Issue	Revision
8.0	Approved

The Incremental Entry Capacity Release Methodology Statement

Effective from 1st September 2008

nationalgrid

INCREMENTAL ENTRY CAPACITY RELEASE STATEMENT

Document Revision History

Version/ Revision Number	Date of Issue	Notes
1.0	July 2002	
2.0	August 2003	Minor clarifications and price schedules for new entry points (Milford Haven and Barton Stacey) included
3.0	July 2004	Minor clarifications, price schedules removed to now only appear in the Transportation Statement
4.0	July/August 2004	Changes following consultation responses
4.1	July 2005	Proposed changes consultation
5.0	August 2005	Proposed changes agreed
5.1	14 September 2005	Proposed amendment to include formal consent process prior to adjusting investment lead times
5.2	30 September 2005	Final proposed amendment to include formal consent process prior to adjusting investment lead times incorporating consultation representations
6.0	6th April 2006	Proposals for the introduction of a methodology for the determination of investment costs
6.1	11th May 2006	Final proposals for the introduction of a methodology for the determination of investment costs
6.2	3rd May 2007	Proposals to generate step prices from Transportation Model (following implementation of GCM01) and revise economic test. Updated to reflect Transmission Price Control Review Final Proposals. Format changes and general updating.
7.0	12th June 2007	Changes following consultation responses
7.0	16th July 2007	Authority approval

7.1	May 2008	Revised terminology to be consistent with new Licence drafting; diagram added to describe different capacity terms. Consistent with changes to the Licence, the emphasis has been changed to one of release of capacity instead of investing to deliver capacity. Changes of a minor nature to improve clarity or readability. Updating of references to Entry Capacity Substitution. Use of “prevailing” to acknowledge potential changes to obligated capacity levels. Reference to “project costs” changed to “project value” in respect of the provision of incremental capacity. Clarify Licence requirements before capacity is made available at new ASEPs and the role of the Authority in approving National Grid’s proposals. Clarification of processes for release of capacity under the “Accelerated Release” incentive.
7.2	June 2008	Minor changes following industry consultation to improve clarity.
8.0	July 2008	V7.2 approved by the Authority.

About this Document

This document describes the methodology that National Grid Gas plc ("National Grid") in its role as holder of the Gas Transporter Licence in respect of the NTS ("the Licence") employs to determine whether to release entry capacity to Users primarily in the unconstrained period i.e. beyond investment lead times. In particular, it defines under what circumstances National Grid will accept applications for incremental entry capacity from Users received through processes described in the Uniform Network Code, and thereby the level of financial commitment required from Users.

This document is one of a suite of documents that describe the release of incremental capacity by National Grid and the methodologies behind them. The other documents are available on our Charging website at:

http://www.nationalgrid.com/uk/Gas/Charges/statements/

This statement is effective from 1 September 2008.

This document has been published by National Grid in accordance with Special Condition C15 of the Licence. National Grid believes the content is consistent with its duties under the Gas Act and is consistent with the Standard Conditions, Standard Special Conditions and Special Conditions of the Licence.

If you require further details about any of the information contained within this document or have comments on how this document might be improved please contact our NTS Gas Charging and Access Development team on 01926 656217 or at box.transmissioncapacityandcharging@uk.ngrid.com or at:

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GENERAL INFORMATION

Background

1. National Grid is the owner and the operator of the gas National Transmission System (NTS) in Great Britain.

2. The NTS plays an important role in facilitating the competitive gas market and helping to provide the UK with a secure gas supply. It is a network of pipelines, presently operated at pressures of up to 85 barg, which transports gas safely and efficiently from coastal terminals and storage facilities to exit points from the system. Exit points are predominantly connections to Distribution Networks (DNs), but also include storage sites, and direct connections to large industrial consumers and other systems, such as interconnectors to other countries.

3. These operations are carried out to meet the needs of the companies that supply gas to domestic, commercial and industrial consumers and to power stations. In 2006/07 1,042 TWh of gas was transported to these consumers.

4. This publication sets out the methodology that applies for the release of incremental entry capacity i.e. capacity to be made available above the prevailing level of obligated entry capacity, primarily beyond investment lead times (the unconstrained period) in response to signals received from Users through processes described in the Uniform Network Code.

5. Details of National Grid and its activities can be found on its internet site at www.nationalgrid.com. An electronic version of this publication, along with the other related statements can be found at the following internet page "http://www.nationalgrid.com/uk/Gas/Charges/statements/".

6. It is important that National Grid is made aware of potential developments where incremental entry capacity may be required (at existing or new entry points) at an early stage. This is needed so that discussions can be held with the customer in relation to any additional work that may be required, including facilitating the physical connection, whether this is at a new or existing entry point. This work is charged for separately as specified in National Grid's Licence Condition 4B statement (The Statement and Methodology for Gas Transmission Connection Charging[1]), which is also available on the National Grid website. Contact can be made with the Customer Services team via e-mail to transmission.newgasconnections.nts@uk.ngrid.com.

National Grid's Licence Obligations

7. New and existing Users of the NTS are able to request to purchase entry capacity products for any NTS Aggregated System Entry Point (ASEP). Such capacity requests will be considered against the provisions of National Grid's statutory licence obligations and in accordance with its published methodologies.

8. Overriding obligations applicable to this statement are set out in the Gas Act and National Grid's Gas Transporter Licence in respect of the NTS, ("the Licence").

9. Specific obligations in respect of the release of incremental entry capacity and applicable to this statement are set out in Special Condition C15 of the Licence. Under this condition,

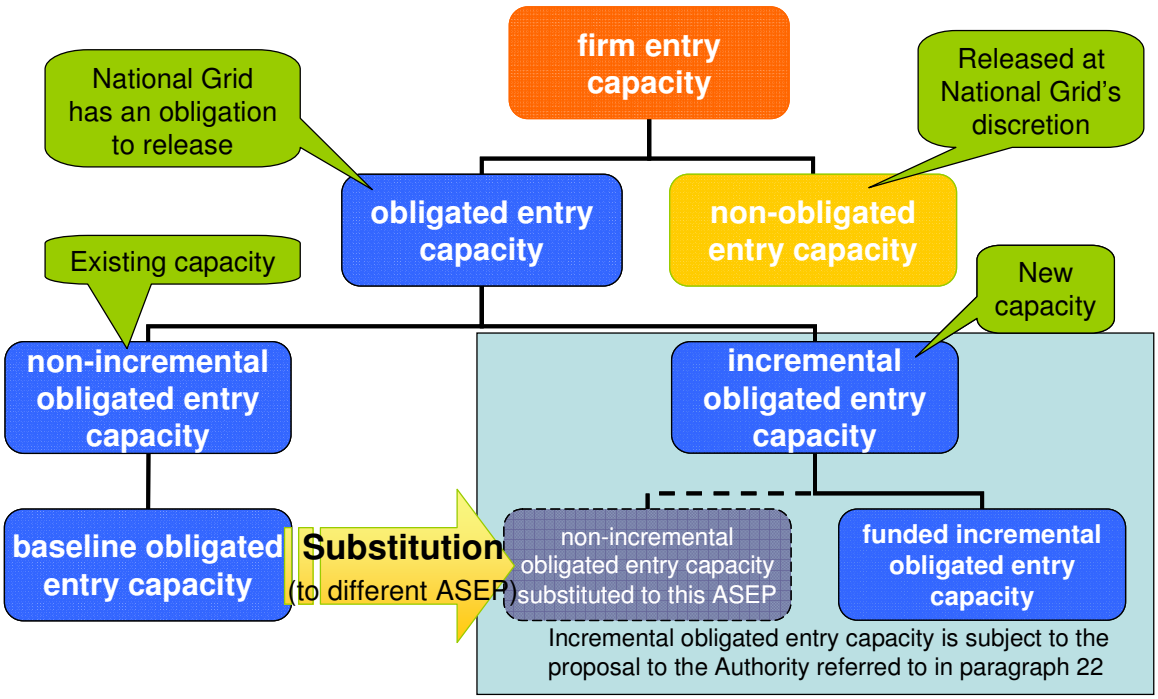
[1] Previously titled "National Grid NTS Statement of Principles and Methods to be Used to Determine Charges for National Transmission System Connection Services".

