Gas Storage in the GB Market

Executive Summary

Storage facilities provide a number of benefits to the GB market. Gas is stored in a variety of facilities helping to match supply and demand in the network from one day to the next.

The benefits they provide include minimising supply and demand mismatches in the market and the need for network balancing, minimising the volatility of prices both within the network and to end users. The flattening of demand spikes and ability to park gas on route to its destination also help to minimise the needs for network expansion and investment in moving gas around the country. In addition storage also provides improved security of supply should problems arise within the network or market, as they have gas immediately available to be able to supply the market.

The proposed changes to the gas charging regime would see storage facilities making a disproportionate contribution to NTS revenues to help manage the network. However, we must ensure that any additional costs for the use of storage does not create side effects so that they can be fully utilised and remain operational. Recent years have seen the closure of the Rough storage facility, and the mothballing or reduction in capacity of several other storage facilities. The "Beast from the East" last year acted as a reminder of how unforeseen events can quickly impact the market, and just how important it is to ensure that flexible gas assets are responding, and storage facilities play a major role is this.

The proposals in UNC Modification 0678F, involve increasing the storage discount from 50% to 80%, excluding all storage capacity from revenue recovery charges including after transfer to storage users, and allowing contracts acquired in 2018 to be surrendered. The impact of these proposals on NTS revenues are to reduce NTS revenues from gas storage for new capacity bookings from £4.3m to £500k, 0.6% to 0.1% of the overall NTS revenues. **The impact of UNC Modification 0678F is much lower than the cost of the exemption from TO Commodity Charge for storage under current arrangements. These costs are offset against the additive benefits to the industry of between £40m and £200m.**

This paper demonstrates that proposed UNC Modification 0678F changes are not only of minimal impact to the industry, but they are also delivering overall benefits.

1- Background to Storengy and the Gas Storage industry

Storengy UK, a fully owned subsidiary of Engie, operates the largest gas storage facility in the UK.

The situation of storage operators in the UK is already problematic with disproportionate business rates scheduled to improve very slowly in the coming years and a market value (seasonal spreads and shorter-term volatility) that reflects only partially the real value provided by gas storage to the gas system and the end users. The "missing money" corresponds to the storage contribution to system flexibility and its insurance value, for which asset owners receive no revenue.

Although these two elements are not the subject of the transmission tariff regime, it is important to keep in mind the economic context in which the Gas Charging Regime (GCR) proposals will apply, to understand their potential impact. The rules currently tabled in the UNC Draft Modification 678 propose a level of 50% for the discount of tariffs applicable to storages. This level, which corresponds to the minimum of the permitted range of the European Union (EU) regulation, is clearly not adapted

to the GB market, where storage benefits have been recognised though the exemption of Transmission Operator (TO) and System Operator (SO) commodity charges. The tabled proposal represents a substantial change threatening the sustainability of the last few gas storage assets of the UK, already near the tipping point. The additional strain on storage economics posed by adverse future tariffs to an already precarious situation will have a disastrous impact both on the storage businesses and on the end users of gas and electricity in GB.

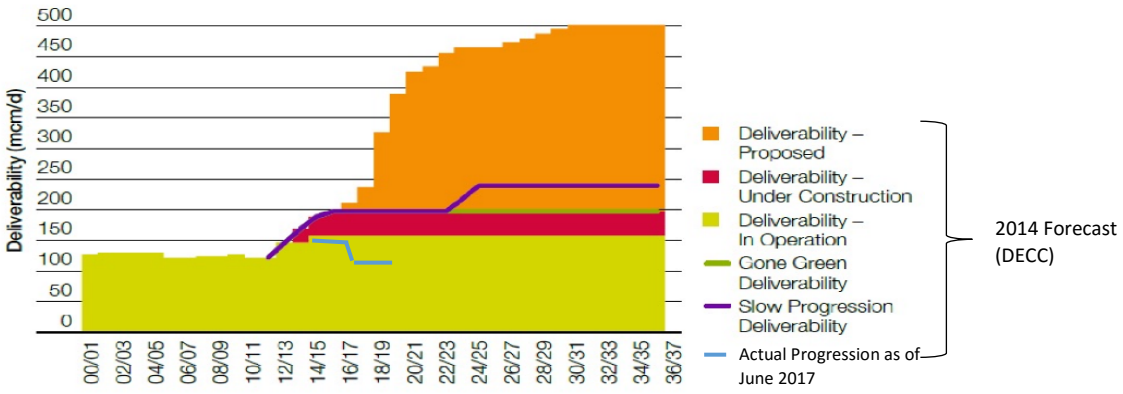
Following the March 2017 and July 2017 position papers on the National Transmission System Charging Methodology Forum (NTS CMF) gas charging review published by Storengy UK, this document intends to open the discussion to set the storage discount (Article 9 of the EU Harmonised Transmission Tariff Structures for Gas Network Code (EU TAR NC)) and highlights the benefits that Storage sites provide to the network and the market. Storengy' view is that the level of the discount should be at least 80%, all Storage capacity bookings should be exempt from revenue recovery charges, and that 2018 Entry capacity bookings should be allowed to be surrendered following the proposed move to floating prices.

