SP ENERGY NETWORKS

Flexible Networks for a Low Carbon Future

Guide to Flexible Network Control

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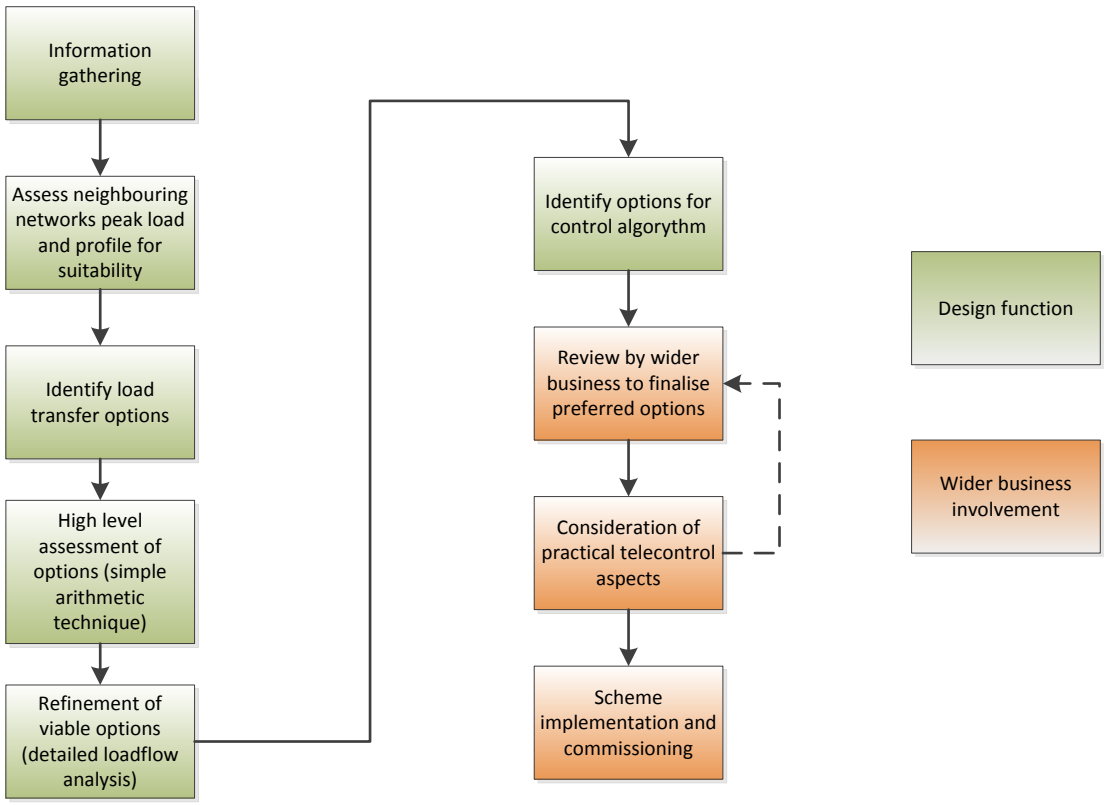
1 Introduction

Work package 2.2 implemented flexible network control within the project trial areas of St Andrews and Whitchurch. The objectives of the work package were to contribute to the increase in network headroom required within the trial areas, and to provide proof of concept and quantify the benefits and costs of using this type of network control.

Incremental capacity can be created on the secondary (11kV) network by using flexible open points to link neighbouring groups with spare capacity or different demand profiles. This work package trialled flexible network control using automated 11kV switches on secondary networks in two of the trial sites to provide the capability to dynamically transfer load between primary substations.

This guide has been prepared to assist SPEN and other DNO's with replication of the techniques employed in the project trial areas. It is intended to be a relatively high level guide for designers who are perhaps using this technique for the first time. Where appropriate, the guide makes reference to the more detailed design analysis that was undertaken for the trial areas. The practical aspects of implementing, or augmenting an existing, telecontrol scheme are highlighted and an example of a typical site survey form is included.

The process from scheme concept through to implementation is outlined in the flow chart below.



2 Design Process

The design process is fully described in generic (i.e. not DNO specific) terms in the document **Network Reconfiguration Planning Methodology and Application Guide**

The design work that was undertaken for the St Andrews trial area under the Flexible Networks project is described in the document **Evaluation of Headroom and Load Transfer Opportunities at St Andrews Primary Substation.**

The design work that was undertaken for the Whitchurch trial area under the Flexible Networks project is described in the document **Whitchurch Load Automation Feasibility Assessment.**

The documents above provide a comprehensive description of the process followed together with 2 examples of actual studies.

Existing telecontrol points on the network are likely to provide the lowest cost switching points for flexible network control if they are suitably located. However it should be borne in mind that the placement of legacy telecontrol points was often to address network performance, and were positioned to enable isolation of known fault zones. As investment during the intervening period has often addressed those failing assets, those telecontrol points may not now be at the optimal location for either fault sectioning or to enable flexible network control.

In designing the location of additional telecontrol points, cognisance must be given to any requirements in existing company policy and engineering standards, for example the Distribution Design Manual in the case of SPD / SPM.

3 Practical Telecontrol Considerations

As part of the output from the design process, it is likely that a requirement for additional telecontrol points on the 11kV network will be identified. These may involve adding telecontrol to existing switching points, or adding new switching points equipped with telecontrol. This section is effectively a checklist of the issues that must be considered when reviewing potential telecontrol points.

