

## **ENERGY ADVISORY COMMITTEE**

### **Loss of Electricity Supply Incident Affecting Parts of South London on 28 August 2003**

#### **Introduction**

This paper informs members of the investigation findings by the National Grid Company plc (National Grid) concerning the loss of electricity supply incident that affected parts of South London on Thursday, 28 August 2003<sup>1</sup>.

#### **Background**

2. National Grid, the sole holder of an electricity transmission licence for England and Wales, owns and operates the transmission system (at 400kV and 275kV) for delivery of electricity from power stations and interconnectors<sup>2</sup> to the regional distribution networks (at 132kV and below), which are owned and operated by 12 regional distribution companies for local distribution of electricity to over 24 million consumers. The peak demand on the England and Wales transmission system is around 54,400 MW.

3. EDF Energy is the licensed distribution network operator for the Greater London area, which represents about 20% of the total transmission system demand in England and Wales. The transmission system in South London includes four substations at Wimbledon, New Cross, Hurst and Littlebrook, where normal demands of around 1,100MW are drawn by EDF Energy to supply domestic customers and London Underground, together with supplies for other large users including NetworkRail.

#### **The Incident**

4. A combination of events led to an electricity supply failure in South London that occurred at 18:20 on Thursday, 28 August 2003, disconnecting 724 MW of power supplies from National Grid's transmission system to EDF Energy's distribution network. The loss of supply affected some 410,000 of EDF Energy's customers in South London areas. The impact of the incident was exacerbated by the significant disruption to the underground and railway transport services, which was reported to trap more than 250,000

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<sup>1</sup> Based on the investigation report released by National Grid on 10 September 2003.

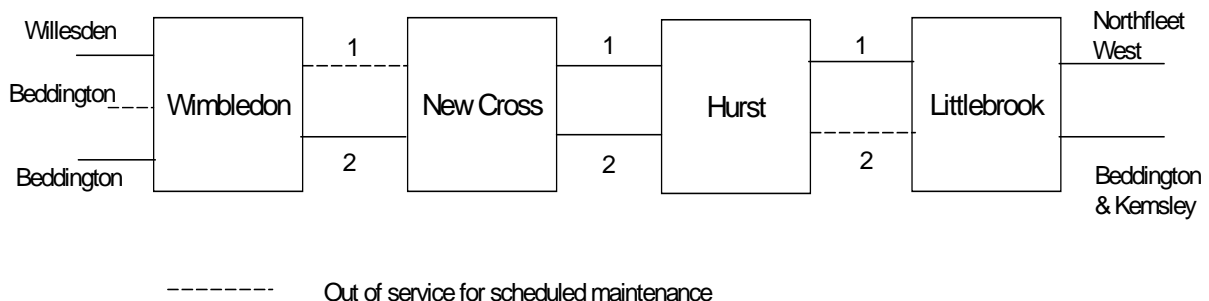
<sup>2</sup> The transmission grid of England and Wales is interconnected with that of France and Scotland.

people on the way home after office hours. This is the largest loss of supply from National Grid for over 10 years. The investigation findings of the incident were subsequently summarised in a report released by National Grid on 10 September 2003.

## Sequence of Events

### *Maintenance activities before the incident*

5. On 28 August 2003, scheduled maintenance was underway on transmission circuit 1 from Wimbledon substation to New Cross substation, and also on transmission circuit 2 from Littlebrook substation to Hurst substation (see Figure 1). This level of maintenance is not uncommon during the summer months, when demand for electricity is generally lower. The arrangements for the transmission system to accommodate the said maintenance activities had been agreed well in advance with all parties concerned during July 2002. EDF Energy had confirmed that it could arrange its distribution system to securely accommodate the outage of these transmission circuits throughout the maintenance period.



Related Transmission System of South London  
Figure 1

### *The first fault*

6. The sequence of events started at 18:11, when the engineers at the National Grid Control Centre received an alarm indicating that a transformer or its associated shunt reactor at Hurst substation was in distress and could fail. Due to the potentially significant safety and environmental impacts arising from the possible transformer failure, the Control Centre initiated a switching sequence to disconnect the problem transformer from the transmission system.

This switching sequence required the temporary switching off of transmission circuit 1 from Littlebrook substation to Hurst substation. This enabled a safe shutdown of the transformer which had suffered the alarm, but left only a single transmission circuit from Wimbledon substation to feed both New Cross and Hurst substations.

