Interconnector Limited proposed storage service

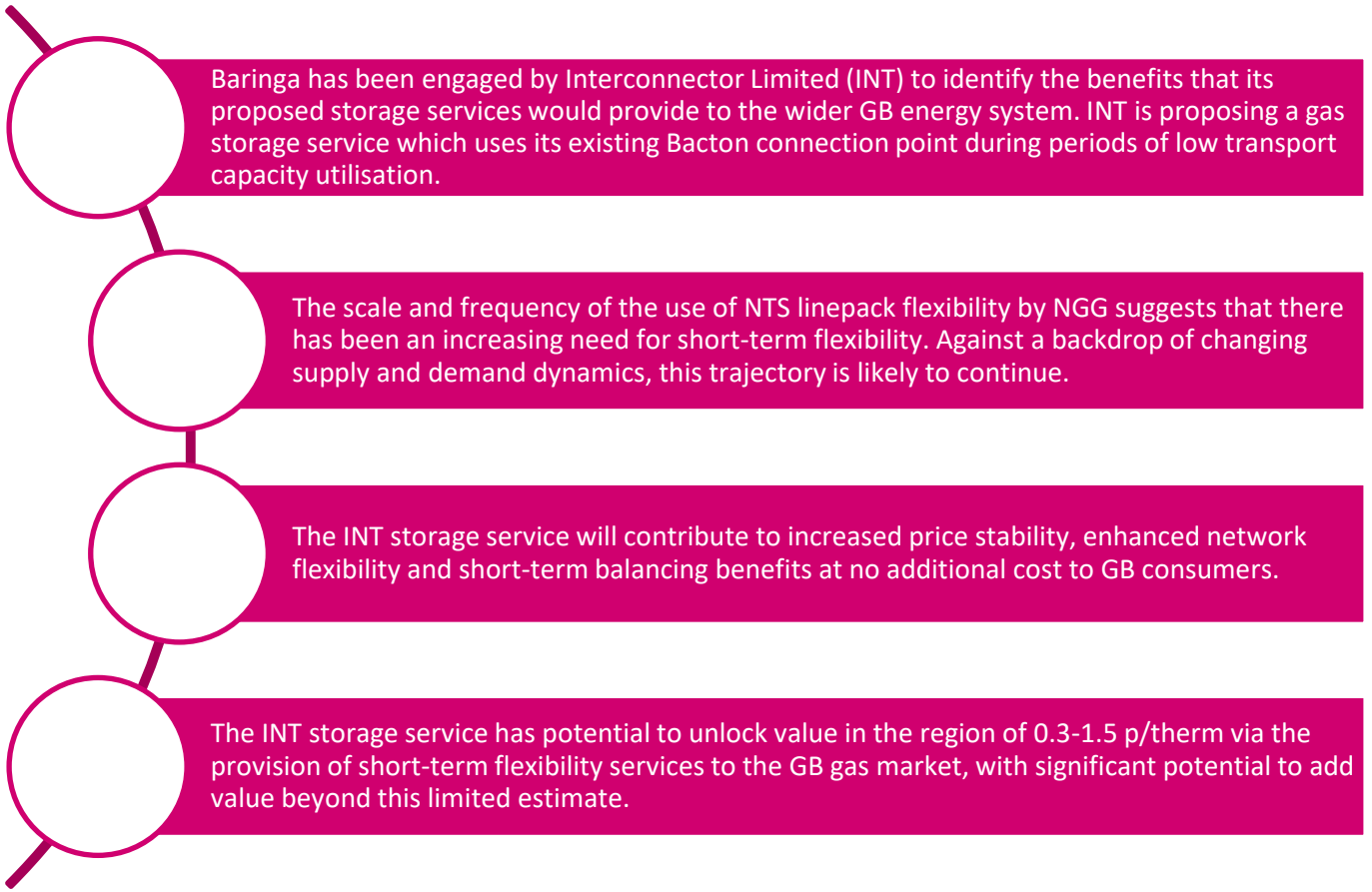
Benefits unlocked for the GB gas market

Interconnector Limited

20 August 2021

Executive Summary

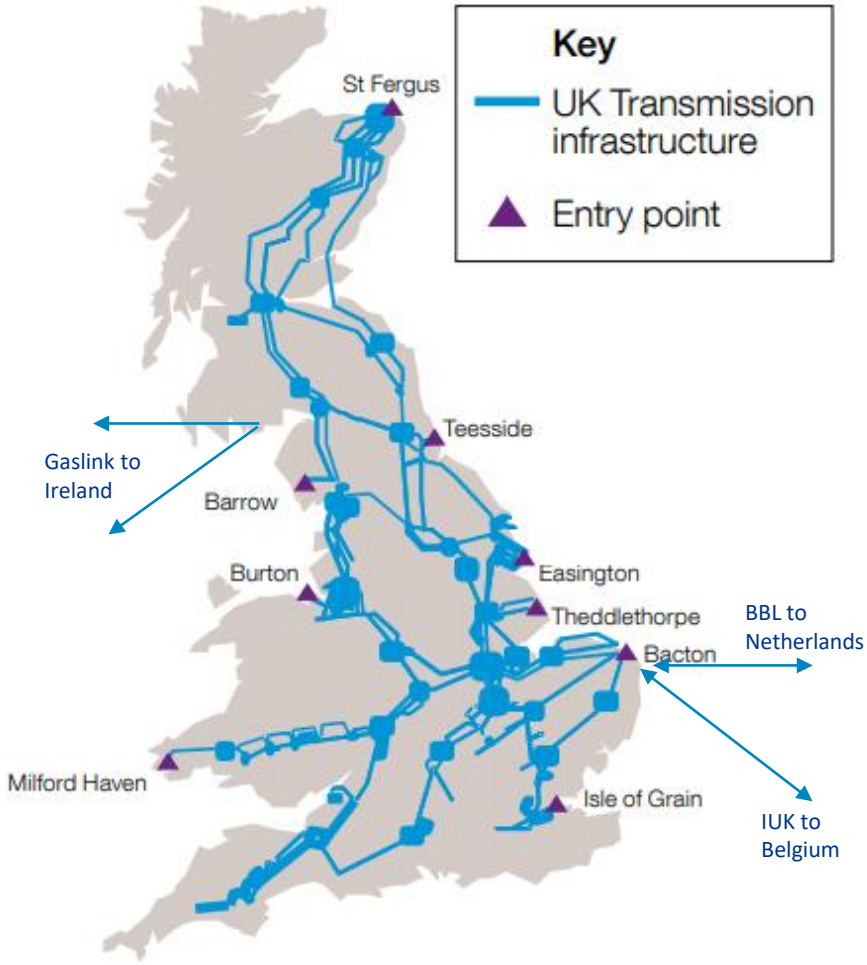
INT proposing a gas storage service which uses its existing pipeline capacity during periods of low transport capacity utilisation



The context of the GB gas market

GB natural gas supply sources are diverse but highly intertwined with the global gas market

- GB natural gas supply sources are diverse, including indigenous production, pipeline imports from Norway and continental Europe, storage, and LNG shipped from global markets to terminals at Milford Haven and the Isle of Grain.
- Supply patterns which were previously predictable and sourced largely from the UK Continental Shelf (UKCS) are now derived from a wide variety of sources that are more enmeshed with global markets, with a corresponding decline in UKCS supplies. As a result, the **role of flexible sources of supply such as gas storage has grown**.
- Gas is transported to exit points via approximately 7,600 km of high-pressure pipelines known as the National Transmission System (NTS).
- The NTS is overseen by National Grid Gas (NGG), who in turn provide access to parties who wish to use the network such as gas shippers, who purchase gas from producers and sell to suppliers.
- In order to ensure that the pressure on the NTS remains within safe thresholds, the NTS must be in balance such that gas injections into the network are equal to withdrawals from the network for a given gas day.
- Shippers are financially incentivised to ensure that mismatches between their injections and withdrawals are minimised. Storage facilities provide a means for shippers to ensure their contractual balances are maintained.