National Grid must prepare and submit to the Authority for approval the Incremental Entry Capacity Release Methodology Statement (the "IECR") setting out the methodology by which National Grid will determine whether to make incremental entry capacity available for sale.

Capacity Terminology

10. This document contains terminology relating to entry capacity which is used in the Licence for the purposes of distinguishing between National Grid's capacity obligations and revenue treatments. It should be noted that although this terminology exists, it does not change the capacity products that Shippers procure through established UNC processes e.g. Firm NTS Entry Capacity and Interruptible NTS Entry Capacity.

11. The terminology and relationships relating to Firm NTS Entry Capacity are provided below to assist the reader in interpreting this statement.



12. The actual definitions of these terms are contained within the Licence (Special Condition C8A). Where any conflict arises between the Licence and this statement the Licence shall prevail.

Planning Process

13. National Grid believes it is appropriate for it to continue to develop the NTS in a way that provides its customers and Great Britain generally, with a gas transmission system that is robust against supply shocks and which keeps pace with changes in the gas market, such as increasing dependency on imported supplies.

14. National Grid is also required by Special Condition C2 of the Licence, "Long Term Development Statement", to prepare an annual statement, with respect to each of the succeeding 10 years that will forecast;

- The use likely to be made of the pipe-line system; and

- The likely developments of that system.

15. National Grid believes it is important to seek wide views on the process for determining how it invests in its network as well as on the underlying assumptions that underpin such investment. An enhanced consultation process is operated under the banner of 'Transporting Britain's Energy' with a view to obtaining industry views on how the industry would like to see the NTS developed.

16. National Grid expects the results of long term auctions to be the primary driver for investment. A sufficiently strong, unambiguous, signal in long term auctions is the start of the process for triggering the release of additional entry capacity, which National Grid would normally expect to support through investment. This statement describes the process by which such releases of entry capacity might be triggered.

17. In addition to releasing entry capacity pursuant to an auction signal, National Grid may at its sole discretion, release for sale additional capacity for which it has no obligation to do so. For the purpose of the Licence any capacity released in accordance with this paragraph will be classified as non-obligated entry capacity.

18. National Grid also has a Licence obligation (Special Condition C8D paragraph 10) to consider whether unsold non-incremental obligated entry capacity can be substituted to NTS entry points where there is demand for incremental obligated entry capacity; i.e. demand exceeds the prevailing obligated level and paragraph 17 does not apply, thereby, potentially, reducing the requirement for investment in the NTS. The process by which such substitutions may be considered and the methodology that would be applied will be provided in the "Entry Capacity Substitution Methodology Statement" (the "ECS"). For the avoidance of doubt, the release of incremental entry capacity will be in accordance with this Incremental Entry Capacity Release Methodology Statement.

19. In its Direction of 3rd March 2008 (un-referenced) the Authority deferred the entry capacity substitution obligation to no later than 6th April 2009 with the ECS to be submitted to the Authority for approval no later than 6th January 2009. It is intended that the ECS will be published late 2008 / early 2009 following industry consultation, subject to approval by the Authority. National Grid will not consider opportunities for entry capacity substitution until the obligation becomes effective, i.e. potentially not until April 2009 and any actual substitution of capacity will be effective from a future date established in accordance with the substitution rules.

CHAPTER 1: PRINCIPLES

Purpose of the Methodology Statement

20. This methodology statement has been produced to meet the requirements of Special Condition C15 of the Licence. This condition requires the preparation of a statement setting out the methodology by which National Grid will determine whether to make incremental entry capacity available for release to Users of the NTS. National Grid believes the content is consistent with its duties under the Gas Act and the Licence.

21. For the purpose of this document, incremental entry capacity means capacity in excess of the prevailing level of obligated entry capacity and consists of incremental obligated entry capacity and non-obligated entry capacity as determined in accordance with Special Condition C8D of the Licence.

22. Where National Grid believes, pursuant to the application of this methodology (except where paragraph 17 applies), that there is, or will be, demand for additional firm entry capacity, National Grid will make a proposal to the Authority to release that capacity as incremental obligated entry capacity detailing the volumes to be treated as:

- Non-incremental obligated entry capacity where the demand for additional capacity can be satisfied in whole or in part through entry capacity substitution (in accordance with Licence obligations); and/or
- Funded incremental obligated entry capacity.

23. Other than for the release of non-obligated entry capacity (in accordance with paragraph 17 above), the methodology will normally be applied to periods following a default lead time of 42 months from the capacity auction. However, under the terms of the Licence National Grid may vary the lead time from 42 months. Where this takes place, this will be clearly signalled to Shippers via the auction process.

24. Consistent with the Licence and the Uniform Network Code, the release of NTS Firm Entry Capacity is a firm commercial capacity right that may be offered on a daily basis or multiples thereof: it does not reflect a commitment or obligation upon National Grid to undertake any investment on its network.

Remuneration for Release of Incremental Obligated Entry Capacity.

25. This methodology has been developed in good faith reflecting National Grid's understanding of the statutory obligations attached to both National Grid and the Authority, and its understanding of the regulatory framework which ensures continued remuneration of properly incurred expenditure on regulated assets.

26. For the avoidance of doubt, National Grid believes that any release of incremental obligated entry capacity is subject to approval by the Authority, whether explicitly in response to a specific proposal or implicitly through the establishment and application of the methodology specified in this statement.

27. National Grid believes that, by giving that approval, the Authority accepts that the implications of applying this methodology, including subsequent investment undertaken by National Grid with a view to physically meeting the demand for funded incremental obligated entry capacity, should be reflected in subsequent regulatory decisions, notably regarding proposals to modify the price controls and incentives defined within the Licence.

28. In this context, National Grid believes that any such approval should be regarded as establishing an expectation that associated investment should be reflected in its assumed regulatory asset value[2]; that any proposals for revising the quantities of obligated entry capacity should be demonstrably consistent with the entry capacity incentive structure (such that the terms on which capacity may have previously been released will not be significantly altered for either National Grid or Users); and that proposals for revising the entry capacity buy-back incentive parameters should demonstrably allow for the level of incremental entry capacity released. National Grid believes this is consistent with the Authority's duty to ensure National Grid is able to finance its functions.

Methodology Objective

29. The primary purpose of this methodology for determining incremental entry capacity volumes is to indicate the way in which National Grid will interpret the results of long term entry capacity auctions in terms of whether or not to seek to allocate incremental entry capacity rights to Users. In considering this, National Grid believes it is appropriate to consider the financial incentives it faces under conditions of the Licence, in particular as a result of the entry capacity investment and incremental capacity delivery incentives or maximum revenue entitlement allowed under, for example, the accelerated release of incremental obligated entry capacity. However, National Grid also believes it is important for the assessment to be set in the context of its wider obligations. The methodology set out in this statement therefore seeks to describe the circumstances in which National Grid believes there would (or would not) be a sufficient signal from entry capacity auctions to create a presumption in favour of releasing incremental entry capacity.

[2] National Grid understands that, as with the approach to price controls to date, Ofgem would wish to assure itself that any such capital expenditure had been efficiently incurred.

CHAPTER 2: DECISION MAKING METHODOLOGY

Information from Long Term Entry Capacity (QSEC) Auctions.

30. Information for considering whether or not to release incremental entry capacity will be based on indications of Users' demand for entry capacity as revealed by the relevant process described in Uniform Network Code.