Storengy Position Paper (March 2017): http://www.gasgovernance.co.uk/ntscmf/060317
Storengy Discount discussion document (July 2017): http://www.gasgovernance.co.uk/ntscmf/170717

2- Storage Capacity in the GB Gas Market

The storage capacity in the UK currently stands at 14 TWh, following the closure of the Rough seasonal storage, mothballing of Hole House Farm, and reduction in capacities at Hornsea and Aldborough. Considering the long lead time required to develop a storage project (5 yrs+), and the fact that no FID has been taken over the last 10 years, this capacity may not grow by more than 2 TWh within the 5 next years in the most optimistic scenario (de-mothballing and completion of caverns). As can be seen in Appendix 1, a few proposed storage projects have been around for some time, but the extremely adverse environment for gas storage in GB makes a FID highly unlikely for the time being. The following graph shows that all projects have been shelved or cancelled, and that the existing asset base has started to shrink. Additionally, UK storage owners have had to impair most of the book value of their UK storage plants, reflecting the lasting unfavourable conditions this asset class faces.

Figure 1: 2014 assessment of existing and proposed UK gas storage



Source: DECC 2014 UK Risk Assessment on Security of Gas Supply & Storengy UK 2017 update

The **14 TWh of storage space** are now exclusively composed of Medium Range Storages (MRS), which **are cycled up to 4 times per year**. This means that over each 12-month period, the volume is injected and withdrawn 4 times on average**.**

3- NTS Revenues and impact of the Storage Discount

Storage facilities respond to supply and demand imbalances. Levels and direction of imbalances can vary dramatically from one day to the next, driving the resultant storage flows. With this uncertainty, and the increase in NTS Entry and Exit capacity bookings, storages are expected to minimise these NTS capacity costs by moving towards daily/within-day pay-as-you-go bookings rather than booking fixed amounts over a monthly or quarterly period.

This would result in only short term bookings based on **Entry flows** going forwards, and with the majority of capacity for flows already covered by historic long-term bookings, any contributions from storage towards new capacity bookings are expected to be minimal. Based on National Grid' most recent model (CWD Transmission Services Model v3.1), and assuming that storages continue to flow at current levels, this would only result in further capacity bookings of around 3.3 TWh/yr, with resultant **NTS revenues of just over £400k** annually, assuming UNC Modification 0678 prices (as shown in analysis in Appendix 2).

With no long term capacity booked for **Exit flows**, capacity bookings at current levels would be in the region of 58 TWh, resulting in **NTS revenues of around £3.9m** (see Appendix 2).

It must be noted that these estimates represent an optimistic (i.e. maximum) view of NTS revenues from storage, assuming storage flows have no sensitivity to NTS capacity price. It is expected that the higher NTS costs will see a reduction in storage flows going forwards, which in turn will further reduce these NTS revenues as storage facilities responsiveness to the market is dampened. The potential impact of a greater storage discount can be seen in Appendix 2, comparing NTS revenue contributions with a 50% storage discount and with an 80% storage discount, where NTS revenues would reduce from £4.4m to £1.8m. This represents a fall from contributing 0.64% of NTS revenues to contributing 0.27% of NTS revenues, representing a negligible impact on NTS capacity revenues and capacity prices (less than 1% increase) for other market participants, with expected significant gains for the market and the consumer, and better utilisation of storage facilities.

This is a very small amount compared to the benefits detailed in section 5 and is comparable to the current arrangements, where the cost of the TO commodity exemption, an estimated £15m, as can be seen in Appendix 3.

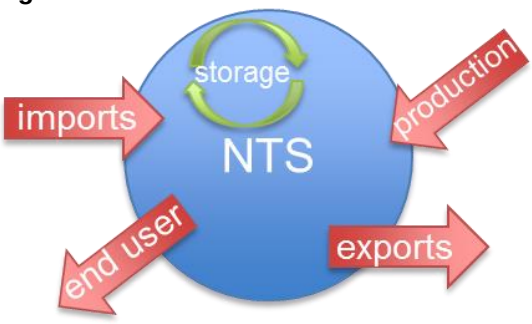
In addition, the analysis in Appendix 2 also shows the effects of Storengy' proposals for surrendering Entry capacity contracts acquired in 2018. It can be seen from this analysis that this significantly inflates NTS revenues received from storage facilities, with £1.3m contribution to NTS revenues per year generated by these contracts at 50% storage discount levels, and £530k generated with a storage discount of £80%, representing unfair treatment for any facilities affected.