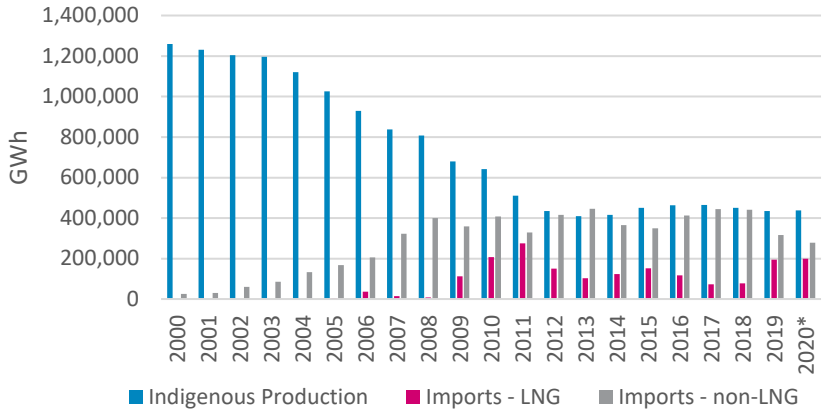
Source: National Grid

Emerging trends in the GB gas market

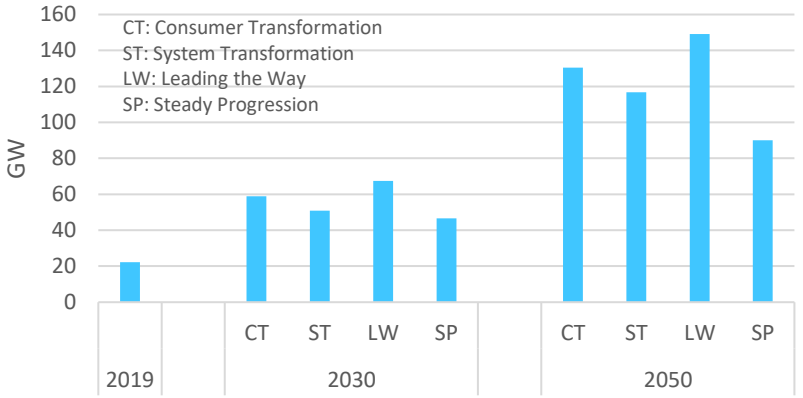
Changing demand and supply dynamics will result in an increasing need for flexibility

- Although the diversification of supply sources has aided security of supply in some regards, exposure to more complex supply chains and greater variability in how gas physically enters the NTS has **made supply patterns more volatile**.
- This volatility goes on to impact the effective management of the NTS both in the short-term and in the longer term. National Grid (2018) reports that this has led to higher and more unpredictable use of their compressor fleet, thereby potentially impacting network resilience. Furthermore, it makes scheduling maintenance activities more challenging.
- Additionally, historically the UKCS has not only provided domestic gas but also acted as a flexible source of gas through "swing fields" which can increase production during periods of high demand or reduced gas supply.
- These fields are now in decline and therefore the capability to ramp up production in periods of tight supply and balance demand is decreasing, further reducing a source of flexibility in the GB market.
- On the demand side, although the volume of natural gas demand is falling and will continue to do so as the transition to Net Zero accelerates through increases in energy efficiency and the electrification of heat and transport, the **predictability of future gas demand** is likely to diminish as the level of intermittent renewable generation on the system increases.
- The need for flexibility in the supply of gas is therefore likely to increase.

Natural gas supply over the years



Expected evolution of wind capacity in Future Energy Scenarios



Source: National Grid, DUKES
* Indicates predicted value

Types of gas storage

Gas storage plays an important part in absorbing gas supply and demand shocks

Key characteristics of gas storage

Total volume of gas that can be stored at one time	Working volume
Maximum rate of gas injection into facility	Maximum rate of gas withdrawal from facility

Main types of storage

	Definition	Characteristics	Example
Short-range	Used to inject and withdraw in response to day-to-day market conditions	Has higher withdrawal and injection rates relative to working volume that enables it to take advantage of shorter-term market changes	INT proposed storage service NTS linepack flexibility Salt caverns
Long-range	Used to inject gas during the summer at times of lower demand, and to withdraw in winter when demand is higher	Has large working volume with relatively low injection rates - suited to filling up over the summer - and higher withdrawal rates to allow flexibility on the pattern of withdrawal across the winter	Depleted gas reservoirs

Focus on Great Britain

Since the retirement of the Rough long-range storage facility, Britain has relied entirely on shorter-range storage options, import flexibility, and NTS linepack.

