NTS Exit Capacity Analysis

Background

National Grid is required under EU regulations[1] to publish the technical capacity at relevant points[2] on the NTS. By publishing baseline quantities National Grid complies with this requirement. However, some parties within the gas industry question whether baseline quantities do equate to technical capacity. They argue that baselines do not accurately reflect the technical capacity within the NTS and that there is additional capability on the NTS which may be used, this is referred to in this paper as "unused system capability" and the term "spare capacity" is sometimes used to describe this. Knowledge of the location and quantity of this additional capacity can, it is argued, aid the development of downstream projects, e.g. new gas fired power stations. This is because this capacity can be released without the need for system reinforcement, and hence may be available with a much shorter lead-time.

National Grid's main concern with requests to use different criteria for determining technical capacity [in addition to the fact that it is inconsistent with the definition provided in the regulations] is that this will cause false expectations that the published quantities will be available whenever Users submit an application. However, National Grid supports publication of information that can help customers develop their businesses and will, in accordance with UNC, and subject to maintaining confidentiality, publish information in excess of that required through legislation. This document has been produced to inform customers where it might reasonably be expected that there may be unused system capability.

In this context, this document sets out to achieve two aims:

- To explain the rationale behind the assertion that baselines are equal to technical capacity, and
- To quantify, as a one-off exercise and recognising its limited value, unused system capability that may be available in excess of the technical capacity at this time.

The document relates solely to exit "flat" capacity, i.e. the right to offtake gas at a continuous rate throughout the gas day at NTS Exit Points. To simplify analysis, only steady-state analysis of a limited number of supply/demand scenarios has been undertaken. As a result no account has been taken of the requirements for, or availability of, exit "flexibility", i.e. the right to offtake gas at variable rates throughout the gas day at NTS Exit Points.

Technical Capacity, Baselines and Unused System Capability.

"Technical capacity" is defined[3] as *"the maximum firm capacity that the TSO can offer to users, taking account of system integrity and the operational requirements of the network" and must be published "on a numerical basis for all relevant points including entry and exit points...."*[4]

- The relevant points are approved by Ofgem and consist of the entry and exit points listed in the NTS Gas Transporter Licence. Hence technical capacity is location specific.

- Firm capacity is defined *as capacity contractually guaranteed as uninterruptible*; and

- "system integrity is "*any situation in respect of a transmission network including transmission facilities in which the pressure and the quality of the natural gas remain within the minimum and maximum limits laid down by the TSO, so that the transmission of natural gas is guaranteed from a technical standpoint."*

[1] Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13th July 2009 on conditions for access to the natural gas transmission networks. Referred to as "the Regulations".
[2] The Regulations relate to both NTS entry and exit points. This document applies only to exit capacity. References to capacity, baselines and capability should be read in that context.
[3] Article 2.
[4] Article 18 paragraph 3.

Baselines are defined quantities of capacity that have been agreed with Ofgem. They are based on statutory and commercial obligations supported by analysis of the network and its technical limits, i.e. they are based on the operational requirements of the system and its integrity. There is scope for varying baselines, but this is subject to defined rules and is subject to Ofgem scrutiny and approval[5]. In accordance with the Licence, National Grid is obliged to make available to Users the baseline quantity.

National Grid does offer the baseline quantity to Users as firm capacity at each exit point but would be unable to make gas available for offtake at all NTS exit points at baseline quantity, simultaneously, as the aggregate baseline quantity is well in excess of the system capability and previous maximum daily demand experienced.

Hence the baselines satisfy the definition of technical capacity in that it:

- can be, and is, offered to users as firm capacity,
- is determined after taking account of system integrity and the operational requirements of the network and
- is determined on a numerical basis for individual, i.e. relevant exit points.

It follows therefore that baseline is technical capacity. However, it has been argued (not by National Grid) that unused system capability also satisfies the definition above and should be included in the quantity published as technical capacity.

Unused system capability is not defined in the Licence, or in European or UK regulations. However, National Grid takes it to mean the capability of the NTS, over and above the baseline, that has not been allocated to a User. Some argue that this capability can be quantified and should be declared as technical capacity. National Grid argues otherwise.

National Grid does not dispute that there has been unused system capability in certain geographical areas. This capability would be released, in response to requests for additional capacity, in preference to investment in new pipeline infrastructure. However, this capability cannot readily be quantified, at a nodal level, in a meaningful manner. Unused system capability varies according to a number of factors, including:

- commissioning of new infrastructure;
- increasing commercial obligations, e.g. pressure commitments, new connected loads; and
- changing gas supply and demand patterns, including within day volatility.

This is compounded by uncertainty created by the changes to the exit capacity regime, e.g.

- interruptible loads being initialised as firm; and
- more flexible operation of storage facilities and bi-directional interconnectors.