4- Storage of gas is simply parking en-route to the end consumers

Following the GCR, the CWD or Postage Stamp methodologies are likely to replace the Long Range Marginal Cost (LMRC) methodology to set transmission tariffs. We agree that CWD or Postage Stamp methodologies are more appropriate to allocate the costs of a network with declining demand.

However, the allocation of costs must not penalise gas storage embedded in the system. Gas in the NTS has already been charged, there is no reason to charge further gas flows to and from a parking embedded within the NTS, which is in essence providing relief to the system by responding to supply-demand price signals.

Figure 2

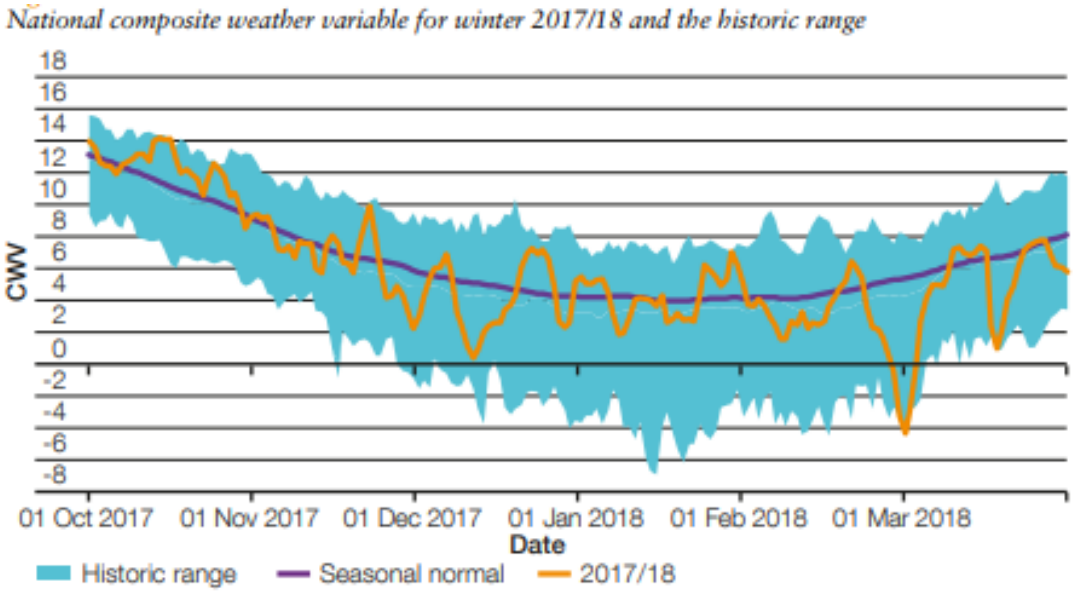


Gas is imported and directly delivered to the end user or exported	Gas is imported and stored before being delivered to the end user or exported
Gas price + 100% entry fee to the NTS + 100% exit fee of the NTS	Gas price + 100% entry fee to the NTS + (1-x)% exit fee from NTS to storage + (1-x)% entry fee from storage to NTS + 100% exit fee of the NTS

The use of storage is essentially a time spread trade at the NBP, and is not causing investment requirement for the network:

- The "off peak" NTS exit capacity usually booked by storage users reflects the counter-cyclical nature of the storage demand on the transport system. Exit points for storages have either zero or a very small Baseline Obligation (BFLEC) and Incremental Obligation (IFLEC). A connection to the NTS without enduring capacity is generally sufficient, because storages absorb surplus gas when demand is low, utilising the spare network capacity. The graph below shows the fluctuations in demand for winter 2017/18. For every 1 CWV change around 13 mcm of gas are required, and storage is key to being able to store (park) these quantities to quickly deliver to market during times of demand spikes and/or supply shortfalls.