31. In accordance with the Uniform Network Code requirements Users will be invited to indicate, for each of a set of prices, the quantity of entry capacity they wish to acquire (if any) at each ASEP, in each available period. These prices will be published in National Grid's Statement of the Gas Transmission Transportation Charges. The pricing methodology used to generate these prices is included in Chapter 3, and forms part of this methodology.

32. The pricing methodology establishes the prices per unit of capacity which are the minimum National Grid would expect to receive over a sustained period in order to justify releasing incremental obligated entry capacity at any given ASEP.

33. The P_0 price is that price at which National Grid would release, in response to valid bids, up to the available quantity of non-incremental obligated entry capacity – all bids will be accepted so long as the available quantity is not exhausted. This minimum available quantity will be calculated and published in accordance with the Licence conditions.

34. The incremental prices for each step of incremental entry capacity (P_1 to P_{20}) are based on the long run incremental cost of providing additional entry capacity above the prevailing obligated entry capacity level at each ASEP.

35. As described in Chapter 3, incremental prices have been calculated for each price step by estimating the cost associated with physically providing each level of incremental entry capacity, annuitising the cost, and adding this value to the P_0 price. This approach produces price steps whereby the change in National Grid's income from bidders, assuming all of the available quantity is sold at the incremental price step is equal to the estimated cost of providing incremental capacity over the period in question.

Estimated Project Value

36. For the purposes of determining the required commitment from bidders that would normally trigger the release of incremental entry capacity, should auction bids satisfy the test given in paragraph 43, an estimated project value will be calculated for each incremental entry capacity level from the final incremental step prices as detailed in Appendix 1.

37. The methodology for proposing that incremental obligated entry capacity should be released (described below) compares the strength of market signals for the incremental entry capacity against the estimated project value for providing the incremental entry capacity.

Procedure for Allocating Incremental Entry Capacity

Qualifying Bids

38. In accordance with Uniform Network Code processes, all Quarterly NTS Entry Capacity (QSEC) bids posted by the end of the bid process will be assessed. Only bids that satisfy

the relevant User credit requirements as specified in Uniform Network Code will be considered in this procedure.

Obligated Capacity Allocation

39. Where the aggregate quantity specified in valid bids at the P_0 price is less than or equal to the available quantity of non-incremental obligated entry capacity then capacity will be allocated to satisfy all requests in full. The "available quantity" will be determined in accordance with Special Condition C8D of the Licence.

Incremental Capacity Allocation

40. In respect of any ASEP where a minimum quantity of incremental entry capacity is demanded in any quarter National Grid will consider releasing incremental entry capacity to meet that demand.

41. National Grid will, for the quarter in question plus the subsequent thirty one quarters (or less where this would be beyond the period for which capacity has been offered), determine the net present value (NPV) of the revenue from bids for incremental obligated entry capacity which would be accepted if the given quantity of incremental obligated entry capacity was released.

42. The "quarter in question" will normally be the first quarter following the default lead time referred to in paragraph 46 where the aggregate volume of valid bids received first exceeds or equals the quantity of non-incremental obligated entry capacity plus the quantity of incremental obligated entry capacity that is being considered. However, at any given ASEP more than one quantity of incremental obligated entry capacity may be considered in which case the NPV test may be applied from more than one quarter. All values will be discounted to the relevant quarter on a quarterly basis using an annual discount factor of 8.3% (6.25% plus inflation).

43. If the NPV equals at least 50% of the "estimated project value", then National Grid would make a proposal to the Authority to release that quantity of incremental entry capacity as incremental obligated entry capacity under the terms of the Licence as detailed in paragraph 22. There would be a presumption that such incremental obligated entry capacity should be released and allocated to Users. The "estimated project value" for each capacity level will be calculated in accordance with Chapter 3 and published alongside incremental step prices. A simple example showing how the NPV test works is given in Appendix 2.

Timing of Release of Incremental Obligated Entry Capacity

44. Following successful bids by Users (i.e. that pass the NPV test) and a proposal for the allocation of incremental obligated entry capacity being approved by the Authority, National Grid has obligations to make that capacity available from a point in the future. In order to deliver against these obligations, National Grid may undertake such system reinforcements as it considers necessary.

45. In the event that National Grid's proposals are not approved by the Authority National Grid will not allocate incremental obligated entry capacity but may, at its sole discretion, release non-obligated entry capacity.

46. National Grid shall release incremental obligated entry capacity for use subject to a default lead time of 42 months. The application of the default 42 month lead time shall be as

outlined within Special Condition C8D paragraph 3 g of the Licence, i.e. from the 1st day of the month following the end of the annual invitation period of the QSEC auction (e.g. the 42 months starts on 1st October 2008 for a successful bid placed in the September 2008 QSEC auction).

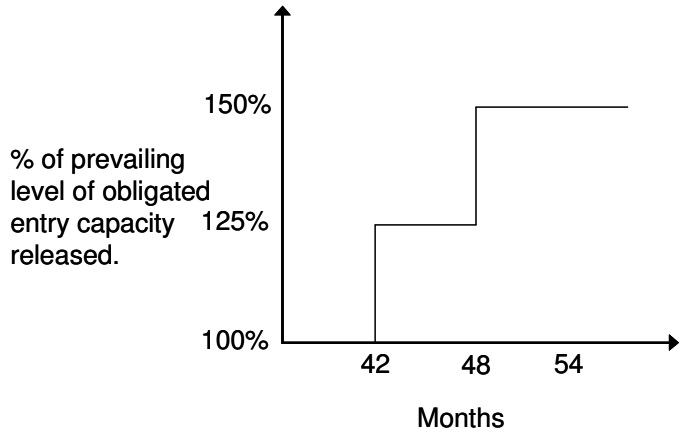
47. National Grid is encouraged, through incentives established in the Licence (Special Condition C8D paragraph 3 g-i), to reduce, where it can, the default lead time between the auction signal and the start of its contractual obligation to make incremental obligated entry capacity available. Hence National Grid is incentivised to take on that contractual obligation earlier.

48. The same Licence condition also provides National Grid with a limited number of opportunities to extend the 42 month lead time between the auction signal and the start of its contractual obligation to make incremental obligated entry capacity available. Such increases to lead times may be caused by the length of time required to obtain consents or construction challenges (for example which would require a construction season of more than one year) and are limited in terms of a total cap on the number of months of allowed delay for a total quantity of entry capacity. Where such opportunities have been exhausted, National Grid may extend the 42 month lead time for the release of incremental obligated entry capacity only with the consent of the Authority.

49. Where National Grid assesses in advance of a QSEC auction that it may be unable to meet a potential obligation to release any anticipated incremental obligated entry capacity within a 42 month lead time National Grid will notify bidders of:
- the relevant ASEP(s);
- the amount, if any, of the anticipated incremental obligated entry capacity that could be released with a 42 month lead time; and
- the revised contractual capacity release date, beyond the default 42 month lead time, for the remaining anticipated incremental obligated entry capacity quantity that would be appropriate at the affected entry point.

50. Where paragraph 49 applies, the lead time, and above information, will be specified in the relevant QSEC auction letter as a table and in the example format shown in Diagram 1 below:

Diagram 1: Example of format of pre-auction notification of earliest possible release of incremental obligated entry capacity at a given entry point.



51. In the above example, at a given entry point, only 125% of the obligated entry capacity will be released as incremental obligated entry capacity with a 42 month lead time. The

remaining volume up to 150% of obligated entry capacity will be made available with a 48 month lead time.

52. In assessing any lead time, National Grid will take into account any preliminary works agreements signed with, and underpinned by, relevant counter-parties ahead of the relevant auction.

53. Where paragraph 49 applies, the "quarter in question" referred to in paragraph 42 (i.e. the date from when the NPV test will be applied) will be the first quarter that any incremental obligated entry capacity requested through valid auction bids can be first released.

54. National Grid will only use its allowed extension to capacity release dates to the extent that valid bids for incremental obligated entry capacity are placed and accepted which match the amount of incremental obligated entry capacity which was subject to a variation from the default 42 month lead time.

