENING

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

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