



**NGC REPORT  
ON THE TENDER**

**for the**

**2000/2001 STANDING  
RESERVE SERVICE**

**NATIONAL GRID COMPANY**

**Report Issued May 2000**

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Prepared by  
Transmission Services  
National Grid Company Plc  
National Grid House  
Kirby Corner Road  
COVENTRY  
CV4 8JY

## INTRODUCTION

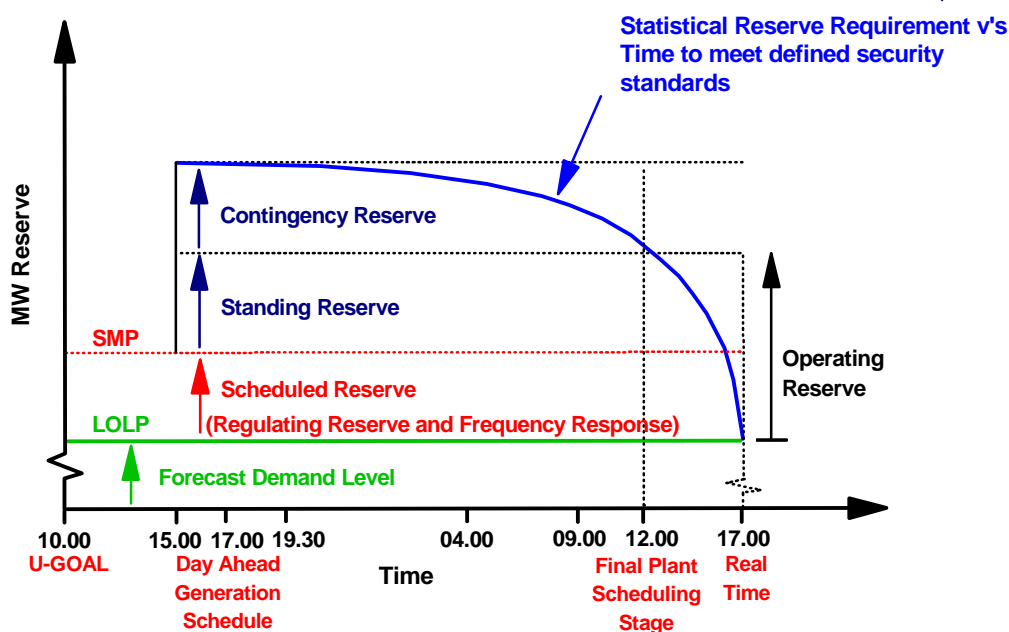
1. This report describes the tenders received and the subsequent selection process that led to Standing Reserve contracts being struck for the financial year 2000/2001.
2. Since the financial year 1993/4, at the request of the Electricity Pool of England and Wales, The National Grid Company Plc (NGC) has carried out a tender process to facilitate the development of a Standing Reserve market. The objective of the process was to contract for sufficient Standing Reserve services to satisfy the Operating Reserve requirements for England and Wales. NGC has prepared similar annual reports for each of the Standing Reserve tenders undertaken.
3. Advertisements were placed in the Utility Week and the Financial Times during September 1999 promoting interest from generating plant and demand sites that could provide at least 3MW of generation or demand modification at short notice. In the past, NGC has conducted seminars, questionnaires and service provider workshops to promote the tender process and its commercial opportunities and to provide an opportunity for providers to offer feedback to NGC. NGC also wrote to all known potential service providers indicating that the new tender would be held.
4. The tender process opened formally on 6th September 1999 with a closing date for tender submissions of 5th November 1999. NGC staff were available to offer general assistance and understanding, either by telephone 'help line' or through meetings with interested parties.

## OPERATING RESERVE ON THE NGC TRANSMISSION SYSTEM

- Centrally Despatched generation plant connected to the transmission system has to be given instructions well in advance of need, particularly if it is to start from cold. Plant may be advised up to one day ahead that it may be required to generate at a particular time. At five hours ahead of real time all previously notified plant will have been given a firm

Figure 1

### MW Reserve Requirement / Time Diagram



instruction, either 'called to generate' or 'cancelled'. This stage is termed the 'final plant scheduling stage'. The stage between the 'final plant scheduling stage' and real time is termed the 'despatch phase'. The Reserve Requirement/Time diagram (Figure 1), illustrates the day-ahead reserve margin requirements for secure operation of the NGC Transmission System.

- At the 'final plant scheduling stage' there remains a probability of actual demand being greater than forecast demand or scheduled generation not being available because of breakdown (generation failure) or because it is late in achieving its despatched output (generation shortfall). The level of generation reserve or demand modification required at this 5 hours ahead stage (above the forecast demand) is termed the 'Operating Reserve' and is needed to meet this uncertainty in levels of demand and generation in the five hours preceding real time.
- Operating Reserve has a dual role, to provide a level of security and to provide a means of automatically controlling frequency within statutory limits. This dual role means that

Operating Reserve is a combination of two elements; reserve for security of supply, and response for frequency control. Response is an automatically delivered service and is not the subject of this report. Reserve services are only delivered upon instruction from the Grid Operator.

## **CATEGORIES OF RESERVE**

8. Before the ‘final plant scheduling stage’, any changes to generation capability or demand forecast can be accounted for through re-optimisation of the original generation schedule using some Contingency Reserve. This may include the use of Hot Standby which is a component of Reserve only applicable to steam generators. Hot Standby does not fit readily into either the scheduled or standing reserve definitions since it must be instructed before the ‘final plant scheduling stage’, although may not actually synchronise to the system. A generator is said to be on Hot Standby if it is being held in a state of readiness to synchronise at short notice. Under these circumstances, fuel will have been used to prepare the boiler and the mechanism for recovering this expenditure is through an ancillary services payment. Contingency Reserve is delivered from those generating units which have been notified in advance by the Grid Operator that they may be required to generate.
9. After the ‘final plant scheduling stage’, Operating Reserve is held for security of supply and comprises those options for meeting the last minute changes in demand and available generation during generation despatch timescales. The current options for providing this reserve fall into two distinct categories outlined below:

### **Scheduled Reserve**

- # part-loaded centrally despatched generating plant
- # interconnections to neighbouring national electricity systems
- # centrally despatched plant on hot-standby

### **Standing Reserve**

- # open-cycle gas turbine plant (OCGT)
- # standstill hydro or pumped storage plant
- # demand modification sources
- # standstill independent non-centrally despatched generating plant

10. Scheduled Reserve is primarily remunerated directly via the Electricity Pool, with certain additional payments made under existing Ancillary Services Agreements. This category of reserve can be scheduled by the Grid Operator as required. Such plant will normally have a low or even negative utilisation cost, but there may be a significant holding cost associated with making the reserve available, by holding the generation in a part-load state.
11. Standing Reserve plant has a short notice for call-off (up to 20 minutes), and therefore does not need to be scheduled long in advance to be brought to a state of readiness before

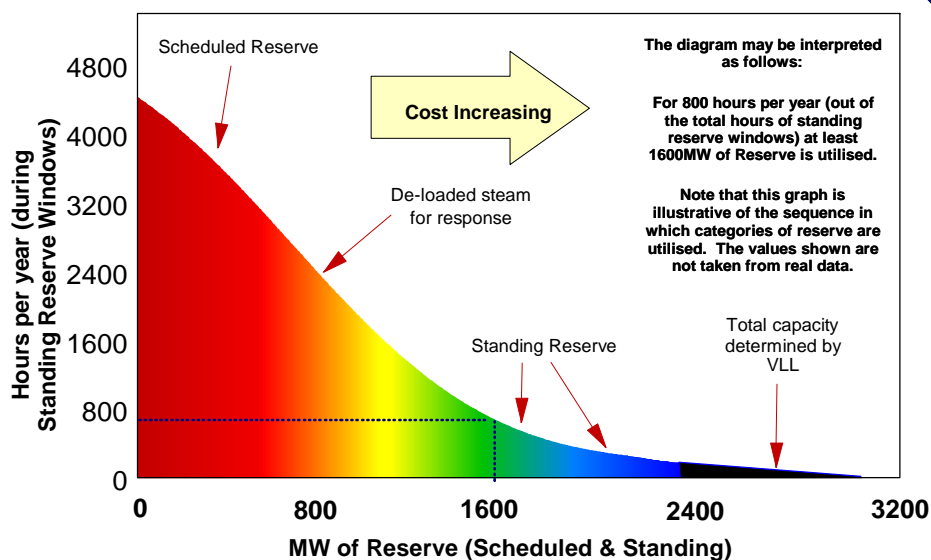
it can be utilised. This plant competes in open tender to secure a Reserve Ancillary Services Agreement, which provides for payment of availability and utilisation fees. The availability cost for this plant is generally lower than the cost of holding Scheduled Reserve but the exercise cost can be significantly higher. Standing Reserve services attract two contract payments which are availability payments for declaring the service available, and additionally utilisation (or exercise) payments if the service is instructed. The precise mechanisms and payment rates are defined in an Ancillary Services Agreement.

12. An availability fee is required because if a utilisation fee only is paid, the provider is dependent solely on revenue from use which is uncertain as it depends upon the number of incidents which occur on the transmission system. If an availability fee only is paid, then the provider suffers the risk that the number of times he is requested to deliver reserve exceeds his expectation.

## OPERATING RESERVE REQUIREMENTS

13. Since the role of Operating Reserve (Scheduled Reserve + Standing Reserve) is to cover the changes in generation and demand that take place in the last five hours before real time, the requirement for Operating Reserve is related to the statistics of generation failures/shortfalls and demand forecast errors over this period. These statistics have been compiled from historical daily offered availabilities in the Electricity Pool, the operational data collected by the Grid Operator and various studies undertaken by NGC.
14. **Figure 2** illustrates that the amount of utilisation of any particular element of reserve will depend on whether it is among the first to be called, or the last.

**Figure 2 Indicative Utilisation of Reserve Energy**



The

reserve that is used first and frequently will have a low cost of utilisation. The first tranche of reserve energy to be used is likely to be generated from de-loaded marginal plant which effectively has a low (or negative) exercise cost. This is followed by other marginal plant with only small exercise cost differences compared with the unconstrained marginal generation. Both these blocks of reserve will normally be obtained from synchronised generation (Scheduled Reserve).