55. National Grid will notify relevant Users of such extensions following assessment of the QSEC auction and determination of the necessary investment works, if any, required to support successful bids for incremental obligated entry capacity release.

56. The above paragraphs 49 to 55 refer to increases from the default lead time but apply equally to decreases and should be read accordingly.

Timing of release of Non-Obligated Entry Capacity

57. In addition to the variation of the default lead time[3] for releasing of incremental obligated entry capacity described in paragraphs 47 to 56 the Licence (Special Condition C8D paragraph 3 f) also establishes an incentive mechanism which encourages National Grid to make incremental entry capacity available to Shippers in advance of the default lead time in certain circumstances, known as 'accelerated release'. For Licence purposes this capacity is classified as non-obligated entry capacity but is still Firm NTS Entry Capacity for Shipper purposes.

58. As stated in paragraph 6, it is important that new projects and increased requirements at existing ASEPs are discussed with National Grid at an early stage. This is particularly important where Shippers would like incremental entry capacity earlier than the default lead time. National Grid will then be able to explore options to facilitate such a request and, if possible, will signal the potential for early release of non-obligated entry capacity in the auction invitation letter.

59. National Grid may release non-obligated entry capacity under the accelerated release incentive. Such release will be subject to:
    - Shipper bids satisfying the NPV test referred to in paragraph 43. For the avoidance of doubt, the test shall be applied from the default 42 month lead time except where this is adjusted in accordance with paragraph 47; and
    - Satisfactory assessment by National Grid of the associated risks and rewards.

60. Shippers can signal their requirement for the release of non-obligated entry capacity under the accelerated release incentive at any ASEP, irrespective of whether discussions have taken place in accordance with paragraph 58, by placing, in the QSEC auction, appropriate bids ahead of the lead time. In all cases National Grid shall undertake the risk / reward assessment, and hence decide whether to release non-obligated entry capacity, after completion of the QSEC auction.

[3] This may be reduced in accordance with paragraph 47.

61. Capacity will only be released under the accelerated release incentive to satisfy (in whole or part) actual bids received. This means, for example, that if Shippers signal a requirement for a quantity of incremental entry capacity as identified below:

- Months 37 to 39: quantity Q which can be met through accelerated release (non-obligated entry capacity)
- Months 40 to 42: no bids
- Months 43 onwards: quantity Q which will be met through release of incremental obligated entry capacity

then National Grid will have no obligation to release the quantity Q for months 40 to 42 in any future auction, including monthly auctions.

62. In accordance with paragraph 17 National Grid may also release non-obligated entry capacity, with or without the need for investment, in the absence of an unambiguous auction signal.

CHAPTER 3: INCREMENTAL ENTRY CAPACITY PRICING METHODOLOGY

Introduction

63. The objective of the incremental entry capacity pricing methodology is to produce a range of price steps which affords Users an opportunity to reveal their requirement for entry capacity, but which also reflects the estimated project value for providing entry capacity beyond the prevailing level of obligated entry capacity identified under the Licence. The underlying cost assumptions are forward looking and are informed by present day cost estimates for pipe laying and associated activities to provide new capacity.

Derivation of Long Run Marginal Costs and Long Run Incremental Costs

64. The Long Run Incremental Cost (LRIC) approach derives costs which represent the cost of providing capacity to transport increments of gas through the NTS. The LRIC methodology uses the Long Run Marginal Cost (LRMC) methodology described within the Statement of the Gas Transmission Transportation Charging Methodology. However, whilst the LRMC methodology considers only the marginal costs associated with a given supply and demand scenario, the LRIC methodology considers various incremental capacity levels above a given obligated capacity level to calculate the estimated incremental costs of moving from the obligated capacity level to the incremental capacity level.

65. The NTS Capacity Charging Model is used to calculate LRMCs and comprises:

- **The Transport Model** that calculates the LRMCs of transporting gas from each entry point (for the purposes of setting NTS Entry Capacity Prices) to a "reference node" and from the "reference node" to each relevant offtake point.
- **The Tariff Model** that adjusts the LRMCs to maintain an equal split of revenue between Entry and Exit users (where entry prices are used to set auction reserve prices).

These models are described in more detail in Appendix 1.

66. Prices for each Gas Year are calculated using the relevant year's 1-in-20 peak base case supply and demand data and network model (e.g. if setting entry capacity prices for Gas Year 2008/9, the base case supply/demand forecast for 2008/9 and the base network model are used).

67. The P_0 price for each NTS entry point is set equal to the Reserve Price, determined at the prevailing obligated entry capacity level in accordance with the Gas Transmission Transportation Charging Methodology.

68. Price steps above P_0 (i.e. P_1, P_2 and so on) which reflect incremental entry capacity are set by adjusting supply flows from the base case data to reflect the appropriate incremental capacity level at each NTS entry point.

69. For each price step, the marginal distances (i.e. the distance which an incremental entry flow would travel) derived from this process are compared to the marginal distance corresponding to the prevailing obligated capacity level.

70. The differential between the marginal distances is then used to calculate the capital cost of accommodating the incremental entry flow (for that price step). The capital costs are annuitised and adjusted to reflect the calorific value at that NTS entry point.

71. The price steps are also adjusted to ensure that a progression of prices is established i.e. there is a minimum price step size between successive price steps. This is required to allow a cleared price to be established in the auction.

72. Normally, this results in a price progression that increases with the increment of capacity (an ascending price curve). A price progression that decreases with incremental capacity level may also be observed, usually for new NTS entry points where connecting pipeline costs are added to the initial price progression (see below).

Incremental Step Sizes for Existing NTS Entry Points

73. Subject to paragraph 76, the incremental step sizes to be offered at auction are dependent upon the obligated entry capacity at each NTS entry point defined by the Licence. In accordance with the Uniform Network Code (Section B – 2.2.3 (c) & (d)), twenty increments will be offered.

74. For the avoidance of doubt, at any given time, the prevailing obligated entry capacity level incorporates:

- Non-incremental obligated entry capacity which comprises of
  - Initial baseline obligated entry capacity set out within the Licence; and
  - Entry capacity that has been substituted to or from the NTS entry point as a result of National Grid's Entry Capacity Substitution methodology
- Funded incremental obligated entry capacity that has previously been released

75. Price steps will usually be based on releasing capacity increments equal to 2.5% of the prevailing obligated entry capacity level at the relevant entry point. For example, the second price step (P_2) represents the minimum price at which valid bids for at least 105% of obligated entry capacity would need to be received before National Grid would consider releasing incremental obligated entry capacity equivalent to 5% of the prevailing obligated entry capacity level at that entry point.

76. Fewer increments will be specified at the smallest entry points. At NTS entry points that have a prevailing obligated entry capacity level that is less than 300GWh per day then the following will apply;

- In the first instance National Grid will determine the number of 15GWh increments required to offer no less than 50% of the obligated entry capacity level. The chosen increment size approximates to the increment that would be required if 300GWh is offered in 20 equal sized increments.
- No less than five increments are permitted. In instances where the application of a 15GWh increment infers that less than five increments will be required then a quantity that is equivalent to no less than 50% of the prevailing obligated entry capacity level at the relevant NTS entry point will be divided into five equal sized increments.

77. Additional price steps might be required in circumstances where demand is expected to exceed 150% of the prevailing obligated entry capacity level. Broadly this circumstance can arise at locations that have previously experienced high demand and at new entry points where no obligated entry capacity has previously been released.

78. At entry points where the planning process has signalled to National Grid's satisfaction that more than 50% capacity above the prevailing obligated entry capacity level may be demanded in a given year, National Grid would set price steps on the basis of quantities which were expected to exceed the indicated demand.