3.1 Suitability of Existing Switchgear

Much of the ground mounted switchgear on the 11kV network is in excess of 20 years old and was not designed with telecontrol in mind. However with the expansion of telecontrol installations in recent years, retrofit solutions have been developed for some switchgear types to allow telecontrol to be added.

Typical types of switchgear that have been identified as existing at current Normally Open Points on the SPD and SPM networks include:

- South Wales C4X oil filled CB, South Wales HG12 gas filled CB, South Wales IF4X oil switch.
- GEC/AEI BVRP17 oil filled CB, GEC/AEI IB5 oil switch.
- Yorkshire IVIO oil filled CB, Yorkshire RN2 gas filled RMU.
- English Electric T3OF oil filled RMU.
- Reyrolle C7 oil filled CB, Reyrolle ROS oil switch.

- Merlin Gerin SE6 gas filled switch, Merlin Gerin CE6 gas filled CB, Merlin Gerin RN2C gas filled RMU.
- Long & Crawford J3 oil switch, J4 oil switch, T3GF3 oil filled RMU, T4GF3 oil filled RMU.

For the above switchgear, there are some that can be tele-controlled with the use of actuators, shown in the table below:

Actuator	Manufacturer/Supplier	Product still available?	Approx. Unit Cost (£k)
Rotary RN2C & auxiliary switch kit	Groupe Schneider	Yes	0.5
SE6/CE6 Linear	Groupe Schneider	Yes	0.25
Double T3/4GF3 Linear	Lucy	Yes	1.0
J3/J4 Linear	Lucy	Yes	0.75
Double Yorkshire RN2	EPDL	Yes	2.0
Double Merlin Gerin RN2	EPDL	Yes	2.0
SE6 Linear	EPDL	Yes	1.0
Double T3/4GF3 Rotary	EPDL	Yes	2.0

The RN2C RMU is the only switchgear that can be readily tele-controlled, hence the low cost of the equipment used to do so.

There is only one variant of the SE6/CE6 type that can be readily tele-controlled – this variant will have a small socket on the facia plate of the switch. The front cover of the readily tele-controllable SE6/CE6 should be around 3 inches in depth, which makes it able to house a fitted actuator. The other versions of this switchgear do not have the aforementioned socket and the front cover is only around 1.5 inches in depth and these versions can only be tele-controlled using bespoke actuators.

All other options shown in the table above (Lucy & EPDL options) are bespoke actuators, specially made for the type of switchgear, hence the greater cost. To our knowledge, these options are still available.

Where an retrofit telecontrol is not available, consideration can be given to replacing the switchgear with a modern equivalent equipped for telecontrol.

3.2 Suitability of Switchgear Enclosure

The enclosures of existing ground mount switchgear must be checked to ensure the dimensions are sufficient to accommodate telecontrol equipment. Where outdoor switchgear is not currently enclosed, consideration must be given to installing an enclosure, including the civil works required for a foundation.

3.3 Communications

In order to telecontrol a switching point it is necessary to have communications with it. On the 11kV secondary network this would typically be radio communications from the switching point to a data concentrator at a primary substation or other location.

In order to confirm that a radio communications path is available it is normally necessary to undertake a desktop and/or site survey to verify the signal strength over the link and identify any requirement for radio repeaters.

3.4 Data Concentrator Capacity

As discussed above, communications with secondary network telecontrol points is normally via data concentrators in a local primary substation. It is necessary to confirm that the data concentrator has sufficient spare capacity. This can be an issue with the previous generation of data concentrator installed on the SPD and SPM networks.

3.5 LV Supply

As an LV supply is required to power the telecontrol equipment it is necessary to survey the site to determine how this will be obtained. For example there may be an existing supply within the existing building or enclosure, or it may be possible to obtain a supply from an adjacent LV fuseboard or pillar. Alternatively it may be necessary to install a new pole mounted transformer to obtain a supply.

4 Implementation

Implementation of the telecontrol installation will normally require the use of specialist internal resource or specialist contractor. The detail of the activities will vary in accordance with the manufacturer and type of equipment being installed. The generic activities are typically as follows: -

- Installation of telecontrol equipment
- Pre-commissioning (installation check and connection of LV power etc.)
- Radio communications check
- Commissioning (including mapping of inputs and outputs)
- SCADA build (configuration of new point on NMS)
- End to end check (ETEC) of functionality

5 Appendix 1 Site Survey Sheet

Primary Substation Name					
Circuit No					
Secondary Substation Name					
Switchgear Type & Model					
If RN2, Which Variant?	MG	Yorkshire	N/A		
If L+C, Island Gland Present?	Yes	No			
If Yes, which panel(s)?	1	2	3	4	5
If L+C, Will Act'r Control Box fit? (i.e. Inspection Hatch Mod. Req'd)	Yes	No			
Substation Mid-point / NOP	Mid-point	NOP			
Enclosure Description	GRP	Brick	Outdoor		
If Existing, Dimensions					
If Outdoor, Enclosure Type Req'd	GRP	Pre-fab Concrete (i.e. <1m fence clearance)			
Proposed RTU Position	LHS	RHS			
LV Supply	TOC	S/S Pillar	Skeltag	Other	None
If Other, State (e.g. 13A Socket)					
If Skeltag, Will Busbar Clamp Fit?	Yes	No			
If Pillar, Will Fuse Carrier Fit?	Yes	No			
Is HV/LV Earth Linked?	Yes	No			
Is An LV Dig Required?	Yes	No			
If Yes, State Ground Conditions (e.g. Will a Channel Need to Be Cut?)					
Substation Access	Road	Field	Private		
Any Site Hazards Identified	Yes	No			
If Yes, Detail					
Any Further Comments					