15. The correct mix of Scheduled and Standing Reserve must be made from all plant available to ensure that a minimum cost solution is realised. This is an economic choice from the options available that satisfies the requirement to maintain security of supply at all times from minutes to hours following an imbalance incident.
16. The scenario where all Operating Reserve is held on Scheduled Reserve can be considered as a benchmark against which all other options must be compared. Thus for Standing Reserve to be economic it must displace Scheduled Reserve otherwise there would be no economic gain.
17. It must be appreciated that the requirements for reserve vary by time of day, type of day and indeed time of year. This is due to the corresponding variation in the prevailing national electricity demand profile, the distribution of generation failure/shortfall and demand forecast uncertainty. For this reason providers were requested to tender for service provision in specific 'Seasons'. Each Season is divided into Working Days and Non-Working Days (WD & NWD respectively). Two illustrative representations (Figures A4 & A5 in Appendix A) show how service periods relate to daily demand cycles. This Appendix also describes further considerations in the selection of reserve tenders.

## **TENDER PROCESS**

18. The 2000/2001 Standing reserve service hours are determined by defined service seasons as shown in Figure A6 of Appendix A.
19. Tenderers chose whether to tender for some or all of the five Seasons (Working Days and/or Non-working Days) which constitute a full financial year. In other words the year was effectively divided into ten segments. NGC undertook separate tender evaluations for each of these ten segments. The economic analysis behind this evaluation is explained further in the following section. Providers who were successful for only some of the segments were offered a contract for those discrete seasons and day types in which they were successful. However, some providers elected to stipulate in their tender submission that they wished to be selected for all or none of the segments offered. Where this was the case, the overall annual benefit of a given tender was considered to determine whether or not a contract should be offered.
20. Service providers also chose whether to tender to provide a Committed or Flexible service. Once a Committed contract is entered into, providers undertake to make the service available in all contracted service periods within a particular service season. In return, NGC purchases all the availability offered. With a Flexible agreement, providers need not make the service available all the time, however NGC is not obliged to purchase all availability so offered. It should be noted that some providers chose to submit tenders

to provide Committed reserve during some Seasons and Flexible reserve during others.

21. For the financial year 2000/01, a total of 93 discrete tender submissions were received, representing 26 companies and 53 different sites. This translates into volumes of 906MW for Centrally Despatched and 478MW for Non-centrally despatched. Companies acting as Agents for the procurement of reserve represented some 9 sites.
22. All 2000/01 tenders submitted complied with the mandatory service requirement terms detailed in the tender pack. A total of 683 MW of reserve service had been purchased previously on a 2 year deal basis. A further 137MW of centrally despatched services had been contracted on a longer term Black Start and Reserve service basis. Therefore, the total Standing Reserve service options represented in the assessment stage was 2204MW detailed as shown in figure 4 below.

**Standing Reserve Service Options**

**Figure 4**

<b>MW offered</b>	<b>Centrally despatched</b>	<b>Non-Centrally despatched</b>	<b>Total</b>
Tenders received in November 1999 for April 2000 onwards	906	478	<b>1384</b>
2 year services contracted from April 1999 tender process	632	51	<b>683</b>
Longer term (Reserve and Black Start) contracted for 2000/01	137	0	<b>137</b>
<b>Total service options for 2000/01</b>	<b>1675</b>	<b>529</b>	<b>2204</b>

compared with previous years :-

<b>MW offered</b>	<b>Centrally despatched</b>	<b>Non-Centrally despatched</b>	<b>Total</b>
1999/0 total service options	1766	732	2498
1998/9 total service options	1826	673	2499
1997/8 total service options	1859	517	2376

Note that in all Figure 4 numbers, the maximum MW a provider tendered for any service season is recorded.

23. The total 2000/01 volume of 2204MW represents a 294MW decline in volume from the previous years total of 2498MW. Centrally despatched generation options dropped by 91MW, and Non-Centrally despatched services decreased by 203MW. This is largely due to a number of non-centrally despatched services moving over to Frequency Response service contracts. Frequency Response is a higher value service, and NGC welcomes this service development. The proportion of Committed/Flexible Standing Reserve service

options was as follows:

Committed Only	1416 (+137 Black Start MW) = 1553 total
Flexible Only	451MW
Committed & Flexible	200MW
<b>Grand Total</b>	<b>2204MW</b>

24. All tenders were required to comply with certain criteria, and to provide certain information with regard to any service limitations. These parameters are discussed further in Appendix A.

## ECONOMIC ANALYSIS

25. All tenders for each Season of 2000/01 (sub-divided into Working Days and Non-Working Days) were evaluated by Season separately. The objective of the economic analysis was to:-
- (a) Identify the minimum cost solution in meeting the reserve requirement using the tenders received and scheduled reserve alternatives for each Season.
  - (b) Re-optimize, if necessary, retaining any plant required to meet the system considerations outlined in Appendix A.
  - (c) To carry out sensitivity scenario testing for various exogenous variables.
26. As in previous years, a Mixed Integer Linear Programming model was used to select the economic reserve options for the service year 2000/01. This took account of:-
- (a) forecast costs of spinning (Scheduled) reserve by season.
  - (b) new tenders and existing contracted Reserve services.
  - (c) the reserve utilisation established from statistical analysis (statistical plant failures/shortfalls and errors in demand forecasting).
  - (d) historic and forecast service reliability statistics.
  - (e) fixed costs associated with service contracts and monitoring systems.
  - (f) the value of lost load
27. Historic plant losses, generation shortfall statistics and demand forecast errors were analysed to forecast the system requirement for reserve against which tenders were evaluated. Analysis of trends in generator bidding and pool prices contributed to an assessment of forecast costs of Spinning Reserve and thus the optimal balance between Scheduled and Standing Reserve options.
28. Starting from the expected utilisation of each MW of reserve, the CPLEX<sup>1</sup> based optimisation model was used to find the optimum combination of Scheduled Reserve and tendered Standing Reserve to meet the requirement at minimum cost. The Value of Lost Load (VLL) is assumed to represent the notional maximum price consumers are willing to pay to avoid loss of electricity supply. The Electricity Pool rules do not permit energy

to be paid for at a price above VLL and reserve services are therefore bought up to VLL. For the purposes of the optimisation a dummy source of infinite reserve having zero availability fee and a utilisation price of VLL was used to preclude the selection of tenders which produced an Effective Cost above VLL. The Effective Cost of a reserve option is the total anticipated costs incurred (including availability and utilisation payments) divided by the energy it is expected to deliver.

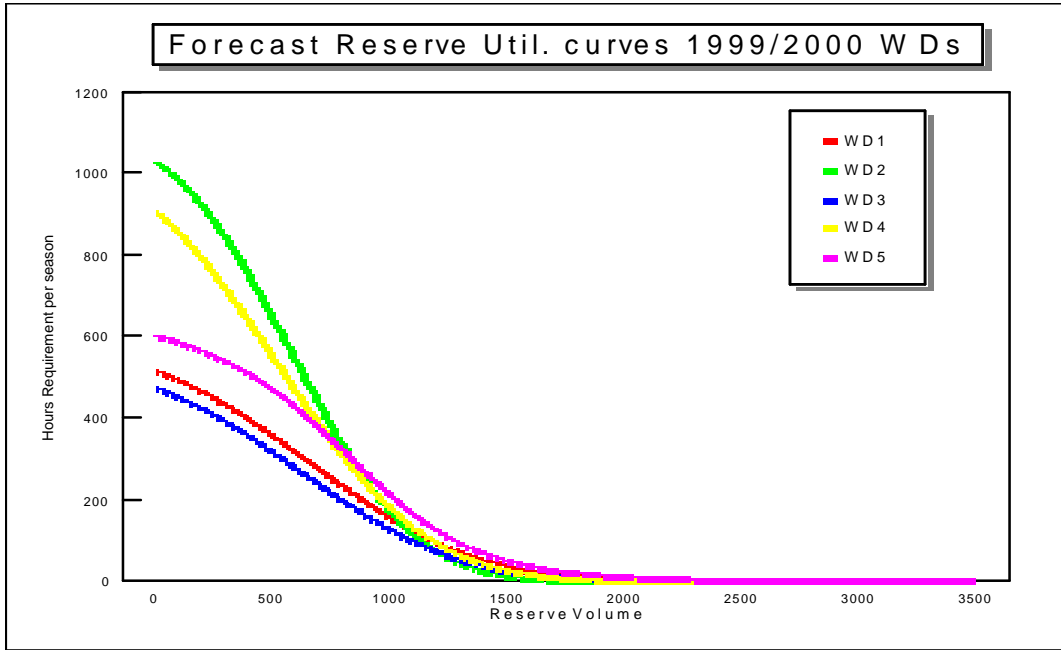
29. Figures 5 and 6 illustrate the nature of forecast reserve requirement curves evaluated for Working Days and Non Working Days during each of the five Seasons in 1999/00 respectively. Note that this representation is not normalised to account for the number of hours in each Service Season. This data is revised annually though the trends remain similar.

(Figures 5 and 6 on page 9)

Notes:

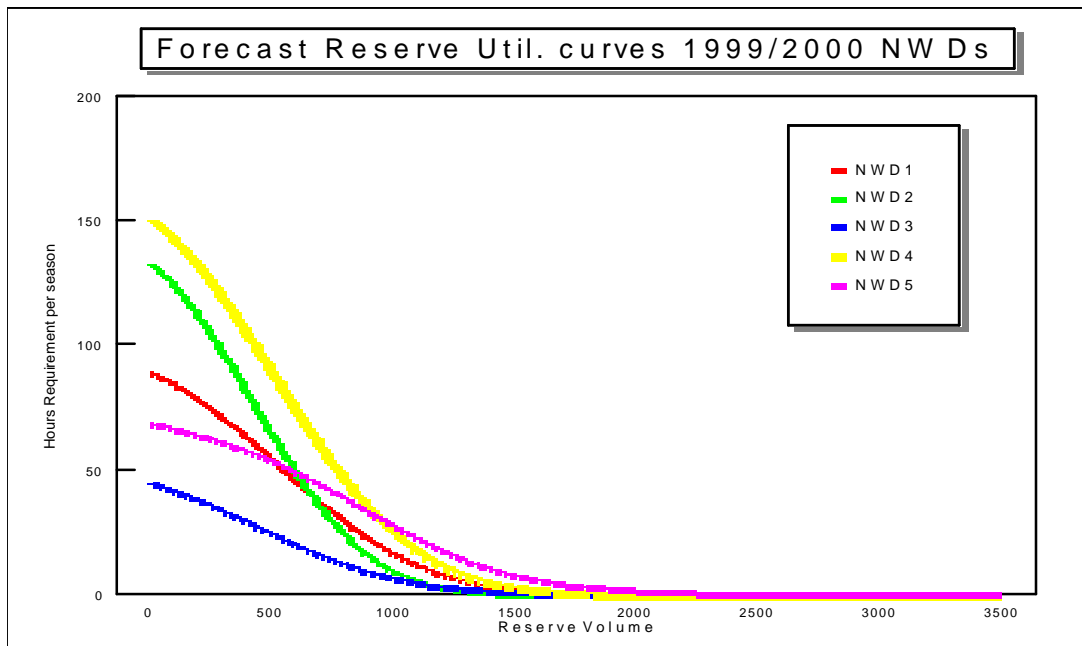
CPLEX<sup>1</sup>

CPLEX is a registered trademark of ILOG CPLEX Division, 889 Alder Suite 200, Incline Village, Nevada 89451 USA.