Figure 3

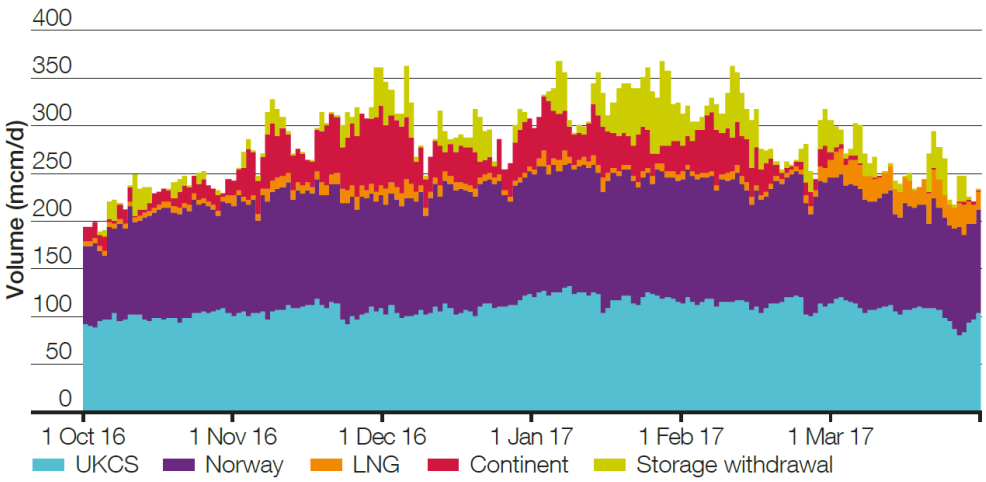


Source: National Grid Winter Review and Consultation document (11 June 2018)

- On the NTS entry side, the withdrawals from storage match the system requirements at times of high demand, as can be seen on the following graph. The gas can thus be physically

consumed locally upon re-entry into the network, without requiring long distance transport. The deliverability of a storage site, typically in a range from 10 to 20 mcm/d is comparable to the daily consumption of a large city.

Figure 4



Breakdown of NTS Supply in Winter 2016/17
Source: National Grid 2017 Winter Outlook and Consultation document

The current gas market arrangement reflect the fact that storage cannot sensibly be treated both as a gas supplier and as a demand customer. This view is also consistent with the plans recently announced by the Government and Ofgem[1] to help electricity storage developers.

At European level, there is a growing understanding that allocation of network costs to points at the borders of entry – exit systems is hampering trade, efficient balancing and security of supply. The findings of the Quo Vadis study[2] commissioned by the EU Commission confirm this view. While it is still premature to anticipate a change of direction of the European charging methodology between entry and exit systems, **this clearly points out the negative impact on trade and balancing that the application of unfavourable entry – exit tariffs to storage located within the NTS would cause**.

5- Benefits of Storage Facilities to the market: lower NTS investment, lower end user prices, reduced price volatility, efficient supply/demand balancing, increased security of supply

a- Lower NTS investment

Previous studies[3] carried out by WWA on behalf of GSOG have argued that storage provides a benefit to the transmission system in terms of avoided investment in additional capacity. The benefits, in the form of **investment savings** were in the region of **£40m to £70m per annum**. In a study[4] of transportation tariff discounts for gas storage, Pöyry estimates that European transmission network and importation infrastructure would need to be 9% to 16% bigger. Applying this ratio to the TO

[1] https://www.ofgem.gov.uk/publications-and-updates/upgrading-our-energy-system-smart-systems-and-flexibility-plan
[2] https://ec.europa.eu/energy/en/studies/study-quo-vadis-gas-market-regulatory-framework
[3] WWA, UK gas transmission system benefits from gas storage – an update to the initial report produced in 2007, April 2014 and UK Gas Transmission System Benefits from Gas Storage, September 2007
[4] http://www.poyry.com/sites/default/files/528_gb_gas_security_and_market_arrangements_v1_0.pdf

allowed revenue of the GB network for gas year 2019/20, corresponds to **investment savings** between **£80m to £140m per annum.** Additionally, National Grid has modelled the closure of storages in its 2017 edition of Future Energy Scenarios[5]. It concluded that if daily storage supply capability is reduced by half, "the margin of supply over demand declines to the point where new capacity would be needed by the early 2020s" in 2 of their 4 scenarios.

b- Lower end user prices

In addition to lower NTS investment, the dampening of price spikes also helps lower end user bills. As well as minimising fluctuations in end user prices, suppliers also see a reduced risk and resultant cost of price volatilities. The impacts of storage can be clearly seen below in comparing prices for the TTF in EUR/MWh (supported by significant storage) to prices for the NBP (supported by very few storage facilities).

