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ENERGY

Measures for a sustainable gas storage market

EXECUTIVE SUMMARY

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Presented To:

gie Gas Infrastructure Europe

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The existing gas storage and networks support an efficient and timely decarbonisation via sector coupling…

2030

Gas storage and networks as enablers of the transition towards a decarbonised energy sector

2050

Gas infrastructure and green gases as a key pillar of a sustainable energy system

Support the decarbonisation of the **power sector by providing flexibility and seasonal storage** to support the development of variable renewable energy sources (VRES)

Development of renewable gas and decarbonised gas which could substantially decrease the emmission of greenhouse gases

Enable an **efficient and timely energy transition** leveraging **existing transmission and storage infrastructures**

Support **efficient sector coupling** and **synergies** for an efficient and affordable decarbonisation

Enable Europe to **amplify efforts for decarbonisation** by shifting the focus from coal to gas or alternatively to RES, in line with the Paris agreement ambition

Gas storage and networks provide flexibility across time and space to the energy system…

Flexibility to the system through time

- Gas storage brings benefits not only to the gas value chain, but to the power industry as whole through sector coupling – as it enables arbitrages on several temporal dimensions:
  - **Seasonal**: balancing seasonal differences in demand and supply
  - **Daily**: reacting to unexpected short-term variations in demand or supply
  - **Hourly**: providing flexibility services close to real-time operation
- In addition, under these different temporal dimensions storage contributes to security of supply and system resilience, including at regional levels.

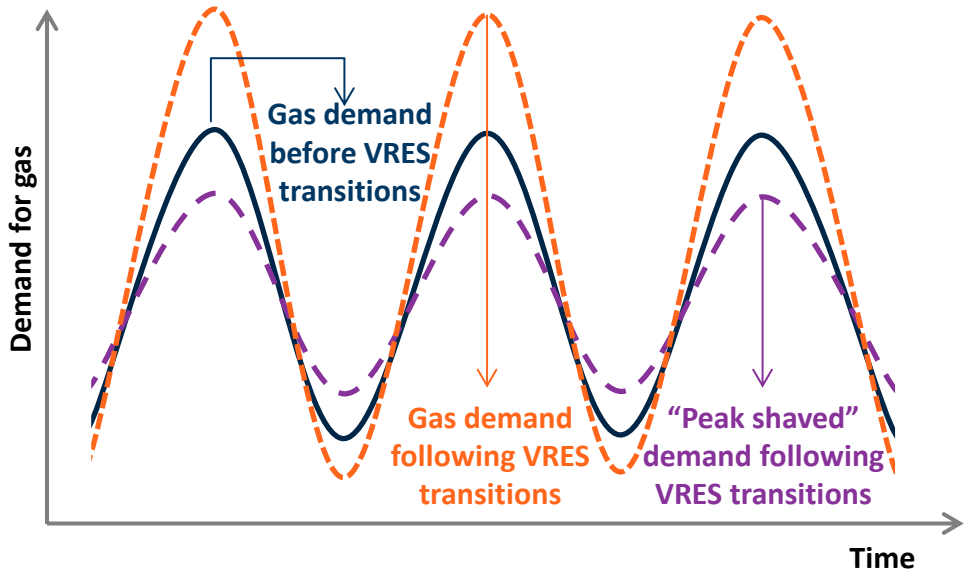
Flexibility to the system through space

- Gas storage brings value to the gas system thanks to its ability to support localised system services, supporting network de-congestion and offering the possibility of optimising capital expenditures to meet peak demands.

Both types of flexibility will be in more demand with increasing levels of variable renewable sources

- The increasing penetration of distributed VRES will create more volatile gas demand patterns in the power sector and gas flows on the infrastructure