**Figure 5**

**Figure 5** can be interpreted as follows; the first reserve MW in Working days Season 2 will be required for 1020 hours of the total 1120.5 hours of Reserve service in WD2, and the 1000th MW of reserve service will be required for some 190 hours of the 1120.5 total WD2 hours.



**Figure 6**

**Figure 6** can be interpreted as follows; the first reserve MW in Non-Working days Season 4 will be required for 150 hours of the total 170 hours of Reserve service during NWD4, and the 1000th MW of reserve service will be required for some 35 hours of the total 170 hours.

30. Figure A1 of Appendix A is an illustration of a typical demand/supply curve which was drawn by plotting historic (1998/9) Scheduled Reserve and Standing Reserve volumes in the order in which they would be scheduled or contracted, against overall service costs. VLL (Value of Lost Load) is also shown. The first MW can expect a high utilisation and so the availability costs are spread over a large energy use and hence the Effective Cost per MWh is low. The last MW of reserve held will only be utilised infrequently, so the availability costs are concentrated in a smaller energy use and the Effective Cost increases. As utilisation decreases the overall Effective Cost eventually crosses and exceeds VLL. The economics then stipulate that reserve is contracted up to the point at which the two lines cross. 'Effective Cost' is defined in the Glossary of Terms.
31. Scheduled Reserve and Standing Reserve options were evaluated simultaneously using incremental Scheduled Reserve costs and tendered Standing Reserve prices. The majority of the costs associated with Scheduled Reserve are lost profit payments plus any additional start-up and no-load costs that are incurred through the Electricity Pool. The economic assessment confirmed that Scheduled Reserve options were first to be called (often with a negative utilisation cost), followed by the Standing Reserve options.
32. The above analysis selects a list of tenders on the basis of Effective Cost. The analysis was then repeated against a range of sensitivities shown below. The final tender selection was substantially robust against this range of sensitivities:-
- (i) forecast costs of Scheduled Reserve;
  - (ii) levels of plant shortfalls/losses/demand forecast error;
  - (iii) likelihood of tendered services breaching their utilisation limits;
  - (iv) possible non-completion of some contracts, particularly with new service providers, or failure of some providers;
  - (v) forecast seasonal variations in Pool Purchase Price;
  - (vi) variations in the average length of discrete Standing Reserve utilisations.
33. The tenders contained a price for availability as well as components for start-up, incremental energy price and in the case of centrally despatched plant, a no-load price. Once a Committed reserve agreement is entered into, the availability payments can be deemed to be sunk. Therefore the utilisation of a given contract is a function of its Effective Utilisation Price. This is the cost of using a particular provider for a given length of time. The average call duration of 1999/2000 Standing reserve tended to be around 45 minutes, although individual instances range from several minutes up to about four hours.
34. Consider a 40MW tender with a start-up cost of £1000, no-load price £500/hr and incremental price £50/MWh. Its Effective Utilisation Price for a 45 minute (0.75hours) call-off would be:

$$\text{Effective Utilisation Price} = \frac{1000 + (500 \times 0.75) + (50 \times 40 \times 0.75)}{40 \times 0.75} = \text{£95.83/MWh}$$

## RESULTS

35. Economic evaluation of new (2000/01) service options combined with services already contracted for 2000/01 took place late November and December 1999 and ultimately lead to tender success for the following new 2000/01 Standing Reserve options in one or more Season:-

Centrally Despatched Generation Options	906 MW
Non-Centrally Despatched Generation and Demand Modification	453 MW
<b>Total new 2000/01 volume</b>	<b>1359 MW</b>

When added to the existing contracted service volumes the overall seasonal variation of successful Standing Reserve volumes can be seen in **Figure 7** below

**Overall Successful Volumes** **Figure 7**

Season	Working Days (MW)	Non-Working Days (MW)
1	2099	2031
2	2034	1992
3	2050	2035
4	1816	1756
5	1827	1875

The overall service volumes selected for one Season or more (including previous multi-year services) being:

Centrally Despatched Generation Options	1675 MW
Non-Centrally Despatched Generation and Demand Modification	504 MW
<b>Total overall 2000/01 volume</b>	<b>2179 MW</b>

36. Of this additional 2000/01 successful capacity, the majority of services are expected to be contracted in time for the 1st April. Any shortfall may be made up with other Standing Reserve services or additional Scheduled Reserve.
37. Ultimately some tenders failed because either:
- a high utilisation price forced down the expected running to a point where the availability fee increased the effective cost of the reserve above VLL or;
  - because the overall saving in utilisation cost obtained by including a particular tender was outweighed by its availability fee.
38. The following table shows eight tendered combinations of Availability and Effective

Utilisation Prices (as defined in accordance with paragraph 34) which were successful for part or all of the year.

**Figure 9**

**Successful Combinations of Availability  
& Effective Utilisation Price**

Availability Price (£/MW/hr)	Effective Utilisation Price (£/MWh)
2.30	42.00
1.85	96.67
1.70	100.00
1.53	131.83
1.45	138.18
1.25	176.26
1.10	191.86
1.06	277.78

39. It is estimated that the Standing Reserve agreements entered into for the 2000/01 financial year will amount to an Average Equivalent Cost of around £10.15/kW per annum of 4749 service hours.  
*ie. £19,700,000 / 1940,000kW (time weighted average volume) = £10.15/kW per 4749 hours of the year. The Equivalent Cost is the total of the expected availability and utilisation payments made under all contracts during the year, divided by the average capacity of plant available for Standing Reserve. The range of Equivalent Costs for discrete tenders is estimated to be between approximately £3/kW pa and £20/kW pa. Note these forecasts are based on anticipated running hours.*
40. Figure A2 of Appendix A shows historic cumulative Standing Reserve call-off data. For the purpose of comparison Figure A3 shows some historic statistical Plant Loss and Generation Shortfall data which contribute to Reserve requirements and window definitions.

**TENDERS RELATING TO THE SECOND YEAR 2001/02**

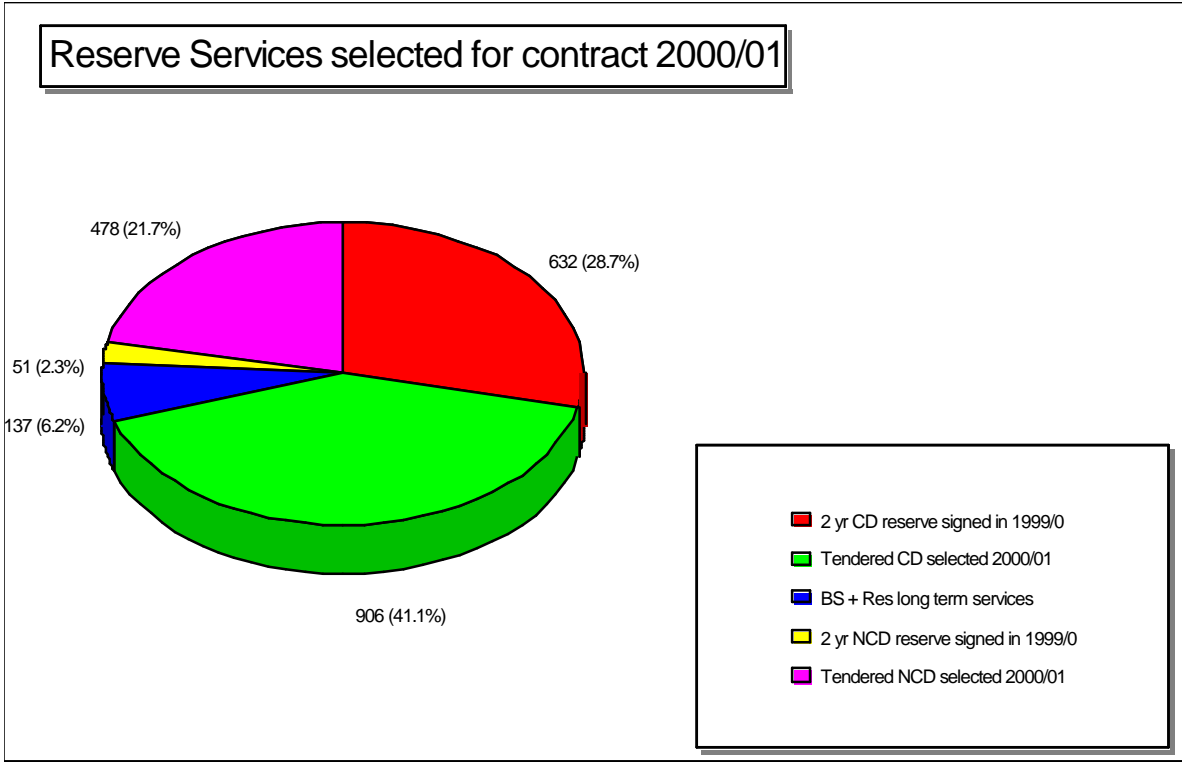
41. NGC did not offer any two tear tender options in this particular tender process due to the anticipated implementation of NETA. The detail of any future Standing Reserve tender process will be published as appropriate, and is not the subject of this particular report.
42. It is probable that any post NETA Reserve tender processes could accommodate options for longer duration contracts in a similar manner as previously.
43. For long term system security reasons, in some cases NGC purchase combined Black Start & Reserve services. This option has been attractive to some generators who are prepared

to accept lower long term prices, for longer duration arrangements encompassing Black Start services.

