National Grid Response to Wraxall & Failand Parish Council Comments to NG response to the "NEUMANN Report"

September 2013

1.0 Introduction

1.1 On Friday 23rd August, National Grid received "Comments to National Grid's response to Neumann Report" dated 17-08-2013.

1.2 The paper raises a number of queries on National Grid's previous response to the "Neumann Report" and covered three main themes:

- Circuit Ratings & Capacity Requirements;
- Data Associated with GIL, and
- Technology Cost Data.

1.3 This response deals with each theme in turn.

2.0 Circuit Ratings and Capacity Requirements

2.1 Firstly, National Grid will restate the load flow requirements underpinning its assessment. These load flows have been calculated using a full power flow analysis model, the principles of which we assume Professor Neumann is familiar.

1. The average pre-fault load flow on the Hinkley-Seabank circuits is assumed to be 2.18GW (1.09GW per circuit) which equates to 1570A per phase and 785A per conductor.

2. The worst-case post-fault load flow on the Hinkley-Seabank circuits is assumed to be 3GW which equates to 4330A per phase and 2165A per conductor.

2.2 The worst-case post fault load flow is seen during WINTER. This is because during summer periods, if a double circuit fault occurs during the maintenance of another circuit (loss of 3 circuits) 1800MW of generation is allowed to be tripped from the system.

Tripping of generation is only allowed for outage conditions and set out within the NETS SQSS[1]. Further, other gas-fired generation would not be considered economic to run during summer periods therefore overall load requirements are not as high. Even though the nuclear units will be considered running, other generation not running in the area lowers load requirements below 2800MVA. This is explained in more detail in our project Need Case[2].

2.3 As we have already stated National Grid has a number of two conductor systems capable of such capacity, with the preferred conductor type described below: -

- Post Fault ratings 2 x 850mm (redwood) AAAC conductor 90º operations
- Winter Rating 3190 MW (4600 A)
- Spring/Autumn Rating 3060 MW (4420 A)
- Summer 2850 MW (4120 A)

2.4 Note that these post-fault ratings have sufficient capacity to meet the needs of the generator connections and provide some margin for future requirements. These overhead lines, strung with 2x850mm conductor at 90 degrees, meet the ratings specified to manufacturers for our conductor requirements on L12 pylons. Previous information provided gave the maximum currents each of these ratings relates to. This was not the requirement for the scheme, which is 3GW WINTER rating, but the maximum capabilities of the conductor system proposed.

2.5 The manufacturer ratings sheet provided within "Comments to National Grid's response to Neumann Report" appears to be generic and we would surmise that they reflect pre-fault continuous ratings at minimal clearances, not to specific pylon design or ground clearance requirements. As quoted in our response once again these circuits are in service and operating to these requirements on the National Grid transmission system.

[1] http://www.nationalgrid.com/uk/Electricity/Codes/gbsqsscode/DocLibrary/
[2] http://nationalgrid.opendebate.co.uk/files/Need_Caset.pdf

2.6 Professor Neumann also contends that a cable solution would require 3 cores per phase to meet required ratings. Fig 4 in Professor Neumann's report was difficult to read and we incorrectly assumed it showed a HDD (Horizontal Directional Drill) cable design. Nevertheless, National Grid is certain that two cables per phase meet the required rating for the proposed route.

2.7 National Grid's requirement is that a cable meets the required post-fault rating for 24hrs from a pre-fault condition.

2.8 Cable ratings have a thermal cycle capability due to their thermal inertia and slower thermal expansion which provides for enhanced post-fault ratings. These are more than sufficient to meet the NETS SQSS requirements and re-secure the network with out loss of supply. This is standard operational practice, not only across the UK electricity transmission and distribution sector, but amongst transmission companies we have worked with elsewhere in the world.

2.9 Matching cables ratings with post fault overhead line ratings would be an over-investment on the transmission system and would fail to utilise the thermal cyclic capability.

2.11 In summary, our proposed design meets the requirements of the power system and the planning & operational standards set out in the NETS SQSS.

2.12 Appended to this report (Appendix A), is information from National Grid's operational circuit data sheets, showing their post fault operational performance. The first is an overhead line circuit with sections operating with post fault continuous ratings set out for 2 x 850mm (redwood) AAAC conductor 90º operations. The second is a circuit which contains a cable section with 2 x 2500mm 400kV cables which operate within the post fault ratings also required by this project.

3.0 GIL Data

3.1 National Grid did understand the premise of 57km GIL installation, we are clarifying that there are many 1000's kms of underground cable installed each year worldwide. There is also a large available resource of contractors and manufacturers with trained staff to install cable and therefore the skill and capacity to deliver a large scale project is likely to be available. GIL installations being limited would face different challenges to scale up. Specialist training would be required, as resources are not available and have not been required on such a scale. Therefore scaling up to 57km of GIL would incur higher costs than other alternatives to deliver. These costs are not captured in the assumptions within the Neumann report, hence our comment about the conclusions drawn.

3.2 We do agree that installation over large distances, such as 57km, would be challenging for either underground technology.

4.0 Transmission Cost Data

4.1 Regarding maintenance costs, National Grid offered a view that OHL maintenance differences could be explained by different maintenance periods and differences in ownership, as the figure quoted is significantly higher than our cost. Our figures are consistent with our submission to Ofgem, on which maintenance allowances are based, and they have also been used in our Strategic Option Reports. It is not in National Grid's interest to understate these costs as the operating cost allowances for maintenance of overhead lines would not cover costs. In any case, all analysis, National Grid, IET and Professor Neumann show NPV maintenance costs to be by far the smallest proportion of cost, and variances have very insignificant impact on whole-life costs compared to losses and capital costs.