INT's proposed storage service provides lower volume but also faster response than most of the existing storage options. It would therefore complement rather than compete with current storage services on offer.

Types of gas storage

INT's proposed storage service provides a short-term, low-volume facility that will complement the existing GB storage offering

GB Storage Facilities

GB Storage facilities are predominantly composed of salt caverns, making up 13 TWh in technical working gas volume of the c. 17 TWh working gas volume that is operational. INT's proposed storage service provides a low-volume facility that complement's the existing GB storage offering.

Operator	Location	Status	Investment	Type	Working gas (technical) TWh	Injection (technical) GWh/day	Withdrawal (technical) GWh/day
EDF Energy	Hill Top Farm (Cheshire)	operational	existing	Salt cavern	0.57	0.00	136.80
EDF Energy	Hill Top Farm (Cheshire)	under construction	extension	Salt cavern	0.38	0.00	90.29
EDF Energy	Hole House Farm	operational	existing	Salt cavern	0.25	0.00	57.00
Stag Energy	Offshore Morecambe Bay	planned	new facility	Salt cavern	17.10	0.00	0.00
Halite Energy Group	Lancashire	planned	new facility	Salt cavern	6.84	0.00	0.00
Humbly Grove Energy	Hampshire	operational	existing	Depleted field	3.42	0.00	79.80
Keuper Gas Storage	Holford Brinefield	planned	new facility	Salt cavern	5.70	387.60	387.60
Scottish Power	Hatfield Moor	operational	existing	Depleted field	0.80	20.52	20.52
SSE/Statoil	Aldbrough I	operational	existing	Salt cavern	2.30	311.00	342.00
SSE	Hornsea (Atwick)	operational	existing	Salt cavern	3.16	30.00	130.00
Storengy UK	Stublach	operational	existing	Salt cavern	4.40	182.00	182.00
Storengy UK	Stublach	planned	extension	Salt cavern	0.00	170.00	170.00
Uniper Energy Storage	Holford	operational	existing	Salt cavern	2.57	286.00	238.33
Interconnector Limited	**Bacton**	**planned**	**No new investment required**	**Existing terminal and infrastructure**	**0.1**	**100**	**100**

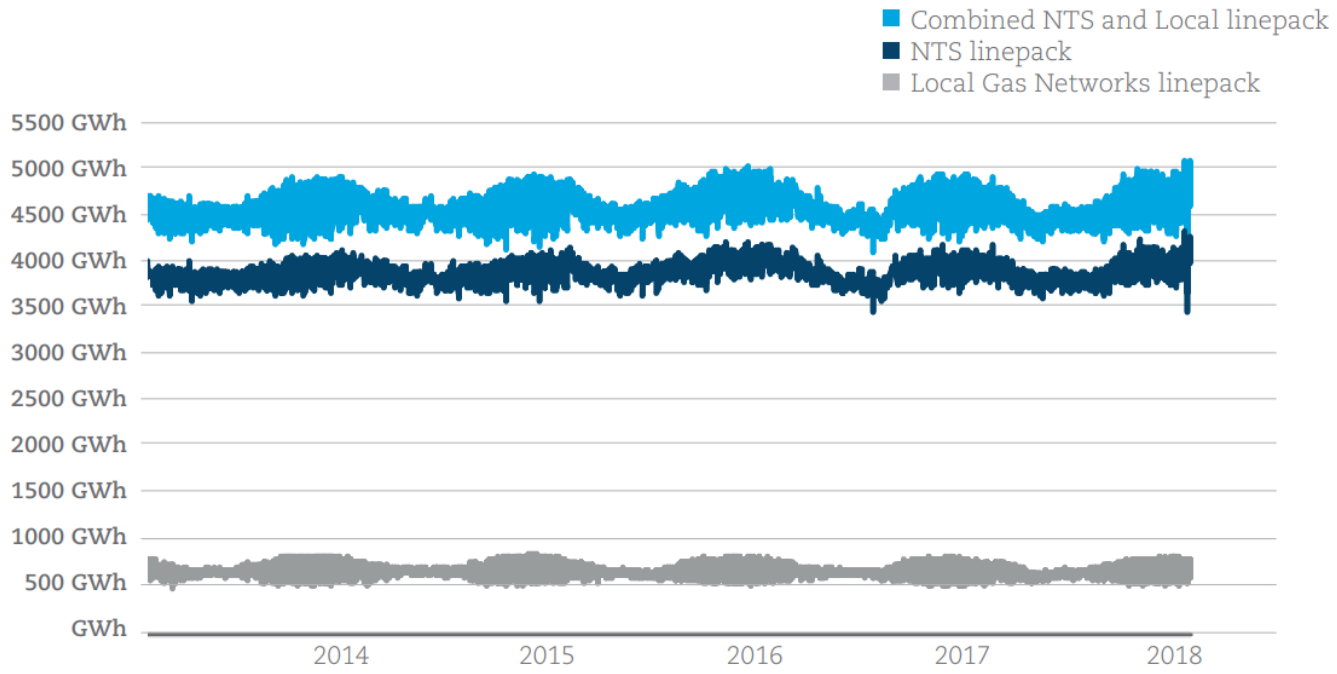
Source: Gas Infrastructure Europe as of July 2021