### *The second fault*

7. The switching sequence to remove the transformer began at 18:20, disconnecting Hurst substation completely from Littlebrook substation. Unexpectedly, a few seconds after the switching, the automatic protection equipment on transmission circuit 2 from Wimbledon substation to New Cross substation operated, interpreting the changes in power flow due to the switching as a fault on the circuit. This resulted in the disconnection of New Cross substation, Hurst substation and part of Wimbledon substation from the rest of the transmission system, causing the loss of supply. 724 MW of power supplies were lost, amounting to around 20% of total London supplies at that time.

### *Restoration*

8. Through extensive operational communications between National Grid and EDF Energy, restoration actions began at 18:26 and overall supplies to all affected substations were restored at 18:57. Although the power supplies from National Grid's transmission system were restored in 37 minutes, the various services to the public returned to normal in different timescales and in different ways.

## **Investigation Findings**

9. While there were other bodies of opinions that the blackout may be due to the lack of investment and maintenance resulting from the introduction of performance-based regulation to the electricity supply sector upon reforming the UK electricity market, National Grid stated in their report that there has been a considerable investment programme in the transmission system in and around London and this programme is set to continue at a high level in future years. National Grid's investigation findings confirmed that the transmission system arrangements and the communication with EDF Energy regarding the maintenance activities prior to the incident complied with the relevant planning standards and operating procedures. The planning of maintenance works had

been carried out in accordance with National Grid's policies and hence the maintenance works could not be regarded as a cause of the incident.

10. The main reason that caused the fault to occur appears to point to an incorrect protection relay (a 1-ampere rated relay instead of a 5-ampere rated relay) installed when old equipment was replaced in 2001. This incorrect installation was not discovered regardless of extensive quality control and commissioning procedures. The actions to remove the problem transformer in Hurst substation from the transmission system did not directly contribute to the cause of the incident. The consequential changes in power flow were within operational limits but it initiated the operation of the said protection relay, which was the direct cause of the incident. National Grid did not expect their actions in configuring and switching the transmission system to remove the transformer in question would have caused such a major loss of supply.

### **Follow-up Actions**

#### *a) by National Grid*

11. National Grid has reviewed its part in the incident and will be working with other parties to identify necessary improvements to the systems or procedures. In this connection, National Grid will:

- (i) work closely with other network operators to identify improvements with the view to enhancing the overall security of electricity supplies, particularly to city centres and transport systems;
- (ii) work closely with relevant parties to set up improved and more responsive communications in the event of major loss of supply;
- (iii) urgently survey all installations as a further check on the integrity of the automatic protection equipment;
- (iv) carry out further comprehensive investigation covering all aspects of the management of the protection systems so as to eliminate, as far as possible, the risk of incorrect installation or operation of automatic protection equipment; and

- (v) review operational procedures, and control room systems, including alarm presentation, in close consultation with the regulator and other associated parties, to ensure that there is the right balance between safety risks and supply security.

*b) by the Regulatory Authority*

12. National Grid and the electricity distribution companies are required by law to develop and maintain an efficient, coordinated and economical system of electricity transmission, in addition to meeting specified technical standards. Pursuant to the Electricity Act 1989 (as amended by the Utilities Act 2000), the regulatory authority (Ofgem) has the powers to impose financial penalties on companies found to be in breach of their licences. With the release of investigation report by National Grid, Ofgem will, in conjunction with the Department of Trade and Industry, investigate to see whether the National Grid and/or the distribution companies concerned might have breached their legal obligations. This further investigation by Ofgem is expected to be completed by the end of this year.

**Observations**

13. While National Grid's investigation found no evidence that any part of the commissioning process had been omitted, there is however evidence that the rating of the automatic protection equipment (that was included on the documentation used for commissioning) could have been more clearly set out, and hence visible to the commissioning engineers in checking the correctness of protection equipment used.

14. The investigation found that the configurations of the transmission and distribution systems were not contributory factors to the incident. However, a more rapid implementation of post-fault actions or alternative configurations could have mitigated the overall impact of the incident, reducing the duration and perhaps the scale of loss of supply.

15. London's experience could be a useful reminder of how things could go wrong even when the system design and procedures were properly devised.

**Advice Sought**

16. Members are invited to note the content of the paper.

Economic Development and Labour Bureau  
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