

National Grid Bramford to Twinstead Connection Project
Proposed Distribution System Connection and Substation -
Supplementary Information

1.0 Introduction

- 1.1 National Grid is currently undertaking pre-application consultations about proposals for a new 400kV connection between Bramford substation in Suffolk and Twinstead Tee in Essex. Through consultations already undertaken, the preferred option identified for the new 400kV connection involves taking down a section of 132kV line between Twinstead Tee and Burstall Bridge.
- 1.2 In February and March 2013 National Grid carried out further consultations about options to keep local people supplied with power when the 132kV line is removed. This supplementary information has been prepared by National Grid and UK Power Networks in response to questions raised during those consultations.
- 1.3 The original options considered for the removal of the 132kV overhead line between Burstall Bridge and Twinstead Tee were outlined in:
- UK Power Networks – “132kV network reconfiguration to accommodate wider system works” (July 2012)¹
 - National Grid – “Distribution System Options Report” (February 2013)²
- 1.4 Three of those options have prompted questions of clarification through the consultation process. These options are: -

¹<http://www.ukpowernetworks.co.uk/internet/asset/2cbd9b6e-c947-47a9-b288-6e44aa6a670K/132kV-network-reconfiguration-to-accomodate-wider-systems-works-July-2012.pdf>

² <http://www.nationalgrid.com/NR/rdonlyres/7F416288-3D96-41AC-91FC-45D43787A3E2/58949/DistributionSystemOptionsReport.pdf>

- Option 2 - "Replace 132kV circuits between Twinstead and Burstall Bridge by underground circuits"
- Option 5.1.2 - "132kV Braintree – Rushley Green (new 132kV underground circuits)"
- Option 6 - "New Grid Supply Point west of Twinstead"

1.5 Both UK Power Networks and National Grid have taken the opportunity to review these options. This supplementary information seeks to further clarify these options and to provide a response to the questions raised during the consultation process.

1.6 This supplementary information will: -

- Provide further descriptions of the three options;
- Review options; and
- Draw final conclusions.

2.0 Option 2 "Replace 132kV circuits between Twinstead and Burstall Bridge"

2.1 As shown in Figure 2.1 below, option 2 comprises the construction of two new 132kV cable circuits between Twinstead Tee and Burstall Bridge. The capital cost of the underground cables alone for this option would be £45.3m. In addition, this option would require the reconfiguration of the Bramford to Lawford 132kV circuits, which would add a further £12.5m capital cost, giving a total capital cost for Option 2 of £57.8m. The two other options described in this supplementary information (option 5.1.2 and Option 6) do not have additional capital cost commitments associated with them.



Figure 2.1 Simplified Schematic for Option 2

- 2.2 Previously, the UK Power Networks report and National Grid's subsequent Distribution System Options Report, which set out how National Grid had considered the options to replace the 132kV line, quoted a total capital cost of £103m. That included an additional £45m of planned UK Power Networks switchgear replacement expenditure at Bramford. This is work UK Power Networks is already proposing to undertake to maintain secure supplies to the Belchamp area by transferring Belchamp Grid to Bramford Grid Supply Point (a Grid Supply Point is a substation where UK Power Networks takes energy from National Grid at 400kV and steps it down to 132kV for distribution locally).
- 2.3 Currently Belchamp Grid is fed via the Pelham/Wymondley Main substation group. Transferring to Bramford would resolve a P2/6 compliance issue within that group and under Option 2, these 132kV circuits would be needed to supply Belchamp Grid from Bramford Grid Supply Point. UK Power Networks' current business plan has allowed for £45m of switchgear replacement associated with the transfer of Belchamp Grid and reinforcement works at Bramford to accommodate the increase in demand.
- 2.4 Taking into account existing works within UK Power Networks' business plan, total works associated with Bramford reinforcement

would be £57.8m directly associated with circuit replacement and £45m of UK Power Networks business plan activity, giving a total spend on the Bramford distribution group of £103m in total.

- 2.5 Option 2 retained the existing 132kV overhead line supplying Belchamp Grid from Twinstead Tee and did not therefore involve any changes to the existing 132 kV overhead line circuits between Twinstead Tee and Rushley Green, which would remain.
- 2.6 During consultation, some respondents also questioned costs associated with 132kV cable installations. However, the evidence cited related to contractor installation only costs for a much smaller capacity, single 132kV cable circuit between Norwich and Earlham. Option 2 and Option 5.1.2 would each require two higher capacity 132kV cable circuits and installing cables such as these, involves additional costs over and above contractor installation costs. For example, the costs for such projects include network design, project management, corporate governance, financing, testing, commissioning, etc. These costs associated with projects, also need to be recovered by infrastructure companies. Such costs described above would not be captured on a contractor's tender price. Any comparison therefore needs to consider appropriately rated equipment and quantity of circuits.
- 2.7 The same respondents raised concerns that infrastructure companies such as National Grid and UK Power Networks inflate their costs associated with projects. Both National Grid and UK Power Networks are licensed utilities under the Electricity Act 1989 and are subject to regulation by the Office of Gas and Electricity Markets (Ofgem). Ofgem undertake regular price reviews of both companies regulated business activities. This includes rigorous scrutiny of each company's unit costs associated with the delivery of infrastructure schemes, including underground cabling. Therefore both National Grid and UK Power Networks, within their respective reports, have produced costs based upon those which