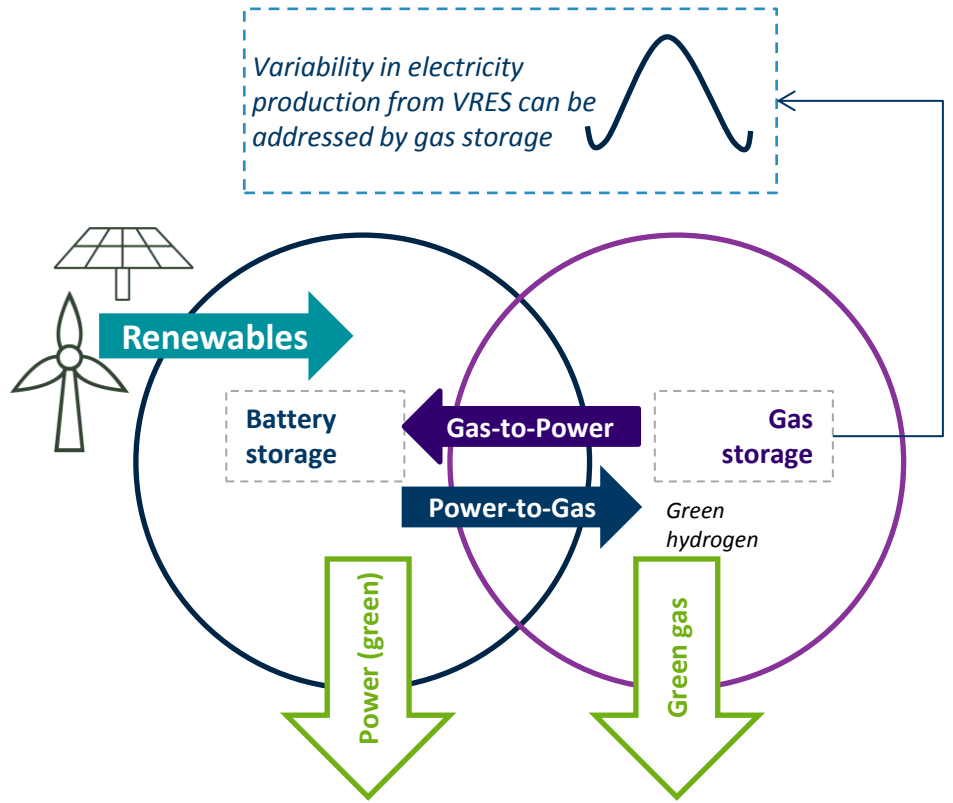
Variable renewable sources increase the need for peak shaving



…and by supporting optimisation of the energy system via sector coupling and further development of green gas

- Gas storage and networks are a **key enabler via sector coupling of an efficient energy transition** in the whole energy system
  - Gas infrastructures can allow optimisation of decarbonisation pathways across different sectors (e.g. for heating and cooling, transport, industry applications)
  - In the longer term, the existing gas infrastructure (including storage) could support the deployment of renewables gas and Power-to-Gas
- Cross sectoral optimisation requires a **systemic approach to decarbonisation of the energy sector** and raises a number of questions regarding the market and regulatory framework:
  - Electricity and gas market designed have so far been so far conceived as largely independent
  - Potential barriers to efficient sector coupling need to be removed
  - The value of externalities needs to be recognized
- **'Decarbonised' and renewable gases can both play a significant role** in a fully decarbonised energy system

Examples of cross sectoral optimisation via Power-to-Gas and green gas



Gas storage provides multiple benefits to the energy system

- Gas storage brings insurance and system value to market participants and system operators

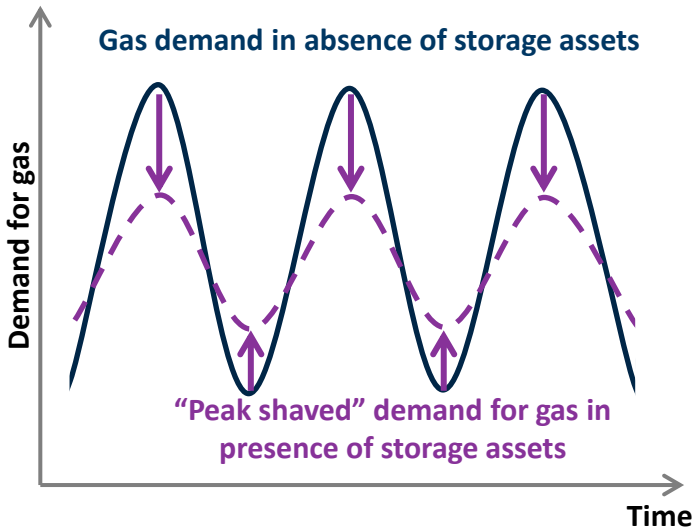
Insurance value

Gas storage brings benefits to the whole gas and electricity value chain as it enables arbitrages on broad spectrum of temporal dimensions (hourly, daily and seasonal) and contributes to security of gas and electricity supplies even at regional level.