Incremental Step Sizes for New NTS Entry Points

79. From time to time demand may emerge for entry capacity at new NTS entry points. When, through its planning process, a requirement for a new NTS entry point has been demonstrated to National Grid's satisfaction, a price schedule will be published for subsequent long-term entry capacity auctions. Preservation of commercial confidentiality is an important consideration when developing a new entry point and therefore National Grid will publish price steps that seek to preserve confidentiality with respect to expected deliverability.

80. The number of price steps will be fixed and the aggregate size will be subject to a range of uncertainty as follows;

- The minimum number of price steps will be 20 increments of 15GWh each.
- The maximum number of price steps will be 20 increments of equal size, which in total are equivalent to 150% of the capacity requirement signalled to National Grid through its planning process.

81. Where a new NTS entry point is required to be established, Ofgem will be required to initiate the process necessary to modify the Licence such that the new entry point concerned is identified in the Licence. Until such modifications to the Licence are effective National Grid is unable to include the proposed new entry point in any long-term entry capacity auctions and incremental entry capacity will not be available for release at the proposed new entry point.

82. The methodology, which applies for new entry points, is consistent with the methodology outlined above for existing entry points, except that there are two main differences:

- Price steps at locations that have a zero obligated entry capacity level, such as new entry points, will commence at an initial price of zero, i.e. P_0 = zero.
- In the case of National Grid building any connecting pipe between the existing NTS and the proposed new entry point, an estimate of the extension costs will be annuitised and added to each of the incremental step prices (P_1 to P_{20}). Any request to build a connecting pipeline must be agreed with National Grid in a timely manner to allow a reasonable estimate of the extension costs to be obtained.

Pricing Recalculation

83. From time to time, when National Grid believe that there has been a substantial change to cost drivers, including the supply/demand balance, investment cost assumptions or network topology, it will be appropriate for National Grid to recalculate price schedules in light of any change. It is not anticipated that release of non-obligated entry capacity would normally trigger such a re-calculation unless the release is for a sustained period.

Appendix 1: NTS Capacity Charging Models for Derivation of NTS Capacity Charges and NTS Entry Capacity Step Prices.

The Transport Model

Model Input Data

84. The transport model calculates the marginal costs of investment in the transmission system that would be required as a consequence of an increase in demand or supply at each connection point or node on the transmission system, based on analysis of peak conditions on the transmission system. The measure of the investment costs is in terms of £/GWhkm, a concept used to calculate marginal costs, hence marginal changes in flow distances based on increases at entry and exit points are estimated initially in terms of increases or decreases in units of kilometres of the transmission system for a small energy injection to the system.

85. The transport model requires a set of inputs representative of peak 1-in-20 conditions on the transmission system:

- Nodal forecast 1-in-20 peak day supply and demand data (GWh)
  - Distribution Network and Direct Connect (e.g. power stations) offtake demands
  - ASEP supplies
- Transmission pipelines between each node (km)
  - Existing pipelines
  - New pipelines expected to be operational at the beginning of the gas year under analysis
- Identification of a reference node

Model Inputs

86. The nodal supply data for the transport model will be derived from the supply/demand match set out in the Ten Year Statement. The supply figures at Storage and Interconnector entry points will be set at a level less than or equal to the expected entry point capability. The aggregate Storage and Interconnector flows will be adjusted such that a supply and demand balance is achieved.

87. Nodal demand data for the transport model will be based on demand that DN Users have forecast to occur at the National 1-in-20 peak day demand level and the booked firm entry capacity for directly connected consumers.

88. National Transmission System network data for the charging year will be based on data taken from National Grid's Ten Year Statement.

89. The use of the reference node enables the marginal costs to be considered as those supply costs generated from a notional change in flow *from* any node *to* the reference node. The costs generated from a notional change in flow from the reference node to any node are the negative of these supply costs.

90. It may be demonstrated that the choice of the reference node does not affect the final tariffs, after they have been adjusted to recover revenue (for exit charges) or to maintain a

defined entry-exit split of revenue (for entry prices) i.e. it determines the magnitude of the marginal costs but not the relativity. For example, if the reference point were put in the North of Scotland, all nodal supply marginal costs would likely be negative. Conversely, if the reference point were defined at Land's End, all nodal supply marginal costs would likely be positive. However, the relativity of costs between nodes would stay the same. For information, the reference node has been set at Peterborough.

91. The model calculates the marginal costs of investment by determining flow distances (or shadow prices) at each node. This type of model does not require a parameter to be entered to determine the size of flow increment that should be injected to generate incremental costs of investment.

Model Outputs

92. The transport model is an optimisation model that calculates the minimum total network flow distance (in GWhkm) given a set of supply and demand flows i.e. it takes the inputs described above and uses a transport algorithm to derive the pattern of balanced network flows that minimises distances travelled by these flows from a supply node or to a demand node, assuming every network section has sufficient capacity.

93. The marginal cost values are expressed solely in km as they are flow gradients i.e. they represent the sensitivity of the total network flow distance value to a change in supply or demand at any node (Total Flow Distance ÷ Change in Nodal Flow implies units of GWhkm ÷ GWh = km).

94. The model computes a marginal cost for supply at each node (which may be positive or negative in relation to the reference node). The marginal cost for demand at each node is then the equal and opposite of the nodal marginal cost for supply. A negative marginal cost represents a marginal benefit or avoided cost at that point.

The Tariff Model

The Initial Nodal Marginal Distances

95. The key inputs to the tariff model are the marginal costs of supply and the marginal costs of demand calculated from the transport model. These are used to set the Initial Nodal Marginal Distances (InitialNMkm):

$$InitialNMkm_{Si} = LRMC_{Si} \quad \text{and} \quad InitialNMkm_{Dj} = -LRMC_{Dj}$$

Where

$InitialNMkm_{Si}$	=	*Initial nodal marginal distance for supply i (km)*
$InitialNMkm_{Dj}$	=	*Initial nodal marginal distance for demand j (km)*
$LRMC_{Si}$	=	*Long run marginal cost of flow to reference node from supply i (km)*
$LRMC_{Dji}$	=	*Long run marginal cost of flow to reference node from demand j (km)*

96. The Initial Nodal Marginal Distances are adjusted to either maintain an equal split of revenue between Entry and Exit users where prices are used to set auction reserve prices, or to recover a target level of revenue, where prices are set as administered rates. This section describes how the nodal marginal distances are used to calculate entry long run incremental costs for each ASEP.

97. Long run incremental costs are calculated for an ASEP by determining the difference between adjusted nodal marginal distances for each incremental capacity level and the obligated capacity level.

98. The differences in the adjusted marginal distances are converted into unit (incremental) costs (£/GWh) by multiplying it by the Expansion Constant. These unit costs can then be converted into daily prices by applying the annuitisation factor[4]. An adjustment to reflect the calorific value at the ASEP is also applied.

99. The price schedule is established by adding each incremental price to the P_0 price to establish a price for each incremental level of capacity.

The Expansion Constant

100. The expansion constant, expressed in £/GWhkm, represents the capital cost of the transmission infrastructure investment required to transport 1GWh over 1km. Its magnitude is derived from the projected cost of an 85barg pipeline and compression for a 100km NTS network section. The 100km distance was selected as this represents the typical compressor spacing on the NTS.