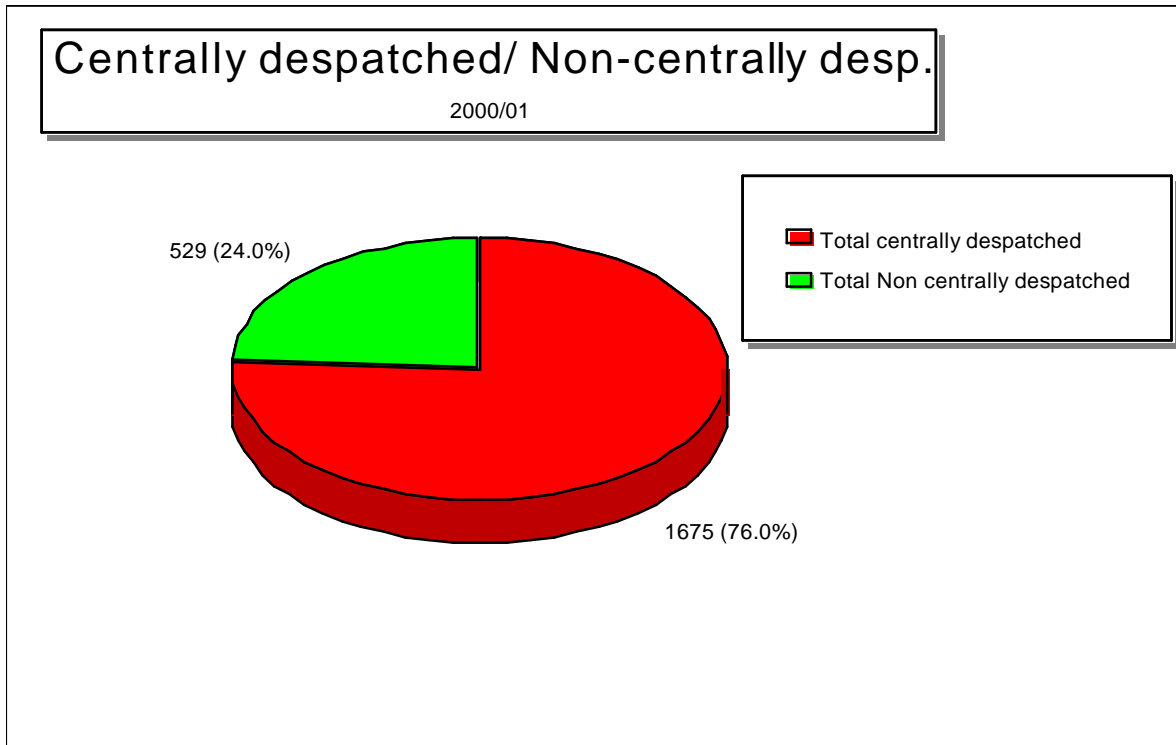
44. The effect of these combined services will be to increase the annual volume of Reserve contracted, whilst retaining a strategic core Black Start & Reserve provision with very attractive Reserve service prices.
45. The reserve component within these agreements was set at (or below) current market values.

## SUMMARY

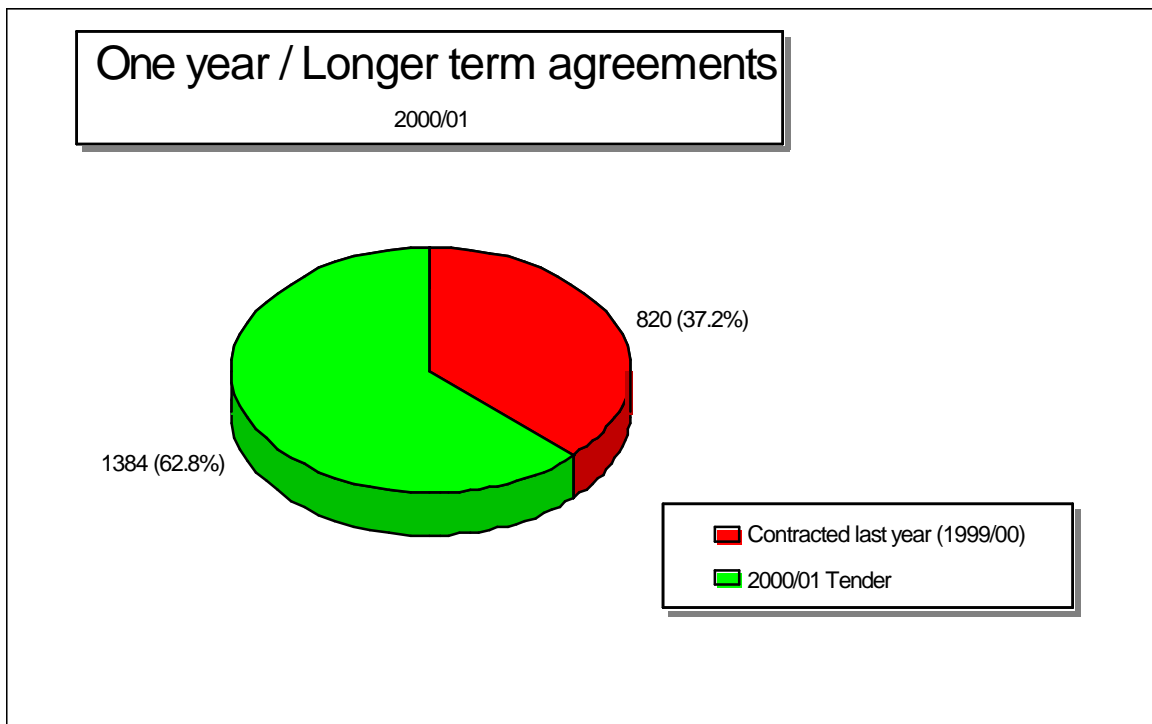
46. For 2000/01 a valid total of 93 discrete tenders with 1384MW total volume for Standing Reserve were received. Tenders consisted of a variety of options including demand modification, small generation and centrally despatched generation plant. The total Standing Reserve volume relating to 2000/01 represented in the modelling process was 2204 MW. This included all new offers and existing contracted services.
47. The tenders were analysed both in terms of their economic value and also taking account of the technical requirements of the system and the other categories of reserve available. NGC pursued some 112 contractual arrangements with 24 companies involving services provided from over 50 different locations around England and Wales for 2000/01.
48. The volume of 529MW successful standing reserve from demand modification and small-scale generation for 2000/01 is less than the 1999/0 level of 608MW. This is largely due to a number of service providers moving onto the Frequency Response service. The volume of successful standing reserve from centrally despatched generation has increased by 304MW from the 1999/0 level of 1371MW to 1675MW predominantly in the high utilisation end of the market.
49. New services have been contracted on a 12 month basis, however a total of 820MW were contracted for multi year periods including a number of Black Start plus Reserve services contracted for three or five years. These agreements will be effected by the introduction of NETA. **Figure 10a, b, & c** below shows the split of Standing Reserve services which proceeded to the contract stage for services relating to 2000/01.



**Figure 10a**



Figures 10b



10c

## APPENDIX A      System Considerations for Selection of Reserve

1. The changes in generation and demand covered by reserve can occur at any time and therefore reserve must be provided at all times. In meeting this requirement economically, four main aspects must be considered:-
  - (a) the inherent reserve,
  - (b) the strategic reserve requirements,
  - (c) the cost of reserve options,
  - (d) the operating parameters of the reserve plant.
  
2. The inherent reserve arises because generation is scheduled and despatched to meet the key demand peaks in the daily forecast demand profile. The scheduling of generation takes account of parameters such as:-
  - (a) minimum run times,
  - (b) start-up costs versus part loading cost,
  - (c) minimum operating levels,
  - (d) the dynamic loading parameters.
  
3. The scheduling of in merit generation often results in generation operating at reduced output through low demand periods, to meet the next peak demand point rather than shutting it down and starting again later which would incur further start-up costs.
  
4. The current demand profile and the parameters described above often result in times when the level of reserve required is inherently provided by generation operating part-loaded. Plant that is operating in this part-loaded state is remunerated through the Electricity Pool mechanisms.
  
5. There are times when this inherent reserve is not present and other reserve options need to be identified, i.e. 'lead-in' to and at demand peaks. Figure A4 illustrates a typical spring demand profile showing where reserve is inherently available and where other options need to be contracted. Figure A5 shows the typical windows where insufficient inherent reserve is available and other options need to be contracted. This logic was used to determine the windows of requirement that were specified in the invitation to tender for Standing Reserve. **Figure A6** on page 22 gives all specific Seasons and periods of the day for which providers were invited to tender to provide Standing Reserve in 2000/01.
  
6. The logic of contracting for only limited hours of each day is borne out by last years actual utilisation of Standing Reserve. Monitoring shows that, of the total running of Standing Reserve services, some 92% occurred within the service windows. Sensitivity analysis shows that the benefits of extending the service windows would be outweighed by the cost of extra hours of Availability payments, though revisions to the defined service windows is undertaken.

7. The tender submissions included information on a variety of parameters concerning the technical nature of the reserve service offered and other features relevant to the NGC system. These parameters included factors such as the time required in order to initiate the service (Response Time) and the duration for which the service could be sustained (Maximum Utilisation Period).
8. Standing Reserve service definitions stipulate that the maximum Response Time acceptable was 20 minutes. In fact it is desirable for the Grid Operator to have a certain proportion of the Standing Reserve fleet available with a Response Time of 10 minutes or faster. The spread of different capabilities of individual providers normally ensures that this 10 minute requirement is satisfied without using Response Time as a primary selection criteria.
9. Due to the limitations of a finite transmission system, there can exist geographical restrictions on the selection of reserve providers. However, as with the issue of Response Time, the natural variance in the geographical disposition of tenderers, means that this does not normally impinge heavily on the selection.
10. The minimum size of a discrete tender was set at 3MW. This was considered an appropriate compromise between a sufficiently low threshold in order to admit as many providers as possible and the practicality/cost for the Grid Operator to utilise a large number of individual contracts in a short space of time. Given the large number of small contracts which the Grid Operator now has to deal with, a PC based monitoring and despatch system has been introduced. This facility is called the Utility Despatch and Monitoring Interface (UDMI) and is described briefly in Appendix C. It enables the Grid Operator to more effectively call-off the contracts and to monitor performance against contract.
11. The anticipated costs incurred by NGC in the UDMI installation (as necessary) and other fixed costs (contract administration) are accounted for on a site (or tender) specific basis.