System value

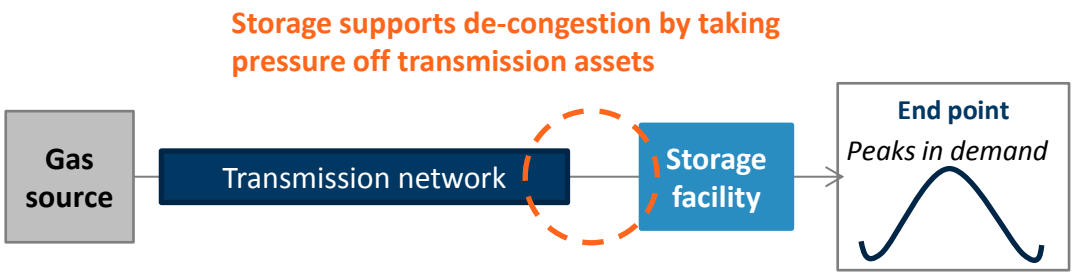
Gas storage brings value to gas networks owing to its ability to support localised system services, e.g. by supporting network de-congestion and offering the possibility of optimising capital expenditures to meet peak demands.

Gas storage enables arbitrages on a range of temporal dimensions



Arbitrage on the seasonal dimension – referred to as "peak shaving" or 'seasonal modulation' is traditionally seen as the key benefit of gas storage, and its value is internalised to some extent

Gas storage supports efficient dimensioning and use of networks



The role of gas storage in offering insurance and system values will drastically increase in a decarbonized integrated energy system

- The future evolution of the energy system will increase the insurance and system value of gas storage

Insurance value

As energy system becomes yet more integrated, with more interdependent flows across greater distances, resilience will be even more valuable

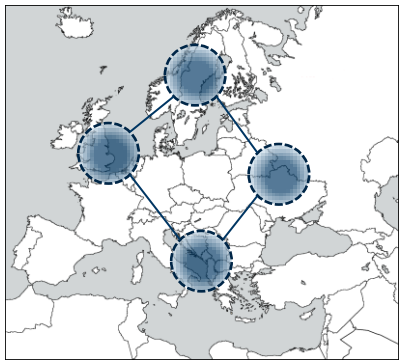
Even across greater distances, resilience will be required at ever shorter timescale

System value

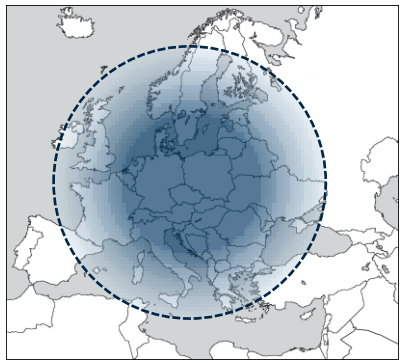
Overall, gas storage will help to ensure, in the energy transition:

- Expansion of the energy system as a whole at the lowest cost
- Efficient investment
- Optimisation of decarbonisation pathways
- Future energy security

Now – gas storage acting across Europe but largely locally



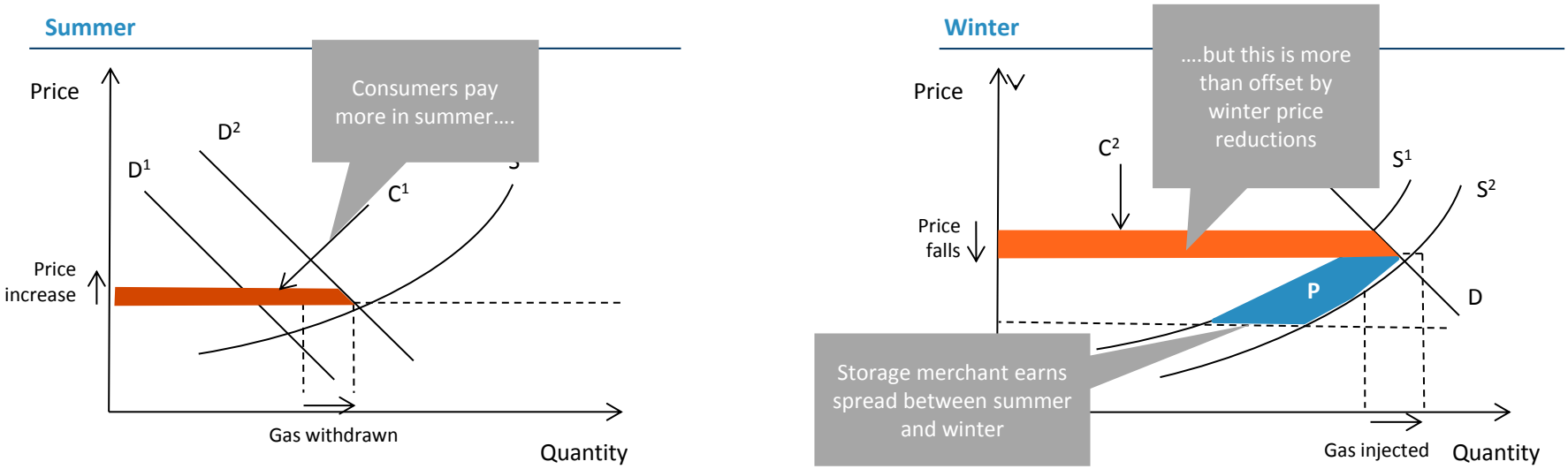
Future – more integrated pan-European energy system will increase footprint of gas storage effects