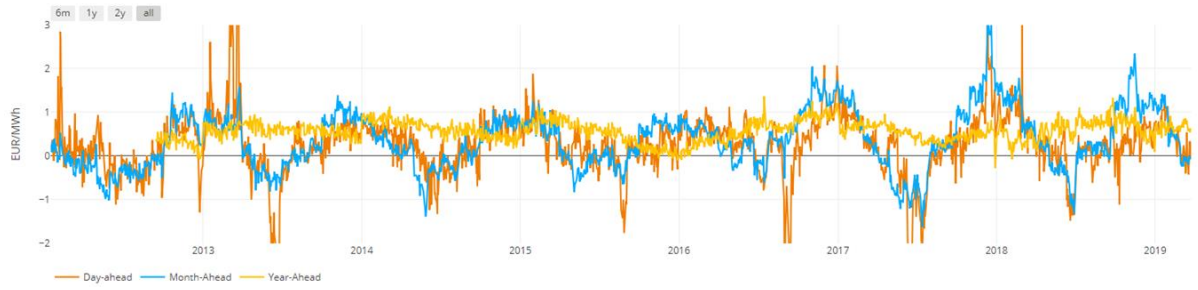
Table 1: NBP v TTF - Month ahead price difference (Eur/MWh)

Gas Year	Winter	Summer
2018/19	0.947	n/a
2017/18	1.342	-0.038
2016/17	1.097	-0.361

Note: Positive means NBP is higher than TTF

It can be clearly seen from this that this results in far more disproportionate pricing between summer and winter, and this can also be seen over the longer term trends shown in the graph below.

Figure 5

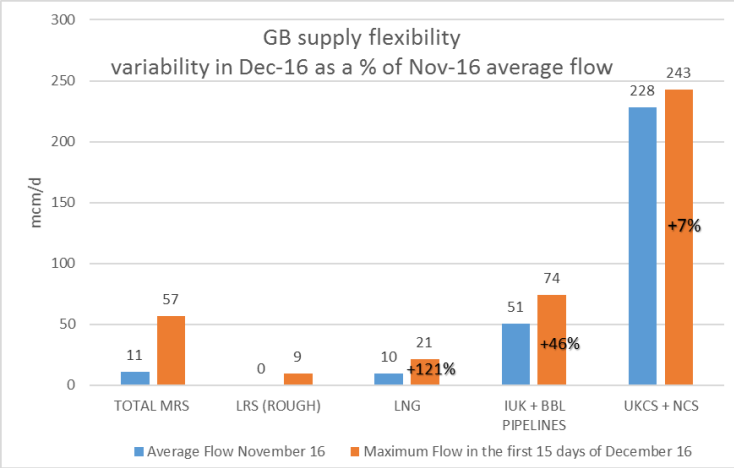


c- Reduced price volatility

In addition to the level of prices at times of high demand, the storages also lower price volatility more than any other flexible gas asset. This can be observed regularly, for the example during the cold spell at the beginning of December 2016. Not only was MRS contribution was by far the greatest, with 57 mcm variability on previous flows, but this was delivered exactly on the day of highest requirements (5 December 2016).

[5] Future Energy Scenarios July 2017

Figure 6



Source: Storengy UK based on National Grid data[6]

The cost of volatility is priced in by retailers and passed on to consumers. In a 2012 EU report of Transportation Tariffs Discounts for Gas Storage, Pöyry[7] estimated the reduction in gas price volatility as a result of storage flows in Great Britain to be 13% on average. Assuming the commodity component of the retail price includes a 8% mark-up on the wholesale prices set aside by suppliers to cover the balancing risks at the time the contract is locked in, the lower price volatility translates into savings[8] over 1% on the commodity component passed to customers. Taking a price of 45 p/th for the gas (1.535 p/kWh), this 1% **reduction in balancing costs** is worth **£122m per annum** on GB end users' bills.

d- efficient supply/demand balancing and NTS operations

Since 2011, the Default System Marginal Price (SMP) reflects the cost of linepack flexibility, considered to be NTS compressors and pipeline space. The Default SMP for the gas year 2017/18 was set at 0.0452 p/kWh (1.32 p/th), which provides an incentive for network users to balance the grid without intervention of the TSO. Storage users incur variable fees when they inject and withdraw gas into and from storages, but the total marginal costs (storage operations + NTS capacity without commodity charge) are currently lower than the Default SMP. As argued by National Grid in the final Modification Proposal[9] for the 2011 change, "*Reducing the incentive to balance **will lead to greater industry costs through imbalance charges and residual balancing actions***". The risk is for the Default SMP to become the next most competitive source of balancing for participants, when short-term import flexibility (imported gas from UKCS, NCS, LNG …, which can be adjusted for a just-in-time delivery into the NTS without incurring a double charging of NTS tariffs) is exhausted or does not respond,

[6] Variability is defined as the percentage increase between November 2016 average flows and peak flows during the cold spell in the first half of December 2016. Methodology based on the Oxford Institute for Energy Study 2013 report "Gas Storage in Britain" (C. Le Fevre), using National Grid 2016 data