Figure A1

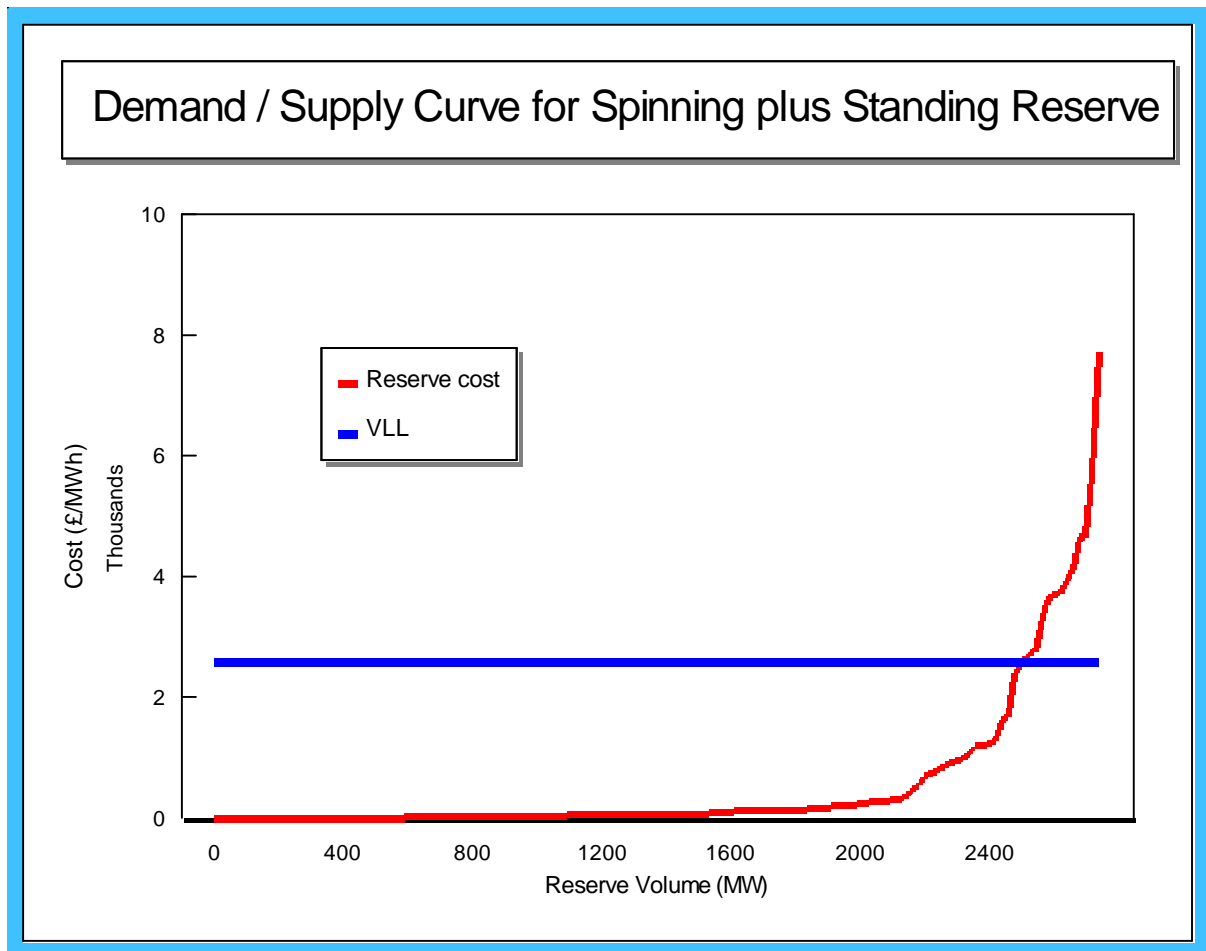


Figure A2

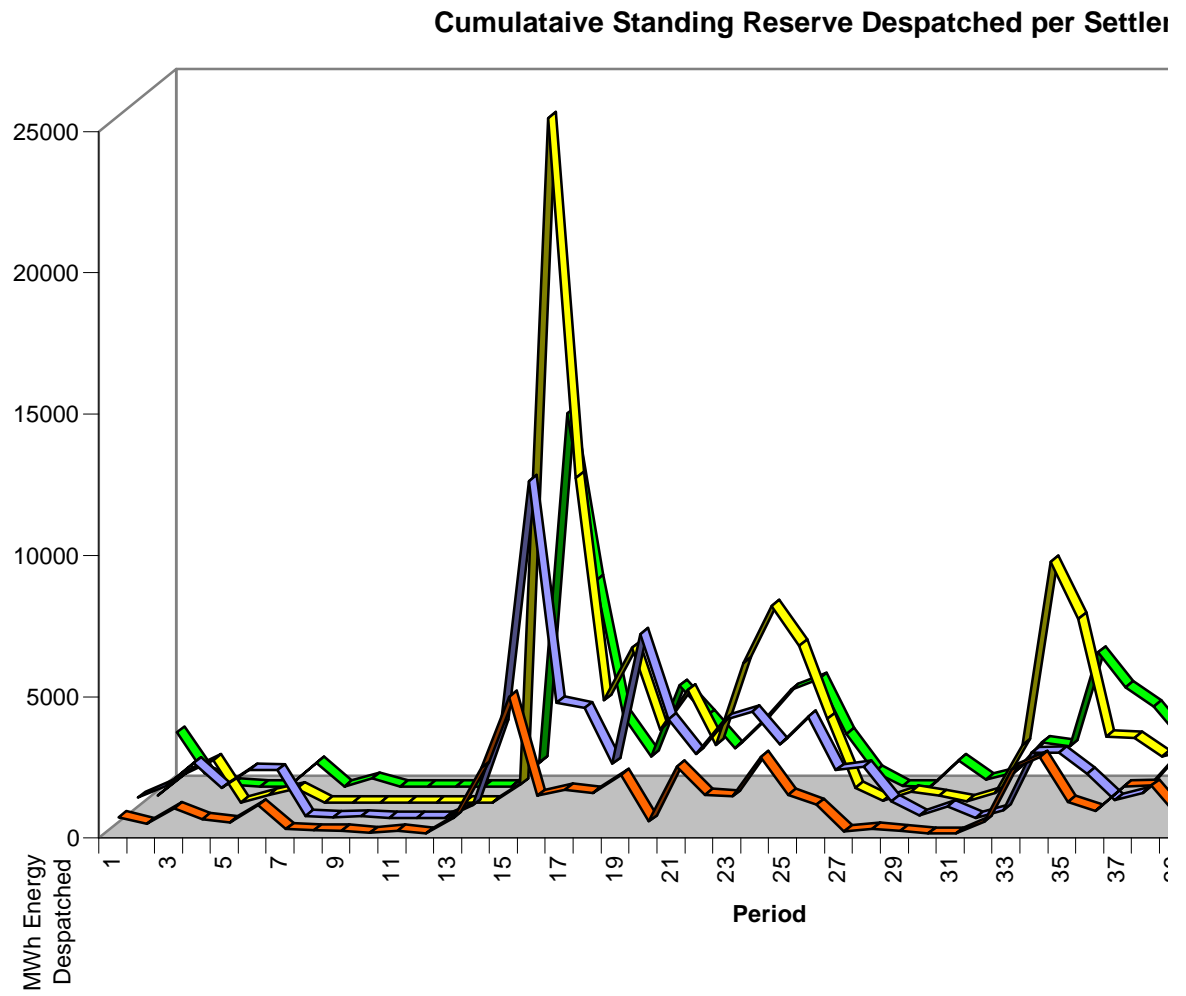


Figure A3

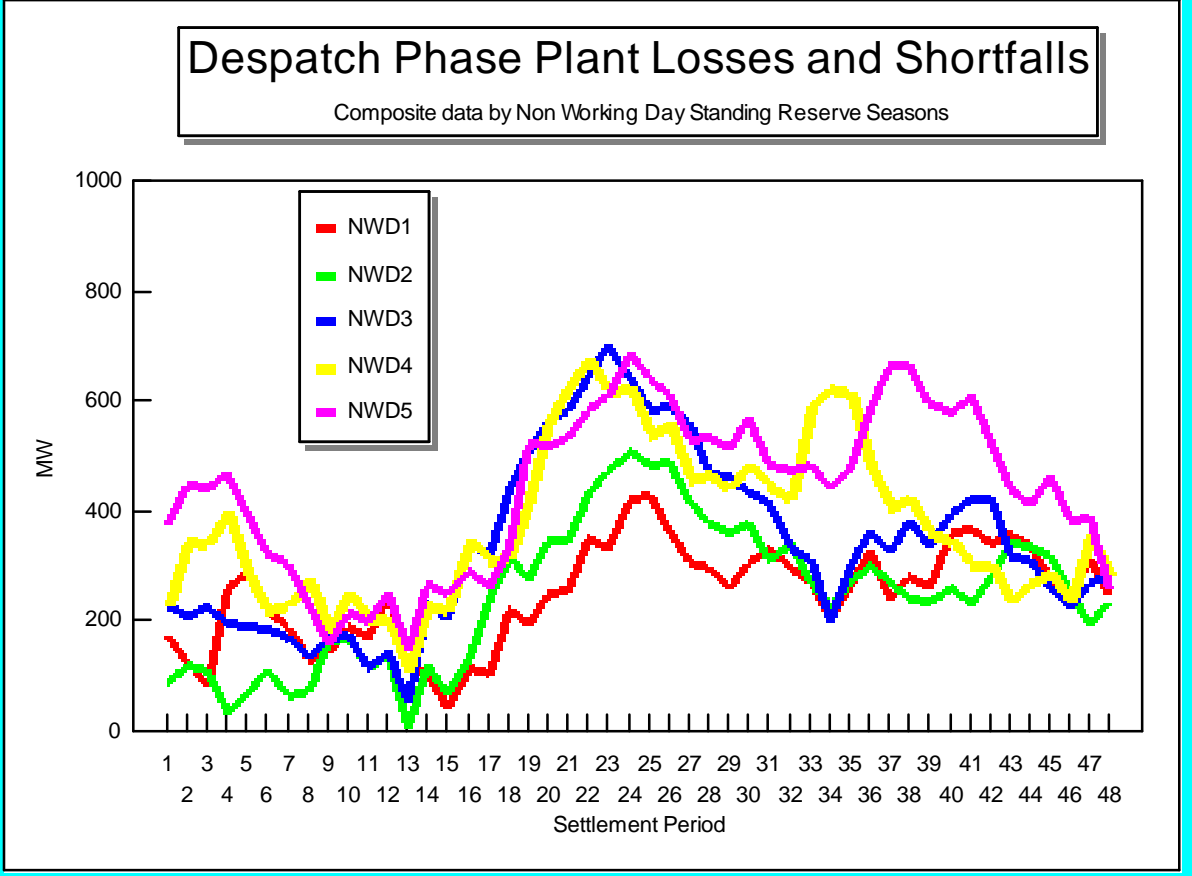
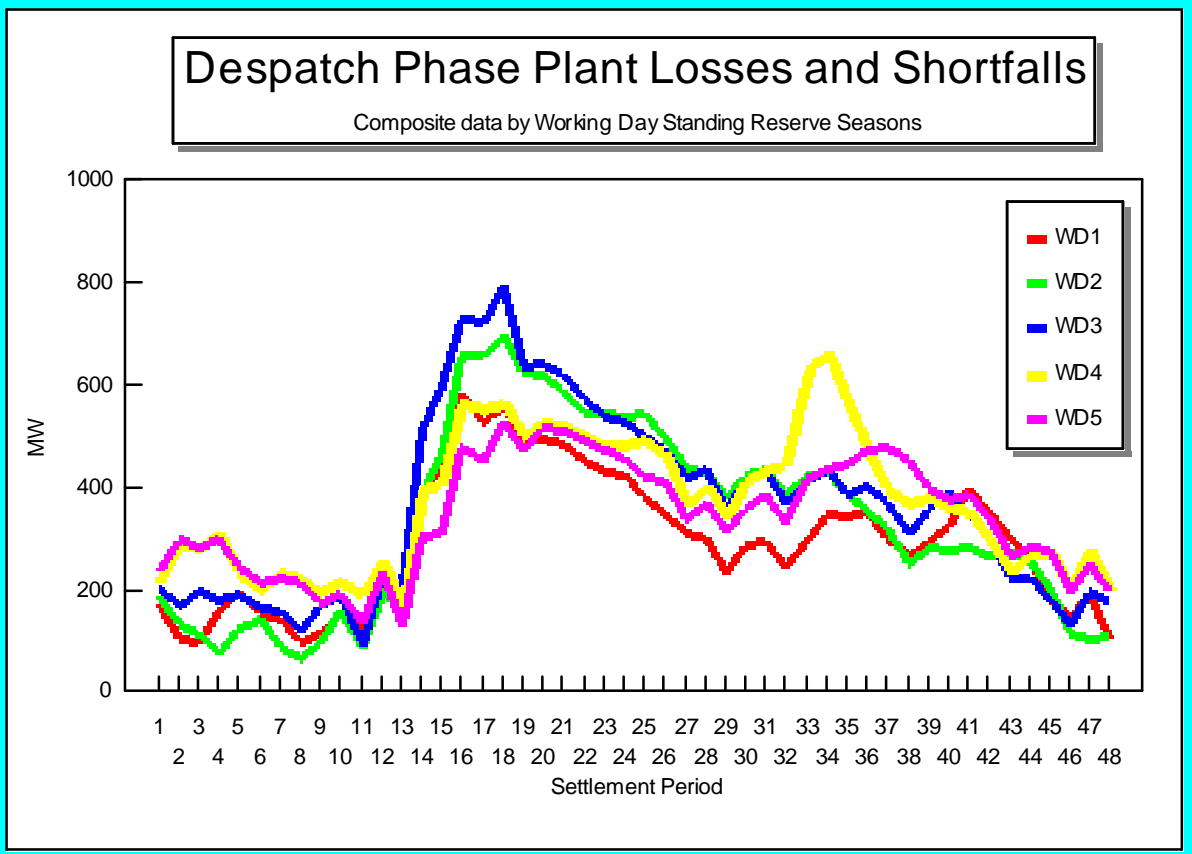