are submitted for regulatory submissions. If such costs were inaccurate, Ofgem would make reference to the fact unit costs were too high during price reviews and set lower allowances.

- 2.8 In summary, the capital cost associated with Option 2, cabling between Twinstead Tee and Burstall Bridge, would be £57.8m, including the reconfiguration of the Bramford to Lawford 132kV circuits. Taking into account any future maintenance, fault repair work and the cost of electrical losses (where some electricity is lost from cables through heat), during the anticipated life of the new infrastructure, this would equate to a lifetime cost of £63.3m.

3.0 Option 5.1.2 “132 kV Braintree – Rushley Green (new 132 kV Underground Circuits)”

- 3.1 As shown below in Figure 3.1, Option 5.1.2 comprises the construction of two new 132kV cable circuits between the existing substation at Braintree and Rushley Green. The capital cost of the two new 132kV underground cable circuits needed for this option would be £30.4m. In addition there would be reinforcement costs at Braintree.

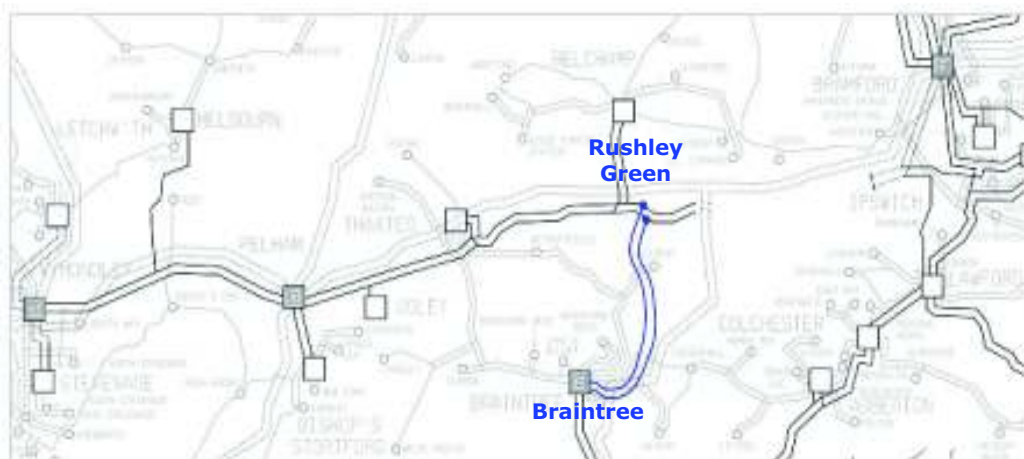


Figure 3.1 Simplified Schematic for Option 5.1.2

- 3.2 Option 5.1.2 would require a new Supergrid Transformer (SGT) at Braintree because, under this option, UK Power Networks would need to transfer the Belchamp Grid demand away from the Pelham/Wymondley main substation group to Braintree (instead of to Bramford as currently planned). In addition, Braintree 132 kV substation is not of sufficient size and does not have connections available for the new cables and as such, would also require modification. A cost of £32m was originally identified for these substation modifications.
- 3.3 National Grid regularly reviews its options responding to changed circumstances and suggestions made through consultation. As part of this process National Grid has reconsidered the design proposed for additional SGTs at Braintree.
- 3.4 The existing Braintree substation is of a “Double Tee” design (shown in Figure 3.2 below), which means that the existing SGTs are connected by a spur directly to the circuit. For the requirements of the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS), it is only possible at Braintree to have two SGTs in this configuration.