Types of gas storage

Short-term flexibility is frequently used and plays an important role as a buffer in the GB energy system

- The volume of gas held within the NTS at any given time is referred to as **linepack**.
- NGG can strategically change the pipeline pressure to vary the linepack over the course of the gas day to help match demand and supply.
- While this enables the linepack to mimic short-term storage on the gas network itself, this is limited to TSO use. Shippers would benefit from a similar short-term offering for their own use if it is made economically viable.
- Analysis by the UKERC shows that within-day linepack flexibility is used frequently and plays a critical role as a buffer in the GB energy system, with over half of the days during the heating season from October – March (2013-2018) exhibiting use of within-day linepack flexibility in excess of 167 GWh.

Combined, NTS and Local Gas Networks linepack in GWh (hourly data)



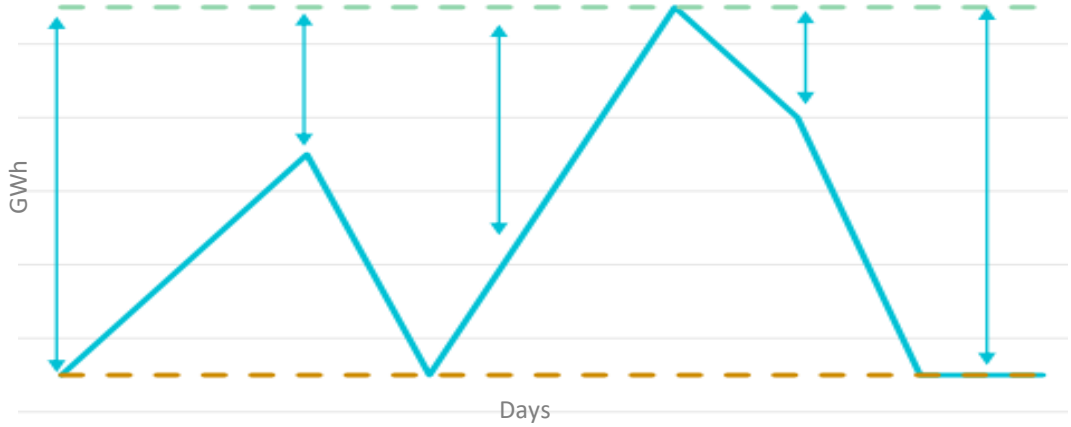
Source: UKERC

INT's proposed storage service

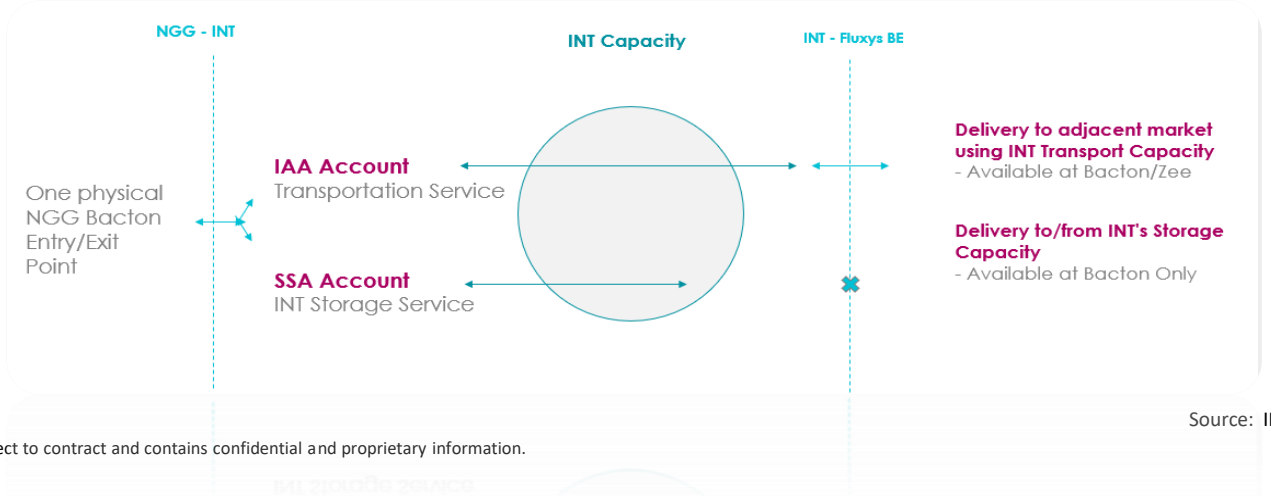
INT is proposing to offer storage services in periods of low utilisation of its interconnection pipeline for gas transportation

- INT is proposing to deliver a fast-cycle storage service for short periods using the existing flexibility in the pipeline alongside its primary service of gas transportation.
- This service would offer additional flexibility to the GB energy market during periods of low utilisation of INT transportation capacity, essentially enabling shippers to offtake gas from the NTS, store it in the INT pipeline and subsequently deliver back to the NTS.
- The service has a capability of c. 50-100 GWh/day, offered as Standard Bundle Units for day-ahead or within-day use.
- Delivery to/from INT's storage capacity would be available only at Bacton.

Determining available space using INT Inventory



Separation of transport and storage services



Source: INT

Charging arrangements for INT

NTS charges levied on INT's storage service should be proportional to other forms of storage

- NTS users pay network charges for use of the network in order to remunerate NGG's investment and other costs.
- Under the present tariff regime, storage capacity receives a **discount on the capacity reserve prices** as well as **exemptions** from the general non-transmission services charge.
- The economic rationale for granting a tariff discount to storage capacity is to prevent double-charging, since gas that enters and subsequently exits storage will have paid an entry charge and will eventually pay an exit charge.
