UK Gas Transmission System Benefits from Gas Storage

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Introduction

- GSOG invited WWA to produce this paper in April 2007
- Final version published in September 2007
- WWA examined potential approaches and decided to use the recently approved Transportation Model
- Using the Model WWA sought to prove the hypothesis that:

  Gas storage sites provide a benefit to the transmission system because on peak days they deliver to the system close to consumer demand, thereby reducing the need for pipe and compression capacity between alternative sources of gas and demand

- The paper is particularly relevant for the following reasons:
  - it is clear given the decline in UKCS supplies further investment in storage is needed; and
  - Proposed/potential changes to the UNC and charges may increase costs associated with shipping gas to/from storage

Key assumptions

- Storage sites are part of the overall system
  - Gas is parked in store for future use
  - Other system points do not “recycle” molecules
    - Uni-directional entry points deliver new gas to the system
    - Other bi-directional points such as interconnectors deliver new gas into the system and withdraw gas to alternative non-UK offtakes
    - Storage sites are more predictable than other entry points as they respond to single market signals (and demand). No interaction with substitutes, foreign markets and/or complimentary fuels/outputs
- For the purposes of the analysis WWA has assumed a single storage facility as results are produced on an aggregated basis
- WWA is aware that other benefits may exist e.g. savings SO costs, but due to data limitations we focused purely on TO benefits accrued from the delivery of gas into the network

Methodology

- Using National Grid's Transportation Model
  - Calculates LRMC for each entry and exit point by optimising peak day flows based on pipeline database
  - LRMC at each point represents the capital investment in additional pipe/compression which would be incurred by an incremental change in supply/demand at each point
  - A constraint in the Model restricts any charge from being <0
    - WWA removed this constraint to identify the true cost/benefit at each entry/exit point
  - WWA calculated a Base Case Value of £2.958bn using the unconstrained approach.
    - Using LRMCs and the Expansion Factor (£2223/GWh km)
  - We assumed storage does not exist and the equivalent volume of gas would be delivered through other existing entry point
    - We assumed 4 scenarios for delivery of that gas

Base Case

Source	GWh	%
Bacton	1492.5	26%
Easington (less Rough)	629.8	11%
Isle of Grain LNG	140.8	2%
Milford Haven	0	0%
St Fergus	1232.7	21%
Teesside	341.1	6%
Other Terminals	579.3	10%
LNG Storage	526.1	9%
Underground Storage	844.8	15%
TOTAL	**5787.1**	**100%**

Base Case Value = £2.958bn

Scenarios

- Due to decline in UKCS and Morecombe Bay we have only considered realistic sources of additional gas:
  - Bacton via Interconnector and/or BBL
  - Easington via Langeled
  - Teeside via Excelerate LNG
  - St Fergus
  - Grain LNG
  - Milford Haven LNG
- Scenario 1 – all gas enters at one of the entry points
- Scenario 2 – all gas enters in equal volume at the entry points
- Scenario 3 – all gas enters through the top three terminals
- Scenario 4 – all gas enters through only Bacton and Teeside

Results – Total NTS savings

	Bacton	Easington	Isle of Grain	Milford Haven	St Fergus	Teesside		**Total**
All values shown in £million capital								
Single Source Replacement of Storage Gas	100%						**£**	**218m**
		100%					**£**	**339m**
			100%				**£**	**314m**
				100%			**£**	**234m**
					100%		**£**	**1,929m**
						100%	**£**	**697m**
Replacement Gas Sourced in proportions:	16.7%	16.7%	16.7%	16.7%	16.7%	16.7%	**£**	**288m**
	33.3%	33.3%	0.0%	0.0%	0.0%	33.3%	**£**	**368m**
	50%	0.0%	0.0%	0.0%	0.0%	50%	**£**	**420m**

Results – Annual Savings

	Bacton	Easington	Isle of Grain	Milford Haven	St Fergus	Teesside		Total
All values shown in £million annual cost								
Single Source Replacement of Storage Gas	100%						£	24m
		100%					£	37m
			100%				£	34m
				100%			£	25m
					100%		£	208m
						100%	£	75m
Replacement Gas Sourced in proportions:	16.7%	16.7%	16.7%	16.7%	16.7%	16.7%	£	31m
	33.3%	33.3%	0.0%	0.0%	0.0%	33.3%	£	40m
	50%	0.0%	0.0%	0.0%	0.0%	50%	£	45m

Conclusions

- Single entry point scenario shows a range of £218m to £1.9bn additional NTS investment
- Of the other 3 scenarios there is a range of £288m to £420m of required investment (£31m to £45m p.a.)
- Hypothesis has been proved that;
  - *Gas storage sites **do** provide a benefit to the transmission system because on peak days they deliver to the system close to consumer demand, thereby reducing the need for pipe and compression capacity between alternative sources of gas and demand*
- Analysis has not considered OPEX savings

Way forward

- Storage sites are unique and provide benefits to the System and UK customers
- Need to be considered independently from other system points
  - In terms of transportation charges
- Should examine benefits that storage brings to the System and UK customers before considering the imposition of additional charges
  - Note that storage is vital for System Security and the investment environment should be attractive