101. Calculated from first principles, the steps taken to derive the expansion constant are as follows:

a) National Grid determines the projected £/GWhkm cost of expansion of 85barg pressure pipelines and compression facilities, based on manufacturers' budgetary prices and historical costs inflated to present values. Pipeline and compression costs are determined in accordance with the NTS Transportation Charging Methodology.

b) An average expansion constant is calculated from the largest three pipeline diameter/compressor sections (network sections n = 1, 2, and 3). The selection of expansion constants calculated from these three network sections is based on recent and expected future projects on the transmission system. The pipe diameters used are:

$$D_1 = 900\ mm$$
$$D_2 = 1050\ mm$$
$$D_3 = 1200\ mm$$

c) The maximum daily flow that can be facilitated through each of the three network sections is calculated. This is based on assumptions of an 85barg inlet pressure and a minimum outlet pressure of 38barg and is calculated from the Panhandle A pipe flow equation (a standard flow equation used within the gas industry).

$$Q_n = K_{flow} \times \left(\frac{T_{std}}{P_{std}}\right) \times D_n^{2.6182} \times \left(\frac{P_1^2 - P_{2,n}^2}{G^{0.8538} \times T_{av} \times L \times Z_{av}}\right)^{0.5394}$$

[4] The annuitisation factor is no longer contained as a separate term in the Licence but is implicit within the revenue drivers. However, a factor of 0.10272 was agreed with the Authority as quoted in paragraph 1.82 of the Transmission Price Control Review: Final Proposals, Appendices, Ofgem, 4th December 2006, Ref: 206/06b.

Where

Q_n	=	*Flow for network section n (mscmd)*
K_{flow}	=	*Constant (0.0045965)*
T_{std}	=	*Standard temperature (291.4 °K)*
P_{std}	=	*Standard pressure (1.01325 bar_a)*
D_n	=	*Diameter for network section n (mm)*
P_1	=	*Pipe absolute inlet pressure (86.01325 bar_a ~ 85 bar_g)*
$P_{2,n}$	=	*Pipe absolute outlet pressure for network section n (bar_a)*
G	=	*Gas specific gravity (0.6)*
T_{av}	=	*Pipeline average temperature (285.4 °K)*
L	=	*Pipe length (100 km)*
Z_{av}	=	*Average gas compressibility (0.85)*

d) The maximum daily energy flow is calculated from the volumetric flow using a standard planning CV of 39MJ/m^3 and the planning flow margin of 5%.

$$Capacity_n = \frac{Q_n \times CV}{((1+FM)\times 3.6)}$$

Where

$Capacity_n$	=	*Daily capacity for network section n (GWh)*
Q_n	=	*Flow for network section n (mscmd)*
CV	=	*Calorific Value (39 MJ/m3)*
FM	=	*Flow margin (5%)*
3.6	=	*Converts 10^6 MJ to GWh*

e) The compressor power requirement to recompress back to 85barg is calculated from the flow and the inlet and outlet pressures. The inlet pressure for the compressor is the outlet pressure of the pipe section for each pipe diameter D.

$$Power_n = \left(\frac{\gamma}{\gamma-1}\right)\frac{K_{power}\times Z_{av}\times T_{av}\times Q_n}{\eta}\left[\left(\frac{P_{out}}{P_{in,n}}\right)^{\frac{\gamma-1}{\gamma}} - 1\right](1+FM)$$

Where

$Power_n$	=	*Compressor power for network section n (MW)*
$P_{in,n}$	=	*Compressor absolute inlet pressure for network section n(bar_a)*
P_{out}	=	*Compressor absolute outlet pressure (86.10325 bar_a)*
K_{power}	=	*Constant (0.0040639)*
Z_{av}	=	*Compressibility (0.85)*
T_{av}	=	*Average gas temperature (285.4 °K)*
Q_n	=	*Flow for network section n (mscmd)*
γ	=	*Isentropic index (1.363)*

η	=	*Compressor adiabatic efficiency (80%)*
FM	=	*Flow margin (5%)*

f) The capital cost of the pipe for each network section is calculated from the pipe cost equation, the pipe diameter and the pipe length of 100km.

$$Pipe\_Cost_n = L \times (D_n \times Pipecost\_diameter\_factor + Pipecost\_constant\_factor)$$

Where

$Pipe\_Cost_n$	=	*Capital cost for pipe in network section n (£m)*
L	=	*Length (100 km)*
D_n	=	*Diameter for network section n (mm)*
Pipecost_diameter_factor	=	*Capital cost factor (£m/km/mm)*
Pipecost_constant_factor	=	*Capital cost factor (£m/km)*

g) The capital cost of recompression from the minimum pressure up to 85barg is calculated from the compressor power requirements.

$$Compressor\_Cost_n = Power_n \times Power\_Unit\_Cost$$

Where

$Compressor\_Cost_n$	=	*Capital cost for compression in network section n (£m)*
$Power_n$	=	*Compression power for network section n (MW)*
Power_Unit_Cost	=	*Unit cost for additional power at existing stations (£m/MW)*

h) An allowance for engineering and project planning costs is included at 15%. Project management costs are variable costs that are dependent upon many factors including location, timing, type and size of investment, however, size of investment is the main indicator of the scale of expected project management costs.

$$Project\_Cost_n = Project\_Factor * (Pipe\_Cost_n + Compressor\_Cost_n)$$

Where

$Project\_Cost_n$	=	*Project costs for network section n (£m)*
Project_Factor	=	*15%*
$Pipe\_Cost_n$	=	*Capital cost for pipe in network section n (£m)*
$Compressor\_Cost_n$	=	*Capital cost for compression in network section n (£m)*

i) The total cost is the pipe cost plus the compressor cost plus the project costs (£).

$$Total\_Cost_n = Pipe\_Cost_n + Compressor\_Cost_n + Project\_Cost_n$$

Where

$Total\_Cost_n$	=	*Total cost for network section n (£m)*
$Pipe\_Cost_n$	=	*Capital cost for pipe in network section n (£m)*
$Compressor\_Cost_n$	=	*Capital cost for compression in network section n (£m)*

j) The Unit cost is the Total Cost divided by the maximum energy flow (£m/GWh).

$$Unit\_Cost_n = Total\_Cost_n / Capacity_n$$

Where

$Unit\_Cost_n$	=	*Total unit cost for network section n (£m/GWh)*
$Total\_Cost_n$	=	*Total cost for network section n (£m)*
$Capacity_n$	=	*Daily capacity for network section n (GWh)*

k) The expansion constant is calculated by dividing the unit cost by the pipe section length of 100km (£/GWhkm). The expansion constant for each pipe diameter section is dependent on the minimum pressure. A higher pressure will reduce the compressor power requirement and hence will reduce the compression cost but will also reduce the maximum pipe flow. An optimum minimum pressure is calculated for each pipe diameter such that the pipe diameter specific expansion constants are minimised.

$$Specific\_Expansion\_Constant_n = 10^6 \times Unit\_Cost_n / L$$

Where

$Specific\_Expansion\_Constant_n$	=	*Expansion constant for network section n (£/GWhkm)*
L	=	*Length (100 km)*
10^6	=	*Conversion factor from £m to £*
$Unit\_Cost_n$	=	*Total unit cost for network section n (£/GWh)*

l) The final expansion constant is a simple average of the individual pipeline expansion constants.

$$EC = \frac{\sum_{n=1}^{3} Specific\_Expansion\_Constant_n}{3}$$

Where

EC	=	*Expansion constant (£/GWhkm)*
$Specific\_Expansion\_Constant_n$	=	*Expansion constant for network section n (£/GWhkm)*

Supply/Demand Scenario

102. Prices are set on the basis of the 1-in-20 peak base case supply and demand data for Gas Year Y+2, but with adjustments to the supply flows to reflect the capacity level in question. Demand flows remain unadjusted from the base case.

103. To determine the entry price at the incremental capacity level offered at an entry point, the supply scenario is adjusted for each entry point as follows:
    - The supply flow is adjusted to the entry capacity level to be provided for the entry point in question
    - All other supply flows are adjusted up or down in order of merit to balance the network back to the peak 1 in 20 demand level in the base case data

104. Each entry point will be analysed in this way in turn e.g. for 25 entry points, a maximum of 25 sets of analysis will be required. Each analysis set comprises a run to determine the LRMC at the obligated capacity level, and up to 20 runs to determine the LRMCs at each incremental entry capacity level.

Supply Merit Order

105. The supply merit order for each NTS entry point reflects the least beneficial alternate supply flow, in terms of enabling capacity provision at that entry point.