The benefits of seasonal modulation may not be allocated sufficiently to storage operators

- Seasonal modulation benefits are earned by both consumers and mid-streamers
  - Under market mechanisms, merchant revenues are driven by the summer-winter spreads
  - Consumers receive a net benefit from gas storage as demand in winter is greater than demand in summer

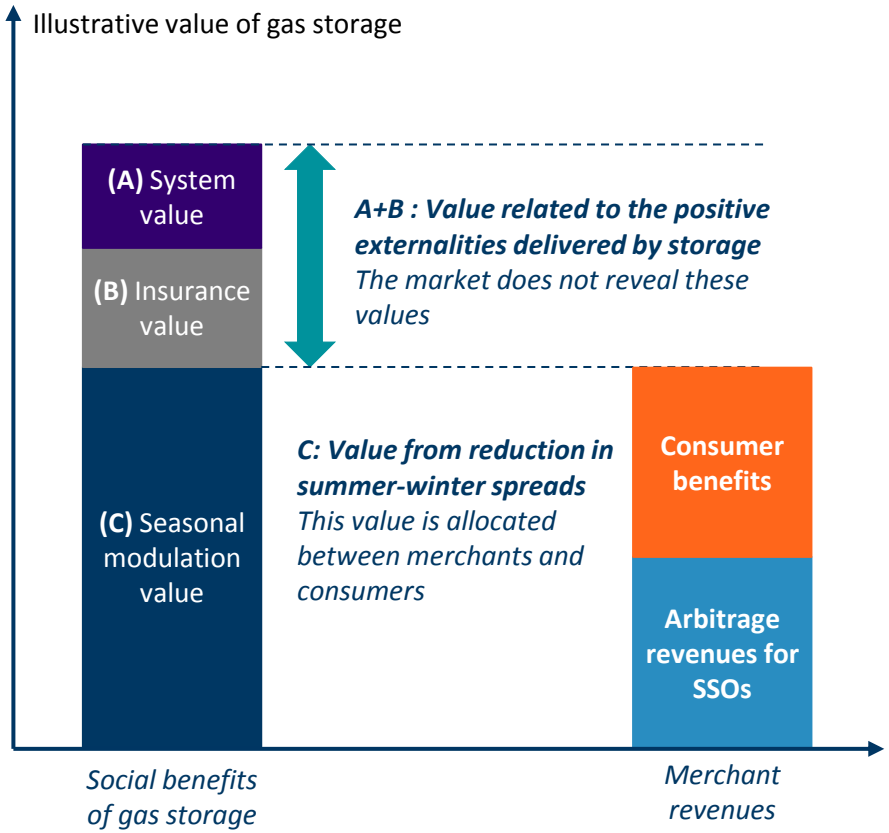
Illustration of economics of seasonal modulation – summer vs winter



- Social welfare benefits created by gas storage may not be reallocated sufficiently to storage operators to maintain a **socially efficient level**
  - The issue of the efficient allocation of the welfare created by some infrastructures is well know and has driven some interventions
  - For instance, merchant interconnectors suffer from the same issue and this has led to intervention (e.g. cap and floor regime or regulation) to ensure that the socially efficient level of infrastructure is built