[7] Transportation Tariffs Discount for Gas Storage - A report to Vereniging Gasopslag Nederland

[8] 8% of wholesale price x (–13%) reduction in volatility = -1.12%

[9] https://www.gasgovernance.co.uk/sites/default/files/ggf/Final%20Modification%20Report%200333%200333A%20including%20formal%20text%20v3.0.pdf

particularly in winter. These benefits have not been quantified, but the Future Energy Scenarios suggest that "the reduction in the availability of flexible supply would also increase the complexity of operating the NTS".

e – Increased security of supply

As suggested, Storage facilities store large amounts of Gas. This helps to provide a gas supply buffer for sudden shocks in the market and other potential supply problems. This could be as a result of weather fluctuations such as the "Beast from the East" in March 2018, where high short-term increases in demand, short-term reductions in supply, and delays in bringing online new supplies saw National Grid use emergency measures to help balance the market. This may be as a result in spikes in demand elsewhere diverting short-term supplies to other markets, or this could be simply due to problems with the physical infrastructure. Storage facilities help to minimise the impacts of all of these potential problems by helping to provide an immediately available store of gas for the market.

The £2.5m annual cost of a 80% discount for storage is to be compared to a series of additive benefits ranging from £40m to £200m.

Conclusion:

While the dynamics of the storage business have been recognised by the EU Network Code, a minimal application in GB of the storage discount of 50% would severely harm a critical component of the energy system already facing major headwinds.

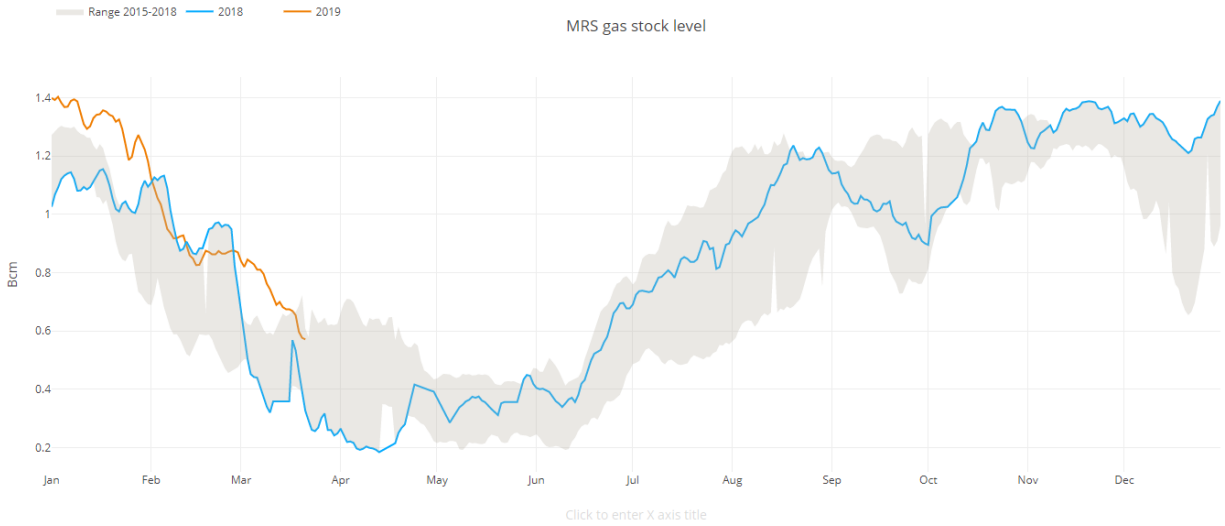
Although the GCR intends to solve issues of the charging regime, gas industry stakeholders, and particularly storage operators are wary that unintended side effects will reshape the market. Consequently, a cautious approach is required, to smoothen any change and avoid operators being abruptly pushed out of business and the market deprived of physical assets.

Storengy believes that the storage discount should be at least 80%, with all storage capacity exempt from revenue recovery charges, and that capacity acquired in 2018 should be allowed to be surrendered under the new proposals. Storengy believes that this paper shows the justification for these proposals, with these proposals providing greater benefit to storage facilities, the wider industry, and the end consumer.