106. The supply merit order is determined by use of the transport model with the base case scenario to calculate pipeline distances from each NTS entry point to every other entry point.

107. For NTS entry points where flow needs to be added to the base case flow to align with the required capacity level, the remaining entry point flows are reduced in order of pipeline distance merit, starting with the furthest entry point ending with the entry point with the nearest entry point.

108. For NTS entry points where flow needs to be reduced from the base case flow to align with the required capacity level, the remaining entry point flows are increased in order of pipeline distance merit, starting with the nearest entry point and ending with the furthest entry point.

Network Model

109. The network model includes all existing pipe sections plus sanctioned projects expected to be completed by the start of the Gas Year Y+2. Any connection that has been paid for and hence is included at zero value in the NTS Regulatory Asset Base (RAB) will be included at zero length.

Entry-Exit Price Adjustment

110. The first step of the tariff model is to adjust the Initial Nodal Marginal Distances (InitialNMkm) such that the predefined 50:50 split between entry and exit is obtained. This is done for each capacity level and each ASEP.

111. An additive constant Adjustment Factor (AF) must be calculated which, when added to each Initial Nodal Marginal Distance, gives a revised marginal distance for each supply (NTS ASEP) and for each demand (NTS offtake). The calculation simultaneously removes the negative marginal distances by collaring the Initial Nodal Marginal Distances at zero.

112. The Adjustment Factor is calculated such that the average marginal distances (flow distances) for supply and demand are equal.

$$\sum_{Si=1}^{n_S}\left(\frac{Max[0, InitialNMkm_{x,Si} + AF_x]}{n_S}\right) = \sum_{Dj=1}^{n_D}\left(\frac{Max[0, InitialNMkm_{x,Dj} - AF_x]}{n_D}\right)$$

Where

$InitialNMkm_{x,Si}$ = *Initial nodal marginal distance for supply i for price step x (km)*

$InitialNMkm_{x,Dj}$ = *Initial nodal marginal distance for demand j for price step x (km)*

AF_x = *Adjustment factor for price step x(km)*

n_S = *Number of supply charging points (-)*

n_D = *Number of demand charging points (-)*

i = $1,\ldots n_S$

j = $1,\ldots n_D$

x = *1,2,…n and the obligated level*

n = *the highest incremental capacity level considered for the entry point*

113. The Nodal Marginal Distance (NMkm) for the entry point in question is then the Initial Nodal Marginal Distance for that entry point plus the Adjustment Factor.

$$NMkm_{x,EntryPoint} = InitalNMkm_{x,EntryPoint} + AF_x$$

Where

$InitialNMkm_{x,Entry\ Point}$ = *Initial nodal marginal distance for the entry point for price step x (km)*

AF_x = *Adjustment factor for price step x(km)*

$NMkm_{x,EntryPoint}$ = *Nodal marginal distance for the entry point for price step x (km)*

EntryPoint = *The entry point being analysed (a node in the set of supplies)*

i = $1,\ldots n_S$

j = $1,\ldots n_D$

x = *1,2,…n and the obligated level*

n = *the highest incremental capacity level considered for the entry point*

Incremental Distances

114. The Nodal Marginal Distances for each entry point being considered at each incremental capacity level are converted to Nodal Incremental Distances by calculating the difference between the Nodal Marginal Distance at the incremental level and the Nodal Marginal Distance at the obligated capacity level.

$$NIkm_{x,EntryPoint} = NMkm_{x,EntryPoint} - NMkm_{Obligated,EntryPoint}$$

Where

$NIkm_{x,EntryPoint}$ = *Nodal incremental distance for the entry point for price step x (km)*

$NMkm_{x,EntryPoint}$ = *Nodal marginal distance for the entry point for price step x (km)*

$NMkm_{Obligated,EntryPoint}$ = *Nodal marginal distance for the entry point at the obligated capacity level (km)*

EntryPoint = *The entry point being analysed (a node in the set of supplies)*

x = *1,2,…n*

n = *the highest incremental capacity level considered for the entry point*

Entry Capacity Step Prices

115. The Nodal Incremental Distances are converted to capital costs by multiplying by the Expansion Constant, and annuitised using the annuitisation factor (which means that the cost is spread evenly over the expected life of the asset taking into account the required rate of return). Annuitised costs are converted from £/GWh/year to p/kWh/day by dividing by 365 and multiplying by 100.

116. Annuitised costs are adjusted to recognise the different calorific values of gas entering the system using ASEP specific calorific values.

117. The initial incremental step price is calculated by adding the annuitised cost for the incremental capacity step to the baseline reserve price.

$$Price_{0,EntryPoint} = ReservePrice_{EntryPoint}$$

$$Price_{Obligated,EntryPoint} = Max\left[0.0001, \left(\frac{NMkm_{Obligated,EntryPoint} \times AnF \times EC \times 100}{10^6 \times 365} \times \frac{39}{CV_{EntryPoint}}\right)_{4dp}\right]$$

$$InitialPrice_{x,EntryPoint} = Price_{Obligated,EntryPoint} + \left(\frac{NIkm_{x,EntryPoint} \times AnF \times EC \times 100}{10^6 \times 365} \times \frac{39}{CV_{EntryPoint}}\right)_{4dp}$$

Where

$Price_{0,EntryPoint}$ = *The P_0 price, being the Final Entry Price for the entry point for price step 0 (p/kWh/day)*

$ReservePrice_{EntryPoint}$ = *The reserve price for the entry point calculated at the prevailing obligated exit capacity level according to the Gas Transmission Transportation Charging Methodology*

$Price_{Obligated,EntryPoint}$ = *Price for the entry point at the obligated capacity level (p/kWh/day)*

$NMkm_{Obligated,EntryPoint}$ = *Nodal marginal distance for the entry point at the obligated capacity level (km)*

$InitialPrice_{x,EntryPoint}$ = *Initial Entry Price for the entry point for price step x (p/kWh/day)*

$NIkm_{x,EntryPoint}$ = *Nodal incremental distance for the entry point for price step x (km)*

AnF = *Annuitisation factor (per year)*

EC	=	*Expansion constant (£/GWhkm)*
10^6	=	*Conversion factor from GWh to kWh*
100	=	*Conversion factor from £ to pence*
365	=	*Conversion factor from annual to daily price*
39	=	*Standard calorific value (MJ/m^3)*
$CV_{EntryPoint}$	=	*Calorific value for the entry point (MJ/m^3)*
4dp	=	*Rounding to 4 decimal places of precision*
EntryPoint	=	*The entry point being analysed (a node in the set of supplies)*
x	=	*1,2,…n*
n	=	*the highest incremental capacity level considered for the entry point*

Application of Reserve Prices

118. The relevant reserve price (P_0 price) for each Gas Year is used to set prices in auctions. For QSEC Baseline Reserve Prices, published in respect of future Gas Years (Gas Years Y+2, Y+3 to Y+16), this means the network model including all projects expected to be completed for the start of Gas Year Y+2.