Although unused system capability within the network could be identified, such steady-state network analysis would be valid only under a specific set of supply and demand patterns which would not capture within day variations, and would only be available on a geographical basis. Thus although unused system capability at a particular exit point could be determined and the same capability might be available at an adjacent exit point, once it had been allocated as firm capacity at one exit point such capacity would not be available at the other. To publish data showing it as available at only one exit point would be as misleading as publishing it as available at them all. Hence, as the unused system capability is not nodal and cannot be allocated to a specific relevant point then it cannot be published on a numerical basis at an exit point as required in the case of technical capacity.

[5] Note that when National Grid releases incremental capacity at a relevant point the obligation on National Grid to make capacity available also increases (only if release is facilitated through substitution will there be a decrease elsewhere). However, although the baseline quantity may not immediately be increased, the revised figure will be published. Ultimately, in accordance with the licence, this increased quantity will be reclassified as baseline. Throughout this document, unless the context clearly states otherwise the term “baseline” relates to the higher “obligated” quantity.

Notwithstanding the increasingly dynamic nature of gas supply and demand patterns and the greater uncertainty that this poses to the operation and flexibility of the NTS, this document is limited to steady-state analysis which does not take account of within day variations.

National Grid believes that it is more useful, and is a more efficient use of resources, if unused system capability is identified in response to specific capacity applications. If it is identified, at the time of the application, in the required quantity and at the relevant location, then it can be made available on a firm basis. Conversely, and notwithstanding National Grid's Licence obligation to make available capacity up to the baseline quantity, when an application is made for exit capacity, analysis may show that previously available (and possibly published) capacity is, due to changing parameters mentioned above, no longer available. Hence when taking account of system integrity and the operational requirements of the network at the relevant time, unused system capability cannot be offered to users and is not, therefore, technical capacity.

Unused System Capability

To provide an indication of where capacity might be available without the need for investment in the NTS National Grid has undertaken analysis of the network under limited circumstances. Notwithstanding the doubts expressed above, National Grid hopes that this information will provide developers with an indication of where there exists unused system capability.

It should be noted that:

- **The information provided is indicative only: National Grid does not guarantee its availability, which will be confirmed in response to specific applications.**
- **The information provided must not be regarded as being technical capacity as defined in the Regulations.**

Scenario Assumptions

The scenario considered for the analysis is:

- Gas Year 2014/15 – incremental capacity can be requested in July 2011 window.
- Steady State Analysis only. When considering specific applications for capacity further analysis may be undertaken for Transient State. This could identify additional constraints, thereby limiting available capacity. In addition, because steady state analysis is undertaken no account has been taken of obligations to make flow flexibility available particularly at DN offtakes: this would require transient analysis.
- Results identify capability in excess of existing commitments (i.e. baseline plus previously released incremental capacity). Any existing, but unsold, capacity will be also available. However this may be subject to substitution to other exit points.
- Analysis has been undertaken on a regional basis as explained below, because:
  - There is a high level of interactivity within the NTS;
  - Baseline plus previously released incremental capacity cannot be accommodated in aggregate.

Sector Analysis

Capacity analysis could, in theory, be undertaken for all existing NTS Exit Points. It could also be extended to the location of potential new exit points. However, National Grid believes that the workload involved would be excessive and would provide little added knowledge over that obtained from the process adopted. Due to the interactive nature of the NTS, exit capability at one exit point is, in many cases, also available at the adjacent exit point. However, it would not be available at both locations at the same time. To tag capacity to one exit point would, therefore, be misleading. It is better, therefore, to quantify a "regional" capability.

National Grid believes that a reasonable compromise between excessive analysis and value of results is to divide the network into three sections: North, South and Central, as shown in diagram 1 and briefly described below.

1. North – North of Barrow and Teesside.
2. South – South of Alrewas, Peterborough and Bacton.
3. Central – Rest of system (between North and South Sectors).

Within these sections unused system capability has been calculated at six locations. No analysis has been undertaken for the South section because extensive analysis has already been undertaken for proposed new connections. This has demonstrated that the section is constrained without any capability above baseline. For the North and Central sections spare capability has been calculated for the West and East of the sections as the East / West divide defines the least interaction within the NTS. National Grid believes that the division of the network along the two lines described represent points of low interactivity. Notwithstanding that there will be some interaction between sectors, each sector (and sub-sector) has been analysed independently.
The six locations throughout the NTS that have been assessed are:

1. North – West
2. North – East
3. Central – West Coast
4. Central – West Midlands
5. Central – East Coast
6. Central – East Midlands / East of England

See map for further details.