Gas storage produces further positive externalities for society but this has traditionally not been fully captured in market pricing

- An externality is the **cost or benefit** that affects a party who did not choose to incur that cost or benefit
  - A **positive externality** is a **benefit** that is enjoyed by a third-party without having paid for the service offered as it is not revealed by the market. Examples include education and healthcare, where there are spill-over positive effects on society.
  - In the case of gas storage, positive externalities arise due to the **insurance** and **system** benefits.
- Due to increasing power market coupling, **insurance value is increasing, but is not priced in markets**
  - Consumers are often unable to signal the value of secure supply and retailers with limited liability are not incentivised to fully insure against extreme events
  - In addition, markets are typically inefficient at pricing low probability, high impact events
- Due to increasing power market coupling, **system value is increasing, but is not priced in markets**
  - The lack of a holistic approach to system planning and optimisation means that some of the benefits of storage are not properly valued
- Market pricing therefore internalises only the benefits of gas storage derived from seasonal modulation of gas prices.



Value of Lost Load ("VoLL")

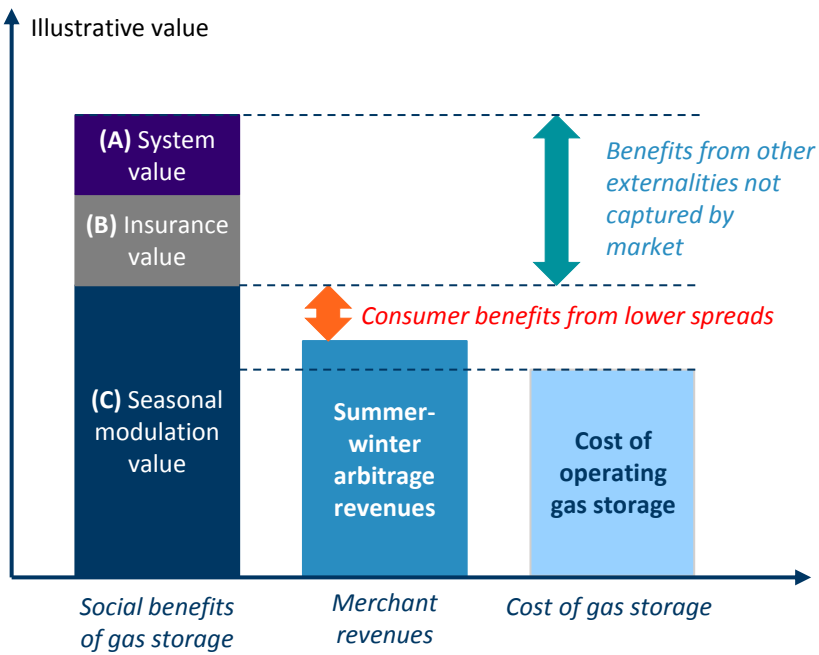
- One way in which a market based mechanism can capture the insurance value of gas storage is through a "Value of Lost Load" or VoLL penalty.
- The calculation values consumers could be willing to pay to avoid a disruption and therefore "internalises" the externality.
- In ENSTOG's 2017 10-Year Network Development Plan, the VoLL for all of EU was calculated at EUR 600 per MWh.

Declining spreads have meant market revenues are no longer sufficient to cover the costs of many storage operators

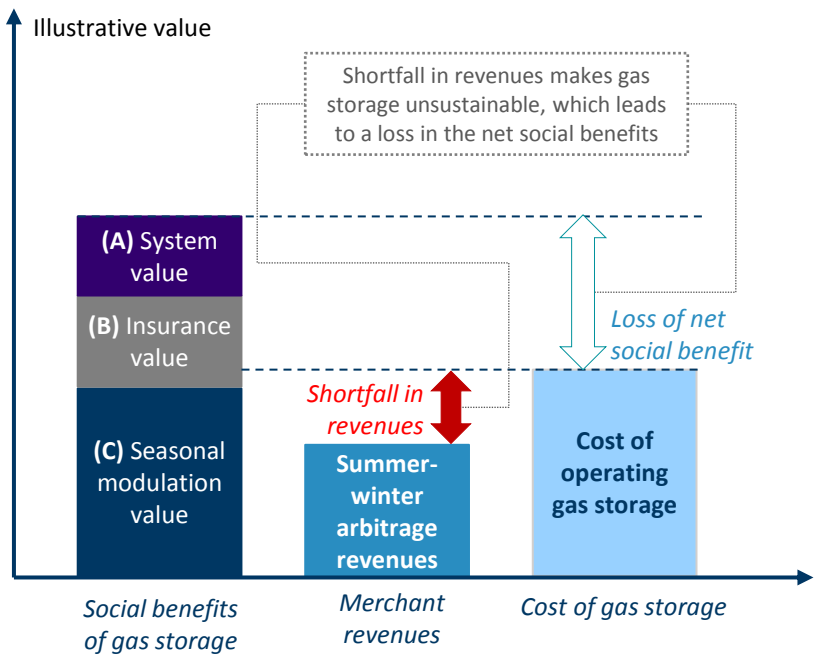
- **Historically**, summer-winter price spreads have funded gas storage operators
- **Even though markets failed to fully capture the system and insurance values of storage,** spreads were high enough to remunerate storage operators adequately