New Entry Points

119. In the event that a connecting pipe is required to be provided by National Grid for a new entry point, the initial price schedule calculation in paragraph 117 will be replaced by the following calculation:

$$InitialPrice_{x,EntryPoint} =$$

$$Price_{Obligated,EntryPoint} + \left(\left\{ \frac{NIkm_{x,EntryPoint} \times EC \times 39}{10^6 \times CV_{EntryPoint}} + \frac{ConnectionCost_{x,EntryPoint}}{Capacity_{x,EntryPoint}} \right\} \times \frac{AnF \times 100}{365} \right)_{4dp}$$

Where

$InitialPrice_{x,EntryPoint}$	=	*Initial Entry Price for the entry point for price step x (p/kWh/day)*
$Price_{Obligated,EntryPoint}$	=	*Price for the entry point at the obligated capacity level (p/kWh/day)*
$NIkm_{x,EntryPoint}$	=	*Nodal incremental distance for the entry point for price step x (km)*
AnF	=	*Annuitisation factor (per year)*
EC	=	*Expansion constant (£/GWhkm)*
$ConnectionCost_{x,EntryPoint}$	=	*Estimate of the connection cost for the entry point for price step x (£m). This may require design and/or feasibility studies to be undertaken.*
$Capacity_{x,EntryPoint}$	=	*Capacity level for the entry point for price step x (GWh)*
10^6	=	*Conversion factor from GWh to kWh*

100	=	*Conversion factor from £ to pence*
365	=	*Conversion factor from annual to daily price*
39	=	*Standard calorific value (MJ/m^3)*
$CV_{EntryPoint}$	=	*Calorific value for the entry point (MJ/m^3)*
4dp	=	*Rounding to 4 decimal places of precision*
EntryPoint	=	*The entry point being analysed (a node in the set of supplies)*
x	=	*1,2,…n*
n	=	*the highest incremental capacity level considered for the entry point*

Ascending and Descending Price Schedules

120. The process for determining prices given above will usually result in an increasing price progression with increasing capacity level (an ascending price curve). However, especially in the case of new entry points where economies of scale may be present when including connecting pipe costs, a price progression that decreases with the incremental capacity level may be observed.

121. In order to test for the presence of an ascending or descending curve, the price at the highest capacity level to be offered (P_n) will be compared to the P_1 price.

122. An ascending price curve is detected if $P_n \geq P_1$ and a descending price curve is detected if $P_n < P_1$.

123. The final incremental step price is determined by ensuring that there is a difference of at least 0.0001 p/kWh/day between each incremental step price. This is required to ensure a monotonic price schedule is generated so that a unique clearing price may be determined for incremental capacity allocation.

124. If the ASEP has an ascending price curve the final incremental step prices are calculated (starting at P_0 and working forwards through the price steps) using the following equation:

$$Price_{x,EntryPoint} = Max\left[0.0001 + Price_{x-1,EntryPoint}, InitialPrice_{x,EntryPoint}\right]$$

Where

$Price_{x,EntryPoint}$	=	*Final Entry Price for the entry point for price step x (p/kWh/day)*
$InitialPrice_{x,EntryPoint}$	=	*Initial Entry Price for the entry point for price step x (p/kWh/day)*
EntryPoint	=	*The entry point being analysed (a node in the set of supplies)*
x	=	*1,2,…n*
n	=	*the highest incremental capacity level considered for the entry point*

125. Otherwise, the ASEP has a descending price curve[5], so the final incremental step prices are calculated (starting from the highest price step and working backwards through the price steps) using the following equation:

$$Price_{n,EntryPoint} = InitialPrice_{n,EntryPoint}$$

$$Price_{x,EntryPoint} = Max\left[0.0001 + Price_{x+1,EntryPoint}, InitialPrice_{x,EntryPoint}\right]$$

Where

$Price_{x,EntryPoint}$	=	*Final Entry Price for the entry point for price step x (p/kWh/day)*
$InitialPrice_{x,EntryPoint}$	=	*Initial Entry Price for the entry point for price step x (p/kWh/day)*
EntryPoint	=	*The entry point being analysed (a node in the set of supplies)*
x	=	*n-1,…2,1*
n	=	*the highest incremental capacity level considered for the entry point*

Estimated Project Values

126. For the purposes of determining the required commitment from bidders that would normally trigger the release of incremental capacity, should auction bids satisfy the test given in paragraph 43, an estimated project value will be calculated for each incremental capacity level from the final incremental step prices as follows:

$$ProjectValue_{x,EntryPoint} = InitialPrice_{x,EntryPoint} \times \frac{365}{100 \times AnF} \times IncCapacity_{x,EntryPoint}$$

Where

$ProjectValue_{x,EntryPoint}$	=	*Estimated project value for the entry point for price step x (£m)*
$InitialPrice_{x,EntryPoint}$	=	*Initial Entry Price for the entry point for price step x (p/kWh/day)*
AnF	=	*Annuitisation factor ($year^{-1}$)*
100	=	*Conversion factor from £ to pence*
365	=	*Conversion factor from annual to daily price*
$IncCapacity_{x,EntryPoint}$	=	*Incremental capacity level for the entry point for price step x (GWh)*
EntryPoint	=	*The entry point being analysed (a node in the set of supplies)*
x	=	*1,2,…n*
n	=	*the highest incremental capacity level considered for the entry point*

[5] For the avoidance of doubt, the P_0 price step remains unchanged in this process.

Appendix 2: Example of the NPV test

This example is provided as an indication of how the methodology to release incremental entry capacity is applied. It should not be taken as being indicative of actual step prices, project values, or the ease with which release of capacity may be triggered.

Assume:

1. for simplicity there are only 5 price steps
2. the obligated volume is 100GWh/d
3. Q1 is April 2012

National Grid publishes the following Price Schedule to apply in a QSEC auction.

Available (GWh)	Price Label	Price (p/kWh/d)	Estimated project Value (£m)
150	P_5	0.06	20
140	P_4	0.05	16
130	P_3	0.04	12
120	P_2	0.03	8
110	P_1	0.02	4
100	P_0	0.01	0

Assume the following bids are obtained through the auction:

Supply			Demand																	
Available (GWh)	Price Label	Price (p/kWh/day)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	…	Q32
150	P_5	0.06	100	100	120	120	110	100	100	100	100	100	100	100	100	100	100	100	…	100
140	P_4	0.05	100	100	120	120	110	100	100	100	100	100	120	100	100	100	100	100	…	100
130	P_3	0.04	100	100	130	130	120	100	130	130	100	100	130	125	100	100	110	110	…	100
120	P_2	0.03	100	100	135	135	120	100	135	131	110	100	132	125	100	100	120	120	…	100
110	P_1	0.02	100	100	140	135	130	100	140	140	120	100	134	125	100	100	120	120	…	100
100	P_0	0.01	100	100	145	140	131	100	140	140	120	100	135	130	100	100	120	120	…	100

Q3 is the first quarter where aggregate capacity bids are placed at the relevant step price. Therefore, there is a signal to release 130GWh per day from Q3. Although 145 GWh per day was bid these were not at the relevant step price. The clearing price for Q3 and Q4 would be P3, P1 for Q5, P3 for Q7 and Q8 and so on. This means that there is a signal for 30GWh per day of incremental obligated entry capacity. The NPV test is applied as below:

It is possible that there could be second signal (not shown in the example) for release of a greater incremental quantity from a later quarter. National Grid will apply the NPV test against both signals, and if successful, will release entry capacity consistent with both sets of bids.

			Oct-12	Jan-13	Apr-13	Jul-13	Oct-13	Jan-14	Apr-14	Jul-14	Oct-14	Jan-15	Apr-15	Jul-15	Oct-15	Jan-16	Apr-16	Jul-16		Jul-20
			Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**		**Q32**
Incremental Capacity to release	**GWh**	**(a)**	0	0	30	30	30	0	30	30	20	0	30	30	0	0	20	20		0
Clearing Price	**p/kWh/d**	**(b)**	0.01	0.01	0.04	0.04	0.02	0.01	0.04	0.04	0.02	0.01	0.04	0.01	0.01	0.01	0.03	0.03		0.01
Days per quarter	**day**	**(c)**	92	90	91	92	92	90	91	92	92	90	91	92	92	91	91	92		91
Incremental Revenue	**£m**	**(a)*(b)*(c) 100**	0.00	0.00	1.09	1.10	0.55	0.00	1.09	1.10	0.37	0.00	1.09	0.28	0.00	0.00	0.55	0.55		0.00
NPV Test	**£m**	**50% Project Value**	**6**																	
NPV of Revenue	**£m**	**2.01%**	**6.65**																	

As the NPV of the revenues (£6.65m) > 50% * Project Value (£6m), the NPV test is passed and 30GWh/d would be released from Q3 as incremental obligated entry capacity.