Analysis Assumptions

Network analysis has been undertaken at "high" demand. High demand is most, but not exclusively, likely to identify system constraints. For specific capacity requests National Grid may be required to undertake analysis lower down the demand curve. As the aggregate baseline (plus existing incremental) capacity is well in excess of available supplies, criteria are required to define a high demand level. The following criteria, which are consistent with analysis for revenue drivers and exit capacity substitution, have been used.

- All exit points in the sector being considered were set at obligated (baseline plus previously released incremental) capacity levels, excluding storage sites and bi-directional interconnectors. It is assumed that at high demand storage and interconnectors will generally be operating as entry points.
- All Distribution Network exit points in other sectors were set to sold capacity levels irrespective of the baseline and obligated quantities. This is indicative of the demand forecast of DN operators.
- All directly connected exit points (i.e. power stations and industrials) in other sectors were set to forecast levels. This reflects the diversification of generation demand.
- All offtake pressure obligations maintain.

The basic assumption for network analysis is that the system is in balance, i.e. supplies equal demands. Hence, having set the demand level, supply levels are determined. The criteria used for this analysis was as follows:

- All supplies, including interconnectors and storage, were set at forecast supply level, except as stated below.
- Storage sites in the sector, but local to the nominal exit point being considered, were assumed to be off, e.g. in the case of the West Coast example, supplies at all local storage sites (Holford, Stublach, Hole House Farm) were reduced to zero. Storage supply sources are unpredictable and

may not be operating as entry points at high demand levels. This could be due to storage stock depletion under sustained high demand conditions.
- In order to ensure a supply/demand balance, supplies were adjusted at the ASEP with least interaction with the sector being analysed. Where an upward adjustment was required, flow at the ASEP was not adjusted above the entry baseline level. Where necessary additional ASEPs were used for balancing.

Following establishment of the network model consistent with the assumptions detailed above, the exit flow at the nominal exit point was increased. These increases in demand were balanced at ASEPs of minimal interaction. Flows were increased until a constraint was reached. A constraint would be identified by failure of the network, typically through breach of pressure or flow obligations within the network. The maximum flow level at which a constraint does not occur was used to determine the level of "spare" exit capacity at the location, and hence region, under assessment.

Results

North Sector: there is no unused system capability in either the West or East of this sector. This is primarily due to the latest forecast flows for St Fergus for 2014: entry flows are forecast to decline to around 76mcm/d. This declining flow from the North of the sector, together with a significant quantity of unsold baseline capacity (~7mcm/d) means that gas needs to flow from South to North and a system constraint occurs before current exit capacity obligations are reached. Hence there is zero "spare" capacity in both West and East coast examples in the North Sector.

For comparative purposes, the scenarios were re-analysed using the 2010 St Fergus forecast for 2014 (~ 91mcm/d). Under these scenarios, exit flows at the notional exit points could be increased to 14mcm/d and 19mcm/d for the West and East Coasts respectively. Hence, using last year's forecasts, there would be "spare" capacity available up to the quantities calculated. This highlights how changing supply patterns / system flows have a significant effect on exit capability and the potential for publication of unused system capability data to create false expectations.

Central Sector

Approximately 20mcm/d of "spare" capacity may be available in the Central sector (East Coast and East of England). In order to determine this level, the majority of ASEPs in other sectors were increased towards their baseline levels until entry constraints were reached.

Further "spare" capacity may be available, but this would require increased supplies in the central sector. Increasing flows from Rough (from the assumed value of zero) would create additional exit capability on a 1:1 basis, i.e. 1 mcmd input from rough creates 1 mcmd exit capability. (Note: a similar increase at Bacton cannot be considered due to the greater uncertainty of potential and existing bi-directional supplies. These supplies would be subject to different commercial influences and hence different analysis assumptions).