- **In recent years**, however, summer-winter spreads have fallen, making it harder for storage to recover costs
- Even if there is a net benefit to society, operators may not have sufficient incentives to provide storage, possibly leading to closures reducing storage availability below socially optimum levels, resulting in a **loss of net social welfare value**

Historically, spreads were high enough to cover the cost of storage



In recent years, declining spreads has made it difficult to recover all costs



- As demand for flexibility increases (due to decarbonisation) , the **benefits for consumers from storage will increase**
- Without support, too much storage could close (or in the wrong locations), jeopardising future consumer benefits

Key principles of a regulatory framework for gas storage to recognise its contribution to the energy transition

The regulatory framework for gas storage should…

…establish market based pricing as the foundation of efficient gas storage use…	• ***Market based pricing*** *should be maintained/generalised in order to ensure that gas storage is* ***allocated efficiently*** • *And to ensure that gas storage can compete on a* ***level playing field with other sources of flexibility*** *across the energy system*
…seek to ensure that value of the positive externalities created by gas storage are captured...	• *The regulatory framework should seek to* ***internalise the value of externalities*** *through incentives or obligations, depending on the regulatory approach adopted* • *In particular, the framework should seek to capture the* ***insurance*** *and* ***system*** *values of gas storage*
…facilitate cost recovery for the socially optimum level of storage in the transition toward a market based decarbonised system	• *Given the deterioration of merchant revenues in light of declining spreads, gas storage may require regulatory support to ensure* ***cost recovery to maintain the socially optimum level of gas storage in the transition*** *towards a decarbonised energy system*
…ensure that the role of gas storage in the energy transition is considered via a holistic approach of the energy system transition…	• *The framework should take a* ***holistic view on the role of gas storage as part of the full energy system*** *decarbonisation through* ***cross-sector optimisation*** • ***Integrated system optimisation and investment planning*** *should factor in the cross sectoral value of storage and the* ***long-term benefits*** *of* ***maintaining sufficient gas storage capacity***

The role of gas storage across the whole energy sector calls for revisiting the regulatory framework to introduce a holistic approach and value positive externalities

Based on the principles identified, some specific interventions can be envisaged

There are five main types of interventions

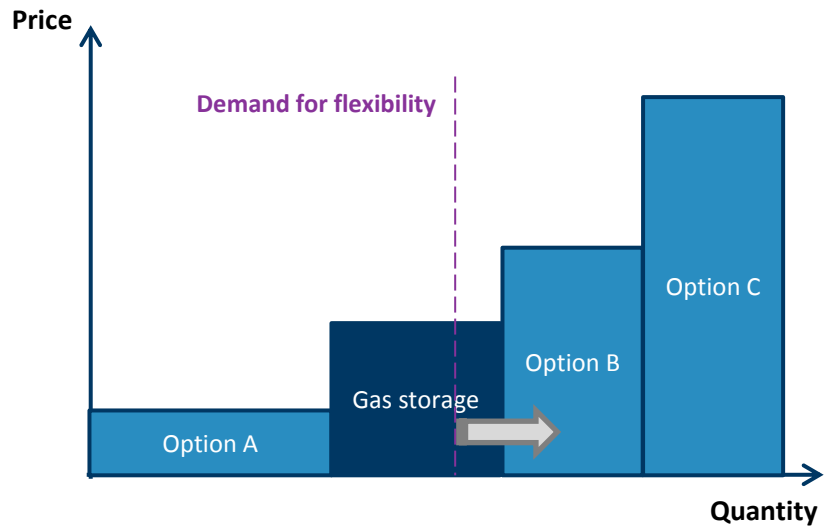
- **Reinforcing incentives for internalizing externalities:** Implementation of regulation may not generate sufficiently strong incentives to motivate efficient usage of gas storage facilities. These measures seek to better enforce objectives of existing regulation.
- **Co-ordinated network development:** Measures which seek to encourage efficient economic decisions by streamlining regulation across different assets and incentivising co-operation.
- **Adjustment to electricity and gas network usage tariffs:** These measures are broadly aimed at internalising the system benefits of gas storage through price adjustments which incentivise greater usage of storage facilities.
- **Volume-based measures**: Interventions aimed at mandating or incentivising demand for the sociably desirable level of gas storage capacity. The market failure linked to the insurance value of gas storage would require a volume-based approach to ensure that the sociably desirable security of supply level is guaranteed. Whilst the interventions would be aimed at volumes, pricing would still generally be set by the market.
- **Revenue-based measures:** Interventions aimed at supporting gas storage directly by guaranteeing revenue flows do varying degrees. This could range from 'fully regulated' revenues to a 'cap and floor' approach.
- **Other measures:** Alternative interventions aimed at shifting incentives in specific parts of the market.

Gas storage should be priced through market mechanisms to ensure storage is used efficiently and stays competitive

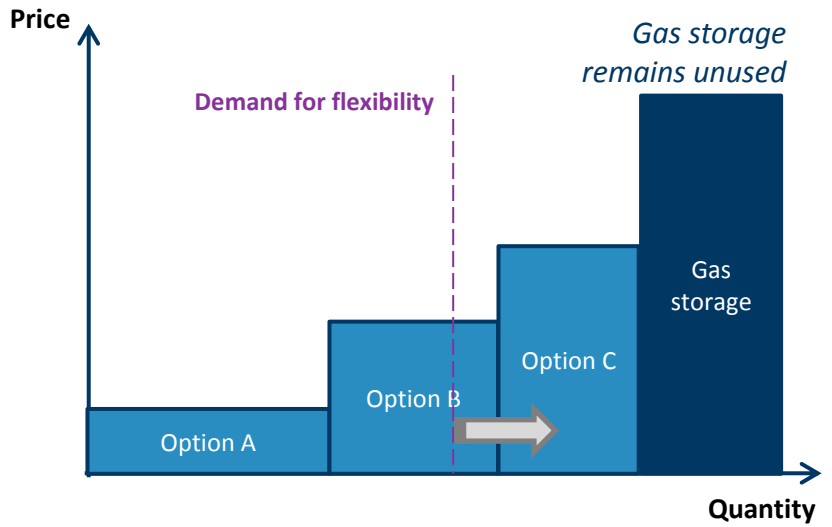
- Market based pricing of gas storage should be enforced in order to ensure that **gas storage is allocated efficiently**
  - To use gas storage efficiently, its pricing should reflect its opportunity value (i.e. the differences in gas prices across different periods) and cover at least its variable costs to store and inject gas back in the transmission system

- Pricing gas storage competitively is also critical to ensure that gas storage can **compete on a level playing field** with other sources of flexibility across the energy system
  - If a price floor is set, it should be based on variable costs only: transmission charges paid for storage use (to withdraw or inject) should also be based on variable costs.

Gas storage needs to be priced competitively to compete with other options for flexibility across the energy system



If not priced competitively, gas storage may remain unused

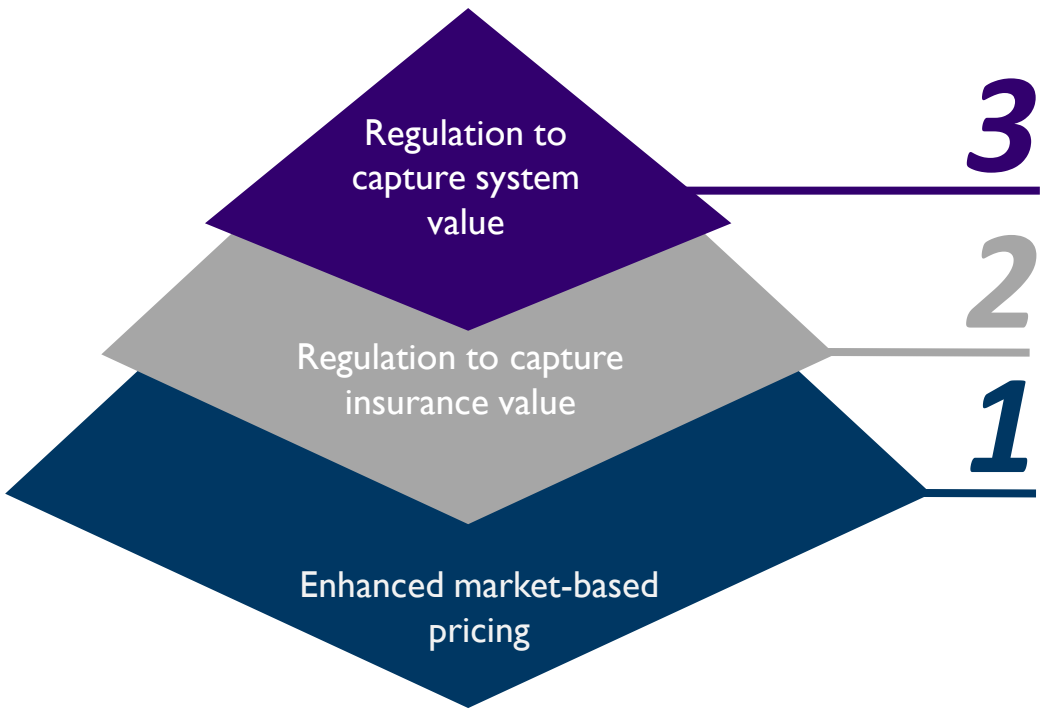


Various regulatory approaches can be deployed to account for positive externalities and ensure long-term sustainability of gas storage

	Market pricing with new products and incentives	Market pricing with regulation of externalities	Market pricing with integrated optimisation and regulation
Key features	• *Removal of market failures and reinforced incentives through development of new products and penalties*	• *Regulation of externalities e.g. storage obligations, tariffs adjustments, and/or capacity mechanisms*	• *Partial or market wide regulation to ensure cost recovery for required storages based on integrated system management*
Principles underlying regulatory approaches to ensure efficient allocation of storage capacity and level playing field with other flexibility options			
Market based pricing and cost coverage to ensure socially optimal deployment	• Market based pricing to ensure efficient allocation of storage capacity and level playing field with other flexibility options • Assessment of the system and insurance value in the relevant market zone		
	• No guarantee of cost recovery	• Additional revenue streams corresponding to externalities but cost recovery not guaranteed	• Regulated revenues to ensure cost coverage to maintain optimal level of storage
Internalising system value externality	• Effective incentive and penalty mechanisms for shippers and TSOs to value insurance and system externalities • Encourage coordinated approach btw. TSOs and SSOs for system optimisation and investment / retirement decisions	• Application of regulatory measures (e.g. tariffs adjustments or storage obligations, capacity mechanisms, etc.) to integrate full social benefits into market pricing • Could be supported by incentives on TSOs and SSOs for integrated approach	• Ensure a consistent and coherent approach in an integrated management plan for the energy system • Could take the form of partial regulation (strategic storage) or market wide revenue regulation for storages necessary for the energy transition
Internalising insurance value externality			

Enhanced market-based pricing should be the backbone, supported by regulatory measures which address externalities

Storage business model in an energy integrated system	• Enhanced market-based pricing should continue to be central to the gas storage business model. • Regulatory measures should be deployed to internalise externalities which market-based pricing does not capture.



Social benefits:

- Additional measures could be considered to ensure that society continues to benefit from the insurance and system value of gas storage
- Consistent and "coupled regulation" to support efficient sector coupling
- If deemed necessary, facilitate cost recovery to ensure SSOs can maintain a socially optimum level of storage

Market enhancements:

- Enhanced market-based pricing to capture arbitrage benefits across different times frames and geographies
- Removal of market failures through development of new products and penalties

The critical role of gas infrastructure in supporting the EU energy transition calls for the need to revisit the regulatory framework

- Gas storage and networks have a **critical role** in supporting an efficient and ambitious EU energy transition:
  - The gas storage and networks can help to fill the "flexibility gap" in the power sector
  - In the longer