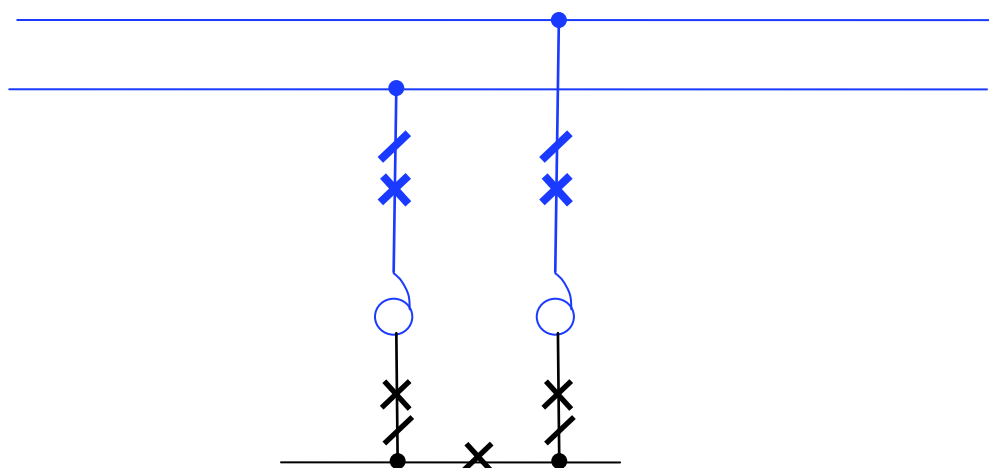
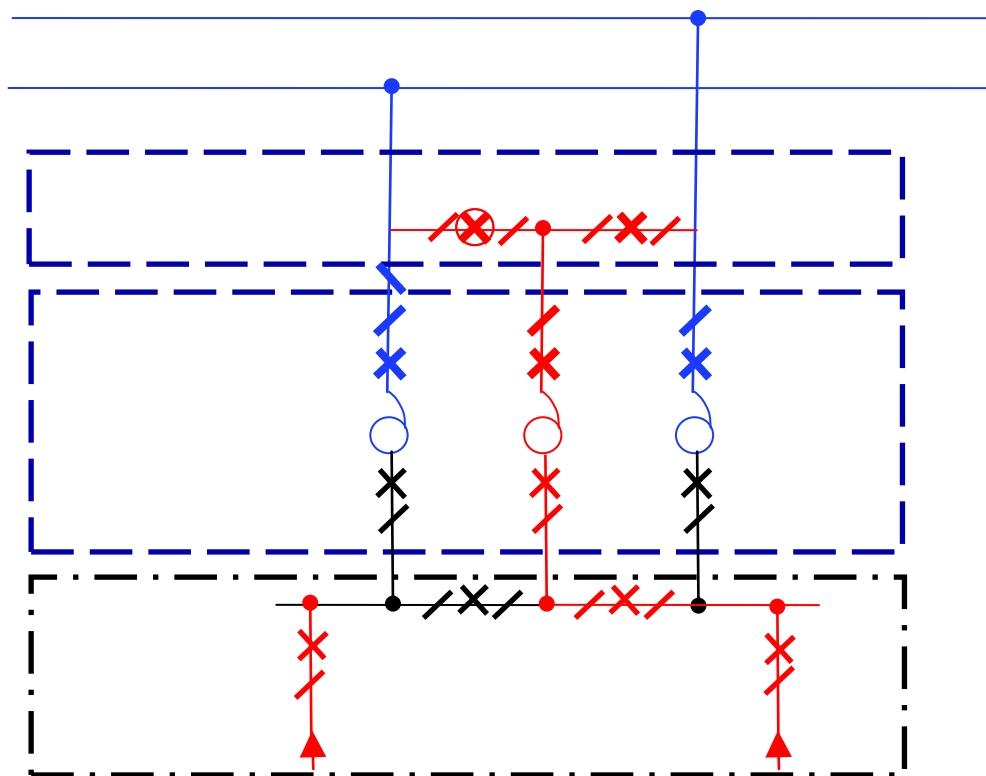








Figure 3.2 Single Line Schematic – Existing Braintree Substation

3.5 To enable a new SGT to be installed, to ensure the system remains reliable and secure following any transfer of the Belchamp Grid demand to Braintree, National Grid has given further consideration to the minimum design that could facilitate the connection, as shown in figure 3.3 below.

Figure 3.3 Single Line Schematic - Minimal 3rd SGT design Braintree



Key

-  Transformer
-  Circuit breaker
-  Disconnector
-  Black indicates existing 132,000 volt assets
-  Blue indicates existing 400,000 volt assets
-  Red indicates new assets

- 3.6 This design would allow the costs of works at Braintree to reduce from £32m to £20m, by reducing the flexibility of the site and using a minimal mesh substation design. This would give revised capital costs associated with Option 5.1.2 of £30.4m for cable circuits and substation cost of £20m, totalling £50.4m.
- 3.7 Whilst the current substation layout at Braintree could not be easily extended to accommodate the alterations that are needed, National Grid has additional operational land at Braintree, which could accommodate the modifications.
- 3.8 This £50.4m cost is the minimum delivery cost for a NETS SQSS compliant connection to be made a Braintree substation and cables circuits feeding Rushley Green. Taking into account any future maintenance, fault repair work and the cost of electrical losses (where some electricity is lost from cables through heat), during the anticipated life of the new infrastructure, this would equate to a lifetime cost of £57.8m.