4.2 It is noted that National Grid and IET cost figures are not the same. The IET undertook an independent assessment using bespoke analysis and cost data. For example, the IET maintenance costs are different from our own and informed by different practices world wide. National Grid has undertaken a review of the IET Report and concluded that although there are differences in detail the outcomes were generally consistent with our view. Our economic methodology appended to the Strategic Option Reports produced for all of our Major Infrastructure projects, refers to comparable elements within the IET report.

4.3 Regarding the use of ratios, National Grid has specifically followed advice from the IET report, not to compare technologies using ratios or percentages, but to present actual costs. We would be happy to receive all information in actual £GB costs, with assumptions around, tender costs, transmission company on-costs, NPV and exchange rates. Such information would allow true comparison to actual costs set out in National Grid documentation and the IET report. Currently it would be impossible to derive such information from the Neumann Report.

5.0 Summary

5.1 National Grid has many years of experience designing, operating and owning electricity transmission circuits, both in the UK and US. Our processes and procedures are developed, updated and enhanced using this vast experience. We are recognised as a world leader in transmission ownership of both gas and electrical systems, with many engineers recognised as world experts in their fields. These engineers actively engage with a number of national and international committees/bodies, while continually keeping up to date with technology developments. National Grid's wealth of knowledge and operational experience is utilised when responses are prepared to technical queries raised by stakeholders.

Appendix A: – Part 1, Highlighted operational post fault ratings of circuit sections of 2 x 850mm (redwood) AAAC conductor 90º operations.

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Branch Items used in Rating Calculation

Season	Item Details	Eqpt Type Description	Post Fault Continuous/Trip MVA
All	MPT	GRL 100-212W	3330
All	MPT	REZ 1Amp	4160
All	MPT	7SS520	3320
All	MPT	DCD324A	3330
All	Prot(Trip)	DCD114	4711
Winter	CIRB	AR SPD2 (A18)	3750
Winter	CONS	VA Tech YGIII	3340
Winter	OHL	2x850 AAAC 90C 3.12R	3160
Winter	OHL	2x850 AAAC 90C 3.05R	3190
Winter	OHL	3x700 AAAC 90C 3.05R	4210
Winter	OHL	4x400 ACSR 75C	3420
Winter	TRAP	Trench LTF 0;2\4000\161S	3740
Spring&Autumn	CIRB	AR SPD2 (A18)	3540
Spring&Autumn	CONS	VA Tech YGIII	3160
Spring&Autumn	OHL	2x850 AAAC 90C 3.12R	3030
Spring&Autumn	OHL	2x850 AAAC 90C 3.05R	3060
Spring&Autumn	OHL	3x700 AAAC 90C 3.05R	4050
Spring&Autumn	OHL	4x400 ACSR 75C	3260
Spring&Autumn	TRAP	Trench LTF 0;2\4000\161S	3630
Summer	CIRB	AR SPD2 (A18)	3330
Summer	CONS	VA Tech YGIII	2970
Summer	OHL	2x850 AAAC 90C 3.12R	2820
Summer	OHL	2x850 AAAC 90C 3.05R	2850
Summer	OHL	3x700 AAAC 90C 3.05R	3770
Summer	OHL	4x400 ACSR 75C	2980
Summer	TRAP	Trench LTF 0;2\4000\161S	3510

Appendix A: – Part 2, Highlighted operational post fault ratings of circuit sections of 2 x 2500mm cable sections.

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Branch Items used in Rating Calculation

Season	Item Details	Eqpt Type Description	Post Fault Continuous/Trip MVA
All	MPT	Standard Protection Thermal Rating (NICAP) 40	3330
All	Prot(Trip)	Standard Protection Thermal Rating (NICAP) 40	5265
Winter	BB	Al 140mmODx10(4000A)	3650
Winter	BUSH	Generic 4000A	3340
Winter	CABLE	A801 Cable	3000
Winter	CIRB	AR SPL2\1A (A19)	3580
Winter	CIRB	GEC Frame 'R' (A3)	4330
Winter	CT	GEC TR36 (C5)	3580
Winter	DISC	CEGB 4000A RCP (B1)	4120
Winter	DISC	AEI RCP 4000A (B1)	4120
Winter	OHL	4x400 ACSR 50C	2780
Winter	OHL	2x850 AAAC 75C 3.12R	2860
Spring&Autumn	BB	Al 140mmODx10(4000A)	3460
Spring&Autumn	BUSH	Generic 4000A	3160
Spring	CABLE	A801 Cable	3000
Spring&Autumn	CIRB	AR SPL2\1A (A19)	3380
Spring&Autumn	CIRB	GEC Frame 'R' (A3)	4120
Spring&Autumn	CT	GEC TR36 (C5)	3360
Spring&Autumn	DISC	CEGB 4000A RCP (B1)	3900
Spring&Autumn	DISC	AEI RCP 4000A (B1)	3900
Spring&Autumn	OHL	4x400 ACSR 50C	2570
Spring&Autumn	OHL	2x850 AAAC 75C 3.12R	2720
Summer	BB	Al 140mmODx10(4000A)	3260
Summer	BUSH	Generic 4000A	2970
Summer	CABLE	A801 Cable	2800
Summer	CIRB	AR SPL2\1A (A19)	3180
Summer	CIRB	GEC Frame 'R' (A3)	3900
Summer	CT	GEC TR36 (C5)	3130
Summer	DISC	CEGB 4000A RCP (B1)	3660
Summer	DISC	AEI RCP 4000A (B1)	3660
Summer	OHL	4x400 ACSR 50C	2220
Summer	OHL	2x850 AAAC 75C 3.12R	2490
Autumn	CABLE	A801 Cable	2800