Appendix 1: GB Storage Capacity

MRS volume usage over the last 5 gas years

Figure 7



Source: National Grid

Existing Storage (as at 31st August 2018):

Table 2a

Facility	Estimated Working gas volume (mcm)	Approx. max. production rate (mcm/d)	Approx. max. injection rate (mcm/d)	Withdrawal duration, from full assuming max. rate (days)	Start date	Owner
Facilities operating under negotiated Third Party Access (nTPA) rules						
Hornsea	235	12	3	20	1979	SSEHL
nTPA exempt facilities that are currently operational						
Hatfield Moor	70	2	2	35	2000	Scottish Power
Humbly Grove[1]	300	7	8	43	2005	Humbly Grove Energy
Aldborough Phase[2,3]	195	31	29	6	2009	SSEHL / Equinor
Holford (formerly Byley)[4]	200	22	22	15	2011	Uniper UK Ltd
Hill Top Farm[5]	20	2	2	10	2011	EDF Energy
Stublach Phase 1[6]	220	18	16	12	2014	Storengy

Due to become operational in 2019:

Table 2b

Facility	Estimated Working gas volume (mcm)	Approx. max. production rate (mcm/d)	Approx. max. injection rate (mcm/d)	Withdrawal duration, from full assuming max. rate (days)	Start date	Owner
nTPA exempt capacity scheduled to become operational						
Hill Top Farm (with HT7 & HT11 commissioned)	56	14	14	4	Expected Sep 2019	EDF Energy
Stublach Phases 1 & 2	400	30	30	13	Expected Dec 2019	Storengy

Source: Ofgem Website:

https://www.ofgem.gov.uk/system/files/docs/2019/01/181207_storage_update_website.pdf

Appendix 2: Storage Revenues from Capacity Acquisition – 2019/20

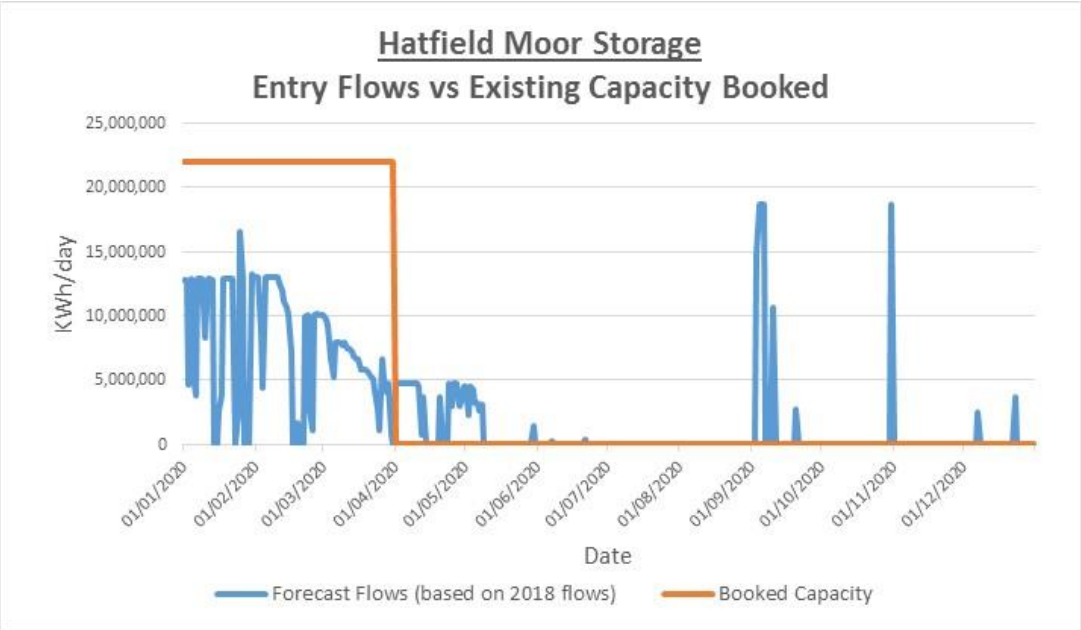
This analysis looks at the impact of increasing the Storage discount to 80% (UNC 0678E) and the impact of an 80% discount with surrendering of 2018 Entry Capacity Contracts on the revenues recovered from Storage sites (UNC 0678F).