Figure A4

### Standing Reserve Requirements

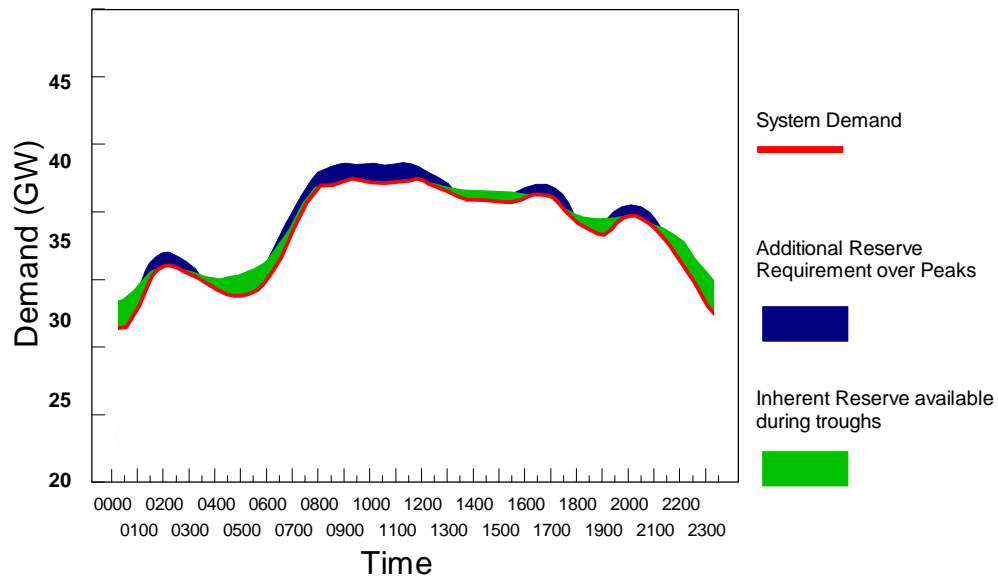


Figure A5

### Typical Reserve Service Windows 1998/9 Working Days Season 5

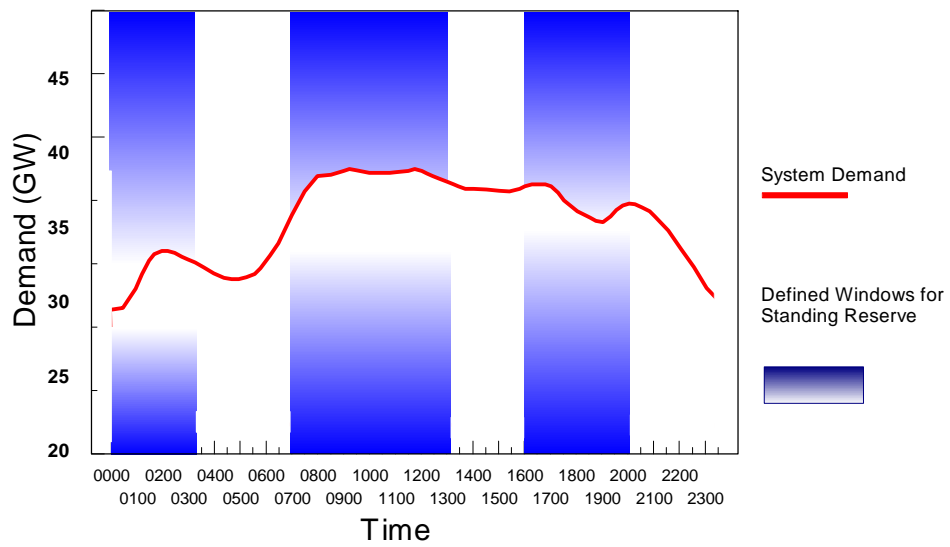


Figure A6

2000-2001 Seasons		Working Days in Season				N
Number	Calendar Month	Availability	WD		Total	Availability
		Windows	Hours	DAYS	Hours	Windows
1	05:00 1 April 2000 - 05:00 29 May 2000	07.00 - 13.30	6.5	47	305.5	10.00 - 13.30
		16.00 - 21.30	5.5	47	258.5	16.30 - 21.30
			<b>12</b>		<b>564</b>	
2	05:00 29 May 2000 - 05:00 4 Sept 2000	07.00 - 18.00	11	82	902	10.00 - 13.30
		20.00 - 22.30	2.5	82	205	16.30 - 23.00
			<b>13.5</b>		<b>1107</b>	
3	05:00 4 Sept 2000 - 05:00 29 Oct 2000	07.00 - 14.00	7	48	336	10.30 - 13.00
		16.30 - 21.00	4.5	48	216	16.30 - 21.00
			<b>11.5</b>		<b>552</b>	
4	05:00 29 Oct 2000 - 05:00 5 Feb 2001	07.00 - 14.00	7	81	567	10.30 - 14.00
		14.00 - 20.00	6	81	486	16.00 - 20.00
		00.00 - 03.00	3	81	243	00.00 - 03.00
			<b>16</b>		<b>1296</b>	
5	05:00 5 Feb 2001 - 05:00 1 April 2001	07.00 - 14.00	7	48	336	10.30 - 13.30
		16.00 - 20.00	4	48	192	16.30 - 20.00
		00.00 - 03.00	3	48	144	00.00 - 03.00
			<b>14</b>		<b>672</b>	
			<b>67</b>		<b>4191</b>	
	<b>TOTAL HOURS</b>		<b>4749</b>			

## APPENDIX B Historic Review of Standing Reserve Contracts Contracted Standing Reserve Levels

- The Standing Reserve tender process has been conducted each year since 1993. One of the major intentions of the tender was to introduce competition from non-centrally despatched generation and demand modification. **Figure 11** below shows how the volume of successful tenderers has changed year on year:

**Figure 11**

### Service Volumes

Financial Year	Centrally Despatched Generation Options (MW)	Non-Centrally Despatched Generation and Demand Modification Options (MW)	Total Contracted Volume (MW)
1993/4	2309 <sup>(1)</sup>	138	2447
1994/5	1854 <sup>(2)</sup>	222	2076
1995/6	1480 <sup>(2)</sup>	438	1918
1996/7	1796	505	2301
1997/8	1809	458	2267
1998/9	1503	617	2120
1999/0	1371	608	1979
2000/1	1675	504 <sup>(3)</sup>	2179

Note 1. This includes approximately 530MW of generation required primarily for local system security considerations.

Note 2. This includes approximately 300MW of generation required primarily for local system security considerations.

Note 3. This reflects several service providers moving to frequency Response services.

The total contracted volume in any year will vary due to a number of factors including:-

- Changes in Scheduled reserve prices within the Pool
- Changes in tendered prices
- Changes in statistical plant losses, shortfalls and demand forecast errors
- Service reliability data from UDMI monitoring systems
- The forecast value of VLL (value of lost load)

### Availability Performance

- In 1999/0 the average availability provided under committed agreements was approximately 97%. That is to say, providers actually delivered 97% of the total hours of Standing Reserve service windows specified in their contracts. A total of 3 providers failed to achieve the 85% threshold, below which the availability reconciliation provisions within committed agreements require that providers pay back a proportion of their total availability monies received during the term of the contract.

### Utilisation

3. In 1999/0 the range of utilisation of individual reserve contracts ranged from a few hours up to several hundred hours per service provider within the year. Providers with Effective Utilisation Prices of under £90/MWh occupied the higher end of this scale. These tended to be generation options, whilst demand modification options with lower availability prices but higher utilisation prices, tended to occupy the lower utilisation segment.
4. From 1st April 1999 to 31st March 2000 there were 402 separate occasions of Standing Reserve call-off, of which 338 occurred in Working Days and 64 occurred in Non-working Days. The exact spread of call-offs per Season can be seen in **Figure 12** below. This level of utilisation was only experienced by services with the lowest Utilisation prices. Service options with progressively higher Utilisation prices experience progressively fewer running hours.