- INT's storage services will be offered in line with the Gas Regulation and Ofgem Guidance; the same as other GB storage services.
- When using INT's services, a shipper would nominate into an Interconnector Access Agreement account (for using INT's transportation service) or a Storage Services Agreement account (for using INT's storage service) depending on their intended use. This allows for correct identification of the use of system.
- Charges for interconnection points differ from those of storage points, and the UNC does not presently consider how charges would apply when a storage service is offered at an interconnection point.
- A UNC modification UNC 0761 (link) has been proposed by National Grid to recognise INT's NTS entry and exit point as being capable of providing both a storage and transportation service and thus apply NTS charges to the INT storage service in a consistent manner to the methodology applied to other GB storage points.
- It is important for a level playing field that the principle of avoiding double-charging applies equally to INT's storage service as it does to other GB storage services. The consequences of levying disproportionate charges on INT's storage service would be the loss of the wider GB market benefits of the service set out in this report.

NTS Charges

Category	Unit	Storage points
Transmission services charges (capacity based)	Pence per kWh per day	Minimum 50% discount on storage entry and exit bookings, rising to 80% from October 2021
Transmission services revenue recovery charges (RRC)	Pence per kWh per day	Discount from October 2021 in line with discounts to capacity based charges
Non-transmission charges (commodity based)	Pence per kWh	Exemption for storage
Fixed charges	Pence per day	

The benefits of the INT proposed storage service

The INT storage service provides a number of benefits to the GB energy system

Uses existing infrastructure

- The INT storage service will use existing physical infrastructure and thus can be implemented quickly (versus traditional storage projects which have long lead times to develop) with no further capex spend.
- The service comes at **no additional cost to GB consumers** as investment in new capacity or physical assets is not required. This means that system users can realise the benefits almost immediately without the provision of regulatory or consumer underwriting.
- As an additional service, it gives opportunities for greater utilisation of existing NTS assets and consequentially additional revenues to meet NTS costs.