4.0 Option 6 “New Grid Supply Point west of Twinstead”

- 4.1 As shown in Figure 4.1 below, option 6 comprises the construction of a new substation to the west of Twinstead Tee. This option originally identified UK Power Networks’ capital costs of up to £3.6m and National Grid new substation capital costs of £30.4m, totalling £34m in capital cost.



Figure 4.1 Simplified Schematic for Option 6

- 4.2 As part of the substation consultation, some respondents commented that National Grid and UK Power Networks had understated the cost of this substation by reducing the requirement to a single SGT. This is not the case, as the cost information provided was based on the inclusion of two SGTs in the new substation, to replace the capacity which would be lost by the removal of the 132kV overhead line between Burstall Bridge and Twinstead Tee. It was made clear during the substation consultations that in fact, upon further analysis, only one SGT in this location would be sufficient to supply demand in the area based on the current UK Power Networks forecasts to 2021 and its current system running arrangements. The cost information was not however amended to reflect that change, instead remaining consistent with costs previously quoted by UK Power Networks and National Grid³ for comparative purposes.
- 4.3 National Grid is clarifying with this supplementary information that the proposed single SGT substation would have capital costs of £22.5m. With additional UKPN capital costs of up to £3.6m, the total capital cost of Option 6 would be £26.1m. Taking into account

³ <http://www.nationalgrid.com/NR/rdonlyres/F50A1521-D755-4116-A787-E623F77D196E/47714/BTReviewofStrategicOptionsReportJune2011.pdf>

any future maintenance, fault repair work and the cost of electrical losses (where some electricity is lost from cables through heat), during the anticipated life of the new infrastructure, this would equate to a lifetime cost of £27.6m.

5.0 Conclusions

5.1 National Grid and UK Power Networks have reviewed the options to maintain local electricity supplies when an existing 132kV overhead line is removed between Twinstead Tee and Burstall Bridge. The review has been undertaken in response to questions raised during National Grid’s substation consultations in February and March 2013. As part of this process National Grid has reconsidered the substation modifications that would be needed under Option 5.1.2 at Braintree. This supplementary information has been prepared to clarify the capital costs associated with the three options (Option 2, Option 5.1.2 and Option 6) that were the subject of specific cost and technical questions during consultation.

5.2 Table 5.1 below, sets out the capital and lifetime costs of the 3 options clarified within this supplementary information.

Option	Capital Cost	Committed Capital Cost	Total Capital Cost	NPV Loss and Maintenance Cost	Total Lifetime Cost
Option 2 - "Replace 132kV circuits between Twinstead and Burstall Bridge"	£45.3m	£12.5m	£57.8m	£5.5m*	£63.3m
Option 5.1.2 - "132kV Braintree – Rushley Green (new 132kV UG circuits)"	£50.4m		£50.4m	£7.4m*	£57.8m
Option 6 - "New Grid Supply Point west of Twinstead"	£26.1m		£26.1m	£1.5m^	£27.6m

Table 5.1 – Option Capital Cost

(*NPV cost from Table 10 page 66 of Distribution System Options Report)
 (^ ½ NPV costs, due to single SGT requirement from table 10 page 66 of Distribution System Options report)

5.3 As shown in the table 5.1 Option 6 “New Grid Supply Point west of Twinstead Tee” remains the lowest capital and lifetime cost connection. Both UK Power Networks and National Grid have an obligation to deliver the most efficient, coordinated and economical infrastructure while having regard to our environmental duties under schedule 9 of the Electricity Act 1989. National Grid has provided a full appraisal of these options within its Distribution System Options Report and Substation Siting Report which remains relevant to this supplementary information provided.

5.4 On the basis of the above information and analysis undertaken in the:

- UK Power Networks – “132kV network reconfiguration to accommodate wider system works” (July 2012);
- National Grid – “Distribution System Options Report” (February 2013);
- National Grid - “Substation Siting Options Appraisal (February 2013)⁴; and
- this supplementary information,

both UK Power Networks and National Grid regard the option of a new substation to the west of Twinstead as being the most appropriate solution for replacement of UK Power Networks’ capacity following the removal of the existing 132 kV circuits between Twinstead Tee and Burstall Bridge.

⁴ <http://www.nationalgrid.com/NR/rdonlyres/CBE163AE-2C8B-4F19-9713-410C6239C6FC/58950/SubstationSitingOptionsAppraisal.pdf>