**1999/0 Service Call-off Data** **Figure 12**

Season	Working Day Call-offs	Non Working Day Call-offs
1	50	11
2	109	17
3	44	6
4	83	20
5	52	10
<b>Totals</b>	338	64

5. **Figure 13** shows the actual number of days for each Season. An overall statistical Call-off of approximately 33 times per month is evident, with typically one service requirement every 1.1 Working Days compared with approximately one service requirement every 1 Non-working Days.

**1999/0 Days per Season** **Figure 13**

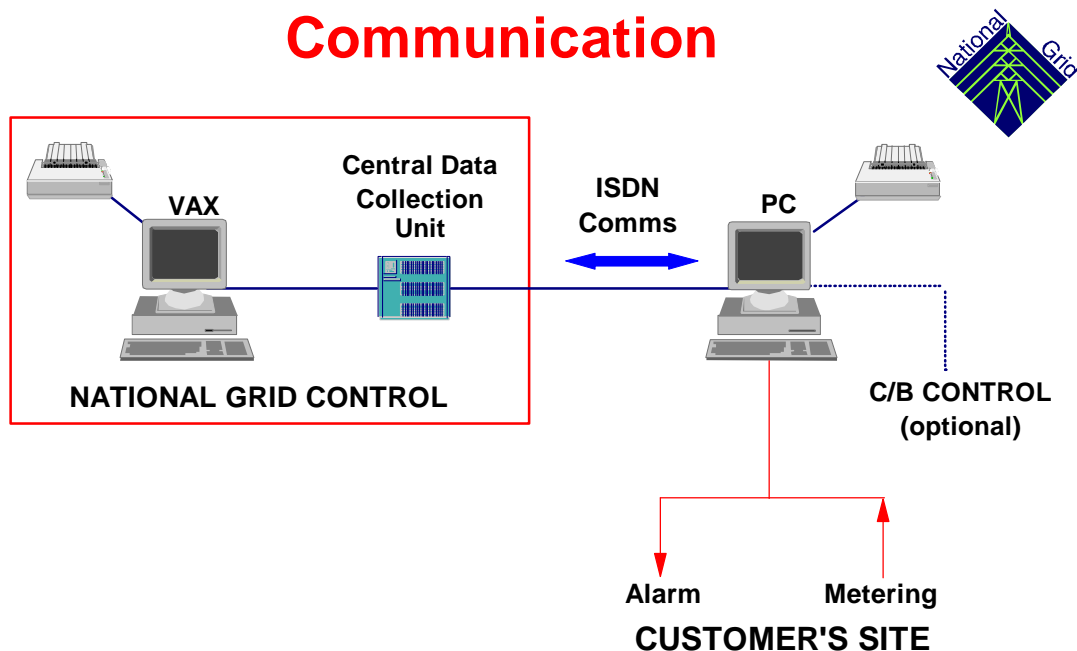
Season	Total 1999/0 Working Day	Total 1999/0 Non Working Day
1	48	13
2	83	15
3	41	7
4	81	19
5	51	8
<b>Totals</b>	304	62

## Purpose

1. In order to use the Standing Reserve Service effectively with large numbers of relatively small service providers, NGC has developed a computer based communication system which allows NGC's National Control Centre to despatch the service and monitor the performance of the service providers.
2. All contracted sites are obliged to submit weekly availability declarations indicating their ability to provide the service (this may be done through an agent). The UDMI system allows these declarations to be made directly from the site or agent to the Grid Operator. Any revisions to the weekly availability declarations may also be made using this system.
3. The ability to electronically record despatch instructions as well as availability and metering data now provides NGC with an accurate record of the utilisation and service performance provided. This system also facilitates the settlement and audit requirements associated with operating the Standing Reserve Contracts.

## System Design

4. The UDMI system shown in **Figure 14** below comprises a site Personal Computer (PC) connected by a modem to a digital phone line. It can communicate with the Central Data Collection Unit (CDCU) located at NGC National Control. The CDCU acts as a central mail box and message router between the National Control VAX system and the site PC.



5. Messages can originate from either the site PC or the VAX and require, in each case, a connection to be made via the CDCU across a phone line. Speed of communication is maintained by using fast digital ISDN phone lines wherever possible. Where ISDN cannot be provided to sites, a slower PSTN line is used.

### **Process**

6. Contract availability data is held on the site PC and provides a default Week Ahead availability declaration which the operator can update with any new information prior to submission. When the operator is satisfied with the data it is transmitted from the site PC, through to the CDCU which then passes it to the National Control VAX. Syntax checking at the site PC ensures that the submission is valid.
7. At the start of each day, an economic merit order is produced by the VAX based on the availabilities declared by all sites (including any subsequent redeclarations made) and their respective contracted prices.
8. When required the Grid Operator calls off a specified number of MW of reserve using a VAX terminal. The VAX automatically identifies the most economic sites to meet the request from the merit order and indicates these to the Grid Operator who can then choose to issue an initiate instruction to those providers.
9. The instructions are then passed by the VAX to the CDCU which in turn makes a call to each site that has been selected. The operator on site has a 5 minute window of opportunity within which to accept or reject the initiate instruction. On acceptance the site PC transmits confirmation to the VAX which in turn begins to request metering data from the site, both for display and contract compliance purposes.
10. Some minor modifications to the above arrangements have been implemented to accommodate service providers own data management/SCADA arrangements. NGC undertakes periodic software upgrades to enhance system facilities etc.

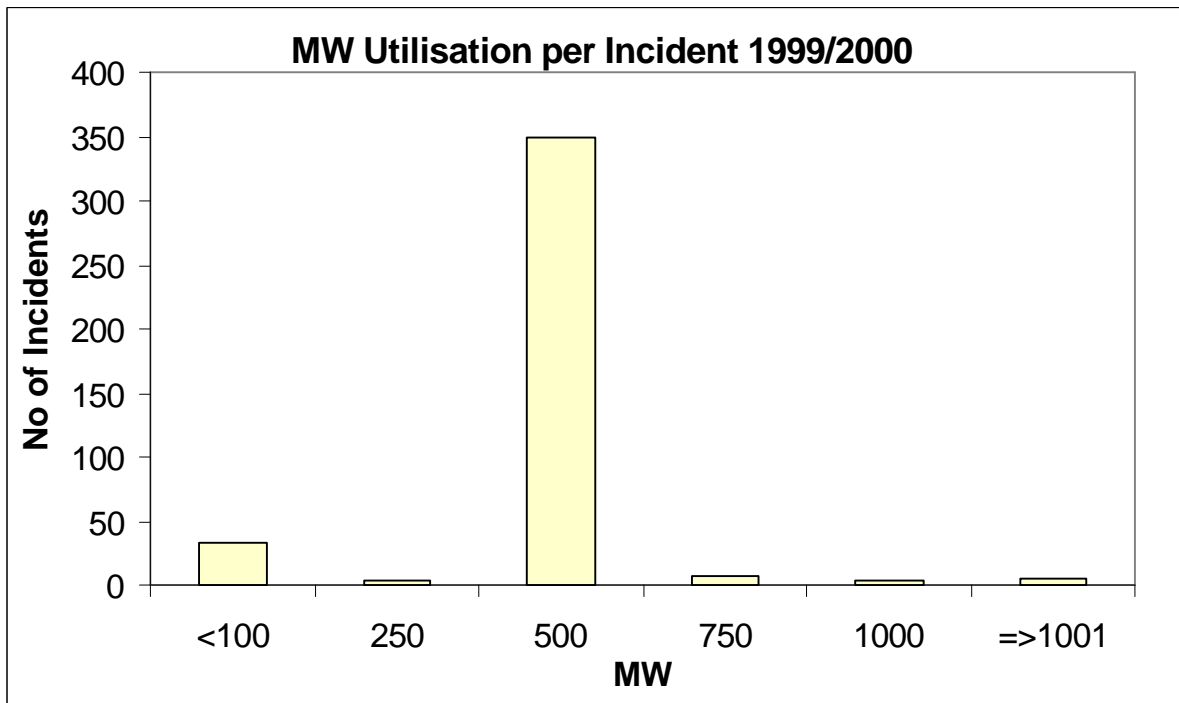
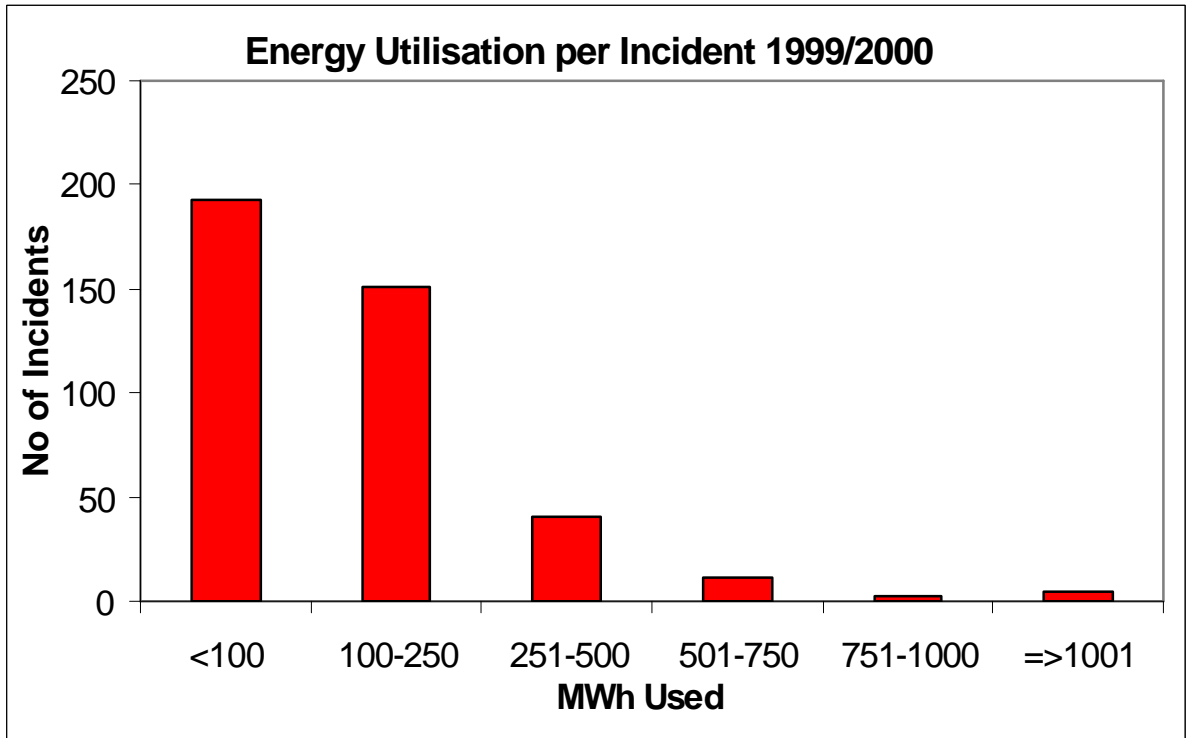
## GLOSSARY OF TERMS