Reducing price volatility

- The INT storage service will contribute to providing **greater price stability** for gas suppliers, shippers and consumers as injections into gas storage are made when it is cheap to do so, and withdrawn when prices are high.
- It enables gas suppliers and shippers to better deal with sudden price spikes through hedging against supply and price risk.

Greater network flexibility

- The INT storage service increases **network flexibility**, being a flexible and responsive form of storage.
- The service enables temporary fluctuations in supply such as outages, time-lags in import response to market price signals and missed LNG deliveries to be partially accommodated.
- The improved regional flexibility the service provides helps grid configurations and local constraints.
- It also provides a means to quickly resolve supply-demand imbalances on the NTS, thereby promoting efficient running of the NTS and **reducing system balancing costs**.

Decarbonising the GB energy system

- The INT storage service can support flexible back-up needs within the power sector, which will be under increasing pressure from the electrification of energy demand.
- It helps to respond to the intermittency of renewable generation sources such as wind and thus help **incorporate more renewable generation** onto the GB energy system.
- The service also reinforces the ability of gas power plants to flexibly respond to the power market, offering reserves to draw down when gas generation demand is high.

Enhancing security of supply

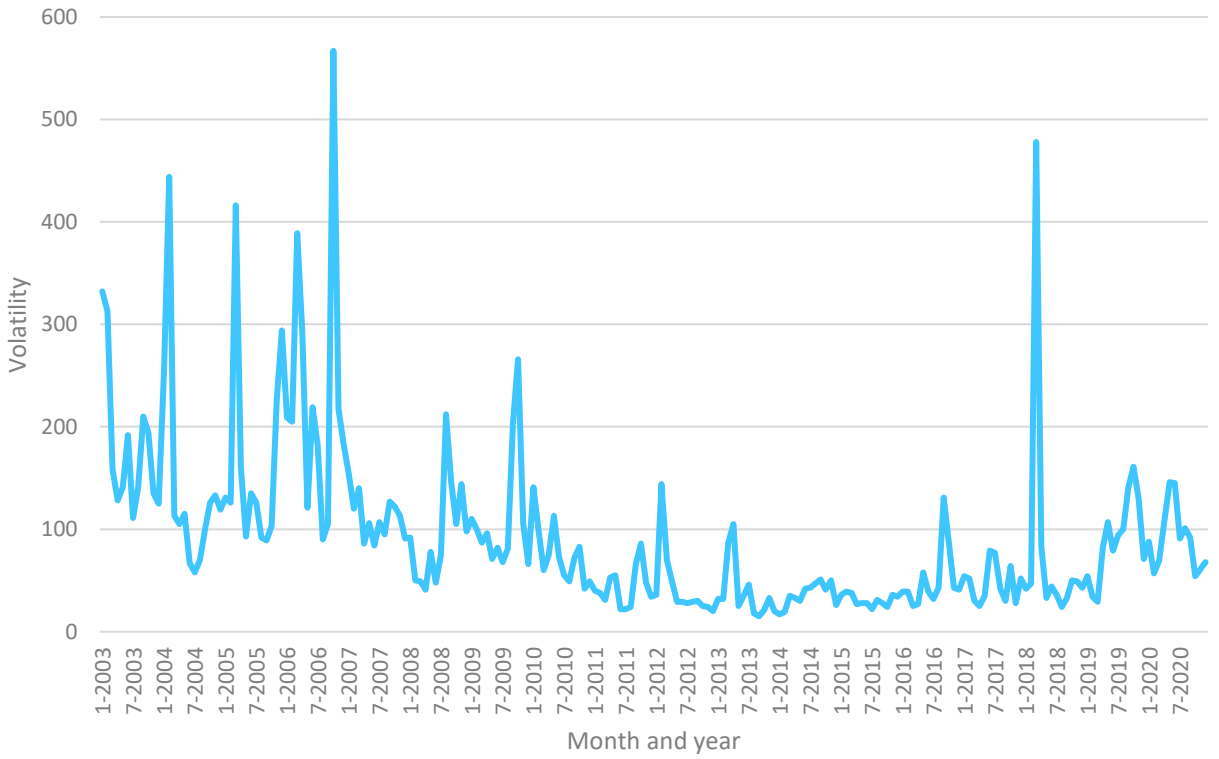
- Ensuring adequate levels of security of supply is fundamental given gas networks do not 'fail safely'.
- The INT storage service can support security of supply by helping to mitigate the effects of supply and demand shocks and ensuring continuity of supply.
- In this way, it can help provide **insurance against unexpected short-term events** which could otherwise generate costs for the network.