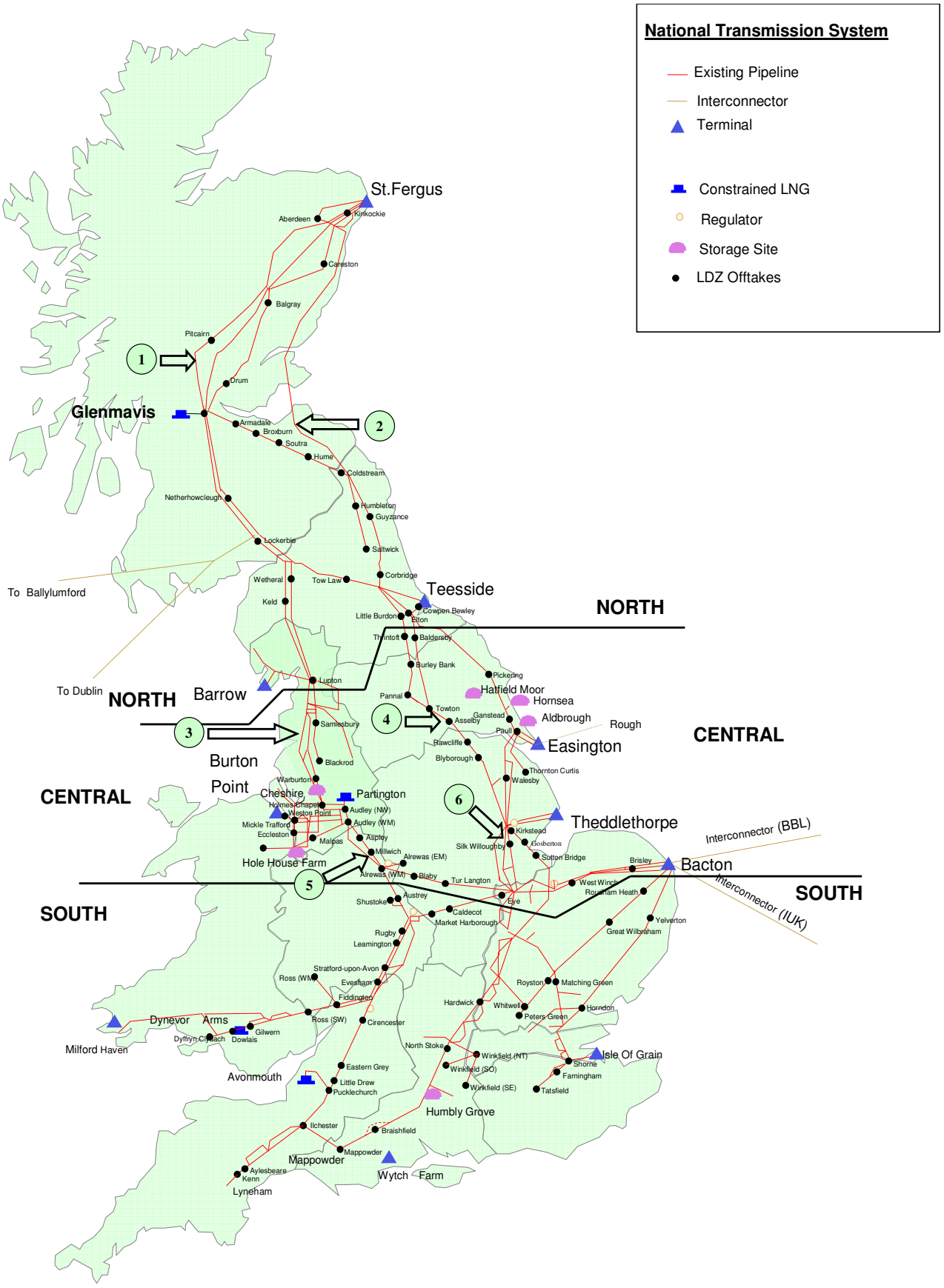
Separate analysis has shown that a maximum of approximately 19mcm/d could be available in the Central sector on the West Coast.
(Note: proposed new and expanded storage sites in this area would not be limited to this quantity because the effect of storage injection from the NTS is subject to different commercial influences and hence different analysis assumptions.)

In the West Midlands area of the Central sector, the maximum "spare" capacity available is heavily influenced by Milford Haven flows as a result of the various compressor/network configurations required to support system pressures. Under a supply pattern of "high" Milford Haven supplies (~67mcmd) which is consistent with the process outlined above, approximately 14mcm/d of "spare" capacity is available. With a lower flow of ~36mcm/d, existing obligations and system pressures cannot be supported in the

West Midlands and therefore zero “spare” capacity is available. The lower flow is based on statistical analysis of historical flows since commissioning of the Milford Haven ASEP and is consistent with similar analysis undertaken for specific projects.

Sector & Exit Point.	Approx Unused System Capability mcmd	Basis of analysis
1) North - West	**0** **14**	2011 forecast peak at St Fergus for 2014 of ~ 76mcm/d 2010 forecast peak at St Fergus for 2014 of ~ 91mcm/d
2) North - East	**0** **19**	2011 forecast peak at St Fergus for 2014 of ~ 76mcm/d 2010 forecast peak at St Fergus for 2014 of ~ 91mcm/d
3) Central - West Coast	**19**	
4) Central - West Midlands	**0** **14**	Historical flows at Milford Haven: ~36mcm/d 2011 forecast peak at Milford Haven for 2014 of ~67mcm/d
5) Central - East Coast	**20** **60**	Rough flow set at zero 2011 forecast peak at Rough for 2014 of ~ 40mcm/d
6) Central - East of England	**20** **60**	Rough flow set at zero 2011 forecast peak at Rough for 2014 of ~ 40mcm/d

Diagram 1 – Map of Sectors and Locations for Unused System Capability Calculation



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