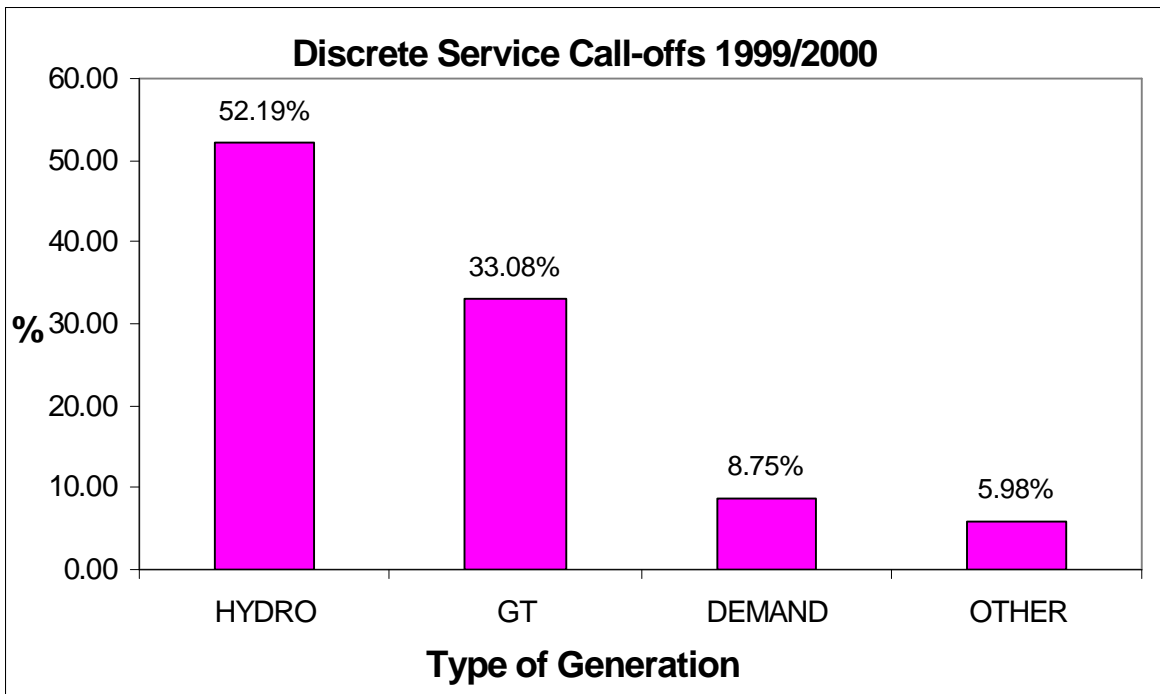
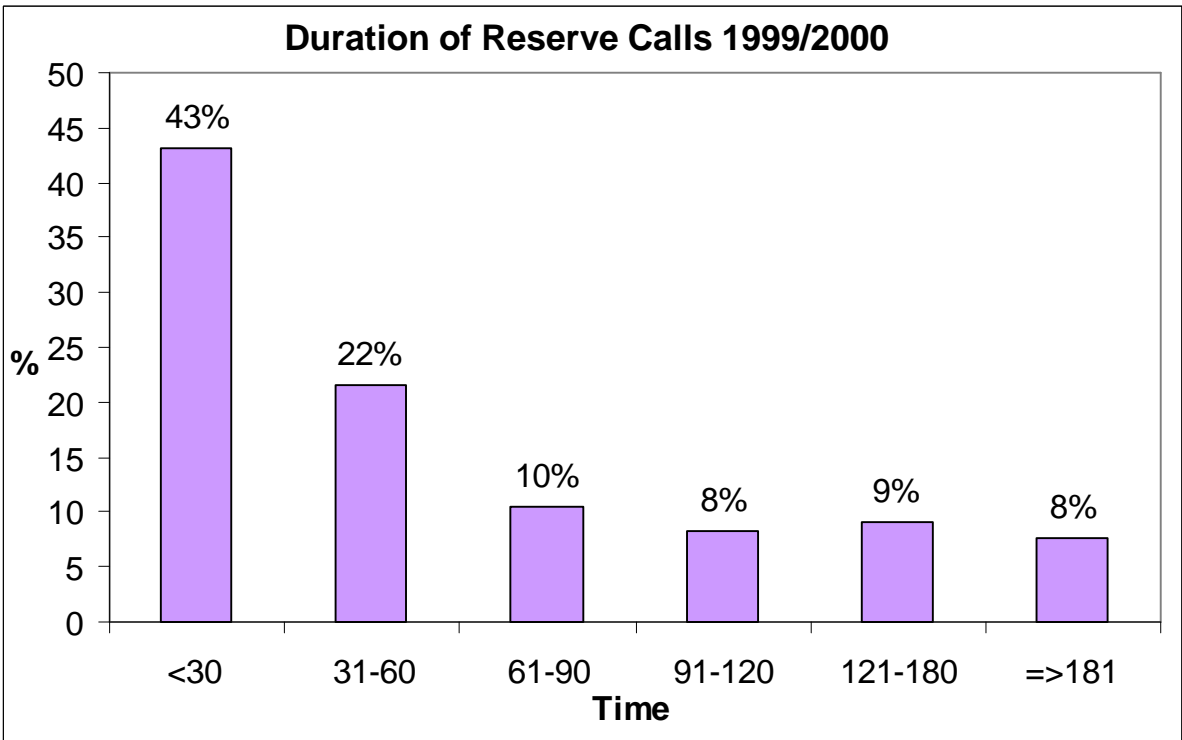
<b>Agent</b>	Certain companies act as agents for the procurement of reserve services. The Agent may provide assistance in the compilation of tender submissions and/or assist in the day to day management of reserve agreements.
<b>Ancillary Services Agreement</b>	A bilateral agreement between NGC and a provider of ancillary services defining the services and payment rates.
<b>Availability Reconciliation</b>	A mechanism defined in Committed Standing Reserve Agreements. At the end of the contract term, the provider is required to pay back to NGC a proportion of the availability monies already received <i>if</i> the number of hours of availability actually provided was less than 85% of the total contracted hours.
<b>Centrally Despatched</b>	Those units subject to scheduling and direct instruction by NGC.
<b>Committed Agreement</b>	Under this type of Standing Reserve Agreement, the provider undertakes to make the reserve service available in all contracted periods. In return NGC is obliged to pay for all availability provided. NGC has an expectation that the provider will achieve an availability performance of at least 85% of the total contracted hours. Failure to do so will invoke the Availability Reconciliation provisions.
<b>Contingency Reserve</b>	The margin of generation over forecast demand which is required at 24 hours ahead to cover against uncertainties in generating plant unavailability and against weather forecast and demand forecast errors.
<b>Effective Cost</b>	The Effective Cost (£/MWh) of a tender is the total of the anticipated availability and utilisation payments, divided by the energy it is expected to produce during the term of the contract. Hence the Effective Cost is dependent upon a forecast of the expected number of hours of utilisation for a given tender. Effective Cost is compared with VLL as part of the tender evaluation.
<b>Effective Utilisation Price</b>	The Effective Utilisation Price (£/MWh) is a measure of the cost of utilising a given reserve tender for a specified length of time. It takes into account all of the components of utilisation price which may be tendered (start-up, no-load and incremental).

<b>Equivalent Cost</b>	The Equivalent Cost (£/kW per annum) is a measure of the cost of Standing Reserve capacity for a year. When applied to a specific contract it is the total of the anticipated availability and utilisation payments, divided by the capacity of the plant. When applied collectively to all Standing Reserve contracts, it means the total payments under all contracts, divided by the average capacity available.
<b>Flexible Agreement</b>	Under this type of Standing Reserve Agreement, the provider need not make the reserve service available in all contracted periods. Such providers give an indicative availability with their tenders and NGC seek that the providers achieve 85% of the indicative availability. Unlike Committed Agreements, NGC has no obligation to accept the offered availability. Availability payments are only made where the offered availability is accepted by NGC.
<b>Grid Operator</b>	The organisation which operates the high voltage transmission system in England and Wales, and implements the provisions of the Grid Code (including the scheduling and despatch of generation) - currently NGC.
<b>Maximum Utilisation Period</b>	A tendered parameter adopted in reserve agreements. The maximum duration for which an individual instance of reserve provision can be maintained following instruction from NGC. The Maximum Utilisation Period should be at least one hour and preferably up to four hours.
<b>Non Centrally Despatched</b>	Those units not subject to scheduling and direct instruction by NGC.
<b>Non-Working Days</b>	Sundays and statutory bank holidays (excluding Good Friday) in England and Wales.
<b>Operating Reserve</b>	The additional output from generating plant and the demand modification available to ensure security of electricity supply and to control system frequency within statutory limits. This encompasses frequency response and reserve (Scheduled and Standing).
<b>Season</b>	For the purposes of the Standing Reserve tender, the financial year is sub-divided into five Service Seasons. Each season is further subdivided into Working Days and Non-Working Days and providers may tender for each discretely.

<b>Response Time</b>	A tendered parameter adopted in reserve agreements. It represents the time required from receipt of instruction to delivery of reserve energy and may be a maximum of 20 minutes. Providers provision of reserve is monitored against the quoted Response Time to confirm contract compliance.
<b>Scheduled Reserve</b>	Reserve generating capacity scheduled by the Grid Operator on Centrally Despatched generation and/or Interconnectors. This is primarily provided on part-loaded generating plant.
<b>Standing Reserve</b>	Reserve generating plant and demand modification sources which can deliver reserve energy within 20 minutes of instruction from the Grid Operator.
<b>Value of Lost Load (VLL)</b>	This industry defined term measured in £/MWh is deemed to represent the maximum price consumers are willing to pay to avoid loss of electricity supply. This was set at £2000/MWh for 1990/91 and has been indexed annually by RPI thereafter.
<b>Working Days</b>	Monday to Saturday, including Good Friday, but excluding other statutory bank holidays in England and Wales.

**Additional Standing Reserve Service  
Despatch Data from 1999/0**





**1999/2000 Standing Reserve Incidents (by month)**