The value of the INT storage service

Short-term price differentials give an indication of the economic value of the service, but may not capture the full extent of the benefits provided

- Wholesale spot gas prices exhibit significant movements on a daily basis.
- The INT storage service provides the opportunity to capture such period-by-period spreads during periods of local volatility in addition to NBP-continent spreads.
- This is not presently captured by INT - doing so would lead to more efficient use of INT's pipeline and improve the longer-term viability of INT, with the added benefit of improving market liquidity.
- Although the longer-term trend has seen lower overall levels of price volatility in the gas market, recent years have seen an uptick in volatility.
- Notable spikes in recent years include the 2018 'Beast from the East' episode, where record-high demand and unplanned supply outages led to widespread disruption.

Monthly average of NBP day-ahead price volatility



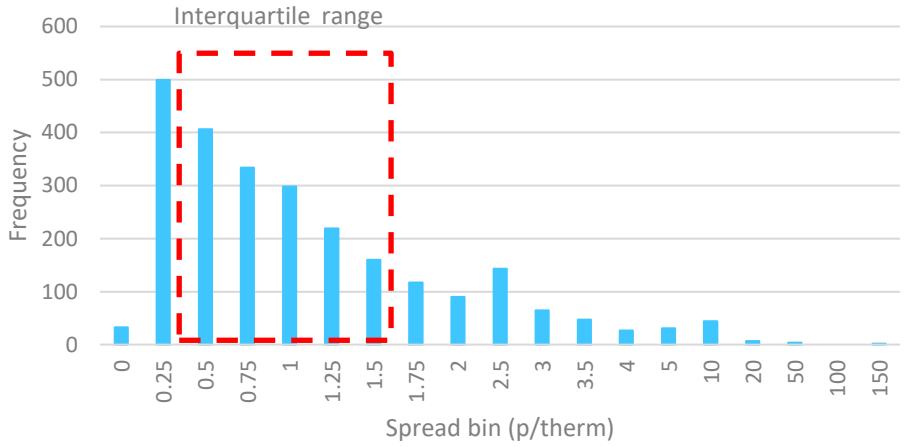
Source: Ofgem

The value of the INT storage service

The INT storage service has potential to unlock value in the region of 0.3-1.5p/therm via provision of short-term flexibility services to the GB gas market

- The commercial value of INT's storage service comes from the ability to buy and inject gas at times of lower price and withdraw and sell it at times of higher price over relatively short timescales.
- The volatility of day-ahead spot gas prices is a reasonable approximation of the value that a short-term storage service like the INT service would bring.
- Analysis of daily data of day-ahead NBP spot prices sourced from Argus suggests that fluctuations from one day to another (1-day spreads) have averaged c. **1.3 p/therm.** On a 7-trading-day spread basis, this average is **3.2 p/therm.**
- The histogram on the right shows how 1-day spreads have been distributed over the past decade. Most 1-day spreads sit between 0-0.25 p/therm, followed by the 0.25-0.5 p/therm range.
- Based on this, we believe that the INT storage service has potential to unlock value in the region of **0.3-1.5 p/therm** on a day-to-day basis via the provision of short-term flexibility to the GB gas market, representing a market value of **c. £500-£5,000 per day.**
- These values are likely to increase with the increasing role of intermittent power generation and more uncertainty on supply.

Distribution of 1-day spread of day-ahead NBP prices (daily data from June 2011 to June 2021)



Day-ahead NBP price spreads

Summary Statistics	1-day spread	7-day spread
Minimum	0	0
Maximum	147	173
Average	1.3	3.2
Median	0.8	2.2
Interquartile range	0.3-1.5	1-3.8

Source: Argus price database