Table 3: Storage Revenues from Capacity Acquisition - 2019/20

		Aldborough	Hatfield Moor	Hill Top/Hole Hse	Holford/Stublach	Hornsea	Humbly Grove	Total
Entry Flows (Total for Year, KWh)								
Storage Flows over current capacity bookings		0	227,711,670	0	607,967,315	2,493,036,992	0	**3,328,715,977**
Additional booking requirements if 2018 Entry Capacity Bookings surrendered		0	0	0	298,485,000	0	0	**298,485,000**
Exit Flows (Total for Year, KWh)								
Storage Flows over current capacity bookings		12,460,066,171	917,223,979	2,068,032,332	34,113,952,147	6,330,417,929	2,145,877,962	**58,035,570,520**
Firm Capacity Prices (p/KWh)								
	Storage Discount							
Entry	50%	0.0119	0.0115	0.0131	0.0133	0.0123	0.0162	
	80%	0.0048	0.0046	0.0053	0.0053	0.0049	0.0065	
Exit	50%	0.0059	0.0060	0.0070	0.0070	0.0060	0.0090	
	80%	0.0024	0.0024	0.0028	0.0029	0.0024	0.0037	
TO Revenues								
Mod 678 (Storage Discount 50%)								
Entry Revenues		£0	£26,187	£0	£80,860	£306,644	£0	£413,690
Exit Revenues		£735,144	£55,033	£144,762	£2,387,977	£379,825	£193,129	£3,895,870
Total TO Revenues from Storage		**£735,144**	**£81,220**	**£144,762**	**£2,468,836**	**£686,469**	**£193,129**	**£4,309,560**
Reduction in Revenues if Storage Discount increased to 80%								
Entry Revenues		£0	-£15,712	£0	-£48,637	-£184,485	£0	-£248,834
Exit Revenues		-£436,102	-£33,020	-£86,857	-£1,398,672	-£227,895	-£113,732	-£2,296,278
Total Reduction in TO Revenues from Storage		-£436,102	-£48,732	-£86,857	-£1,447,309	-£412,380	-£113,732	-£2,545,113
Total TO Revenues from Storage		**£299,042**	**£32,488**	**£57,905**	**£1,021,527**	**£274,089**	**£79,397**	**£1,764,448**
Reduction in Revenues if 2018 Entry Capacity Surrendered								
Surrendered Booked Revenues		£0	£0	£0	-£1,320,878	£0	£0	-£1,320,878
Additional Bookings Revenues		£0	£0	£0	£15,820	£0	£0	£15,820
Total Reduction in TO Revenues from Storage		£0	£0	£0	-£1,305,058	£0	£0	-£1,305,058
Total TO Revenues from Storage		**£299,042**	**£32,488**	**£57,905**	**-£283,531**	**£274,089**	**£79,397**	**£459,390**

The graph below showing flows and bookings for Hatfield Moor Storage helps to illustrate that the majority of storage flows would need no new capacity to be booked as Existing Contracts are already sufficient to meet requirements. There are only a small number of days each year when flows would exceed Existing Contract bookings and further capacity would need to be acquired.

Figure 8



Data Sources

Entry Flows: National Grid MIPI – Storage Nominations by site

https://www.nationalgridgas.com/data-and-operations/transmission-operational-data

Entry Capacity Bookings: National Grid Long Term Summary – Summary Report, plus QSEC – Allocation Results (Ad-hoc QSEC 2018)

https://www.nationalgridgas.com/capacity/entry-capacity

Prices: National Grid Pricing Model for UNC Modification 0678 Proposals (Sensitivity Tool (Model) 0678 V3.1 CWD Transmission Services - 21 March 2019)

http://www.gasgovernance.co.uk/index.php/0678/Models

Analysis Assumptions

- Entry Flows reflect calendar flows for 2018. These are assumed to be reflective of 2019/20 flows.
- Flows for Stublach as assumed to be double 2018 figures to reflect the increase in capacity from 10 to 20 caverns by the end of 2019.
- For the purposes of the analysis, Stublach are assumed to have all 20 caverns in operation for the whole year.
- Exit flows reflect the Entry Flows for 2018, as this should minimise distortion caused by topping up cushion gas.

- Revenues from 2018 Entry Capacity Bookings are at the new UNC Modification 0678 prices.
- Capacity prices are unchanged as a result of surrendered capacity as surrendered capacity is not reflected in the proposed FCC calculations for this year.

Appendix 3: Discount applicable to Storages in the current transmission regime

Storage are currently exempt from TO Commodity charge. The cost of the exemption assuming 56 TWh of cycling is £15m per annum (56 TWh x (commodity charge 0.0217 p/kWh exit + 0.0435 p/kWh entry).

The equivalent discount applicable to storage is very close to 100% for entry, and is effectively 100% for exit on the basis that storage users always book off-peak as they are counter-cyclical.

Table 4

Transmission charges (TO) 2018/19	Capacity + Commodity Price	Price after exemption from TO Commodity	Equivalent Storage Discount
	p/kWh	p/kWh	%
NTS TO Entry Cheshire	0.0001 + 0.0435	0.0001	99.8%
NTS TO Exit Stublach	0.0221 + 0.0217 (firm) 0 + 0.0217 (off-peak)	0.0221 0	50% 100%

Source: Storengy UK analysis based on National Grid[10] Transportation Charges

[10] The Statement of Gas Transmission Transportation Charges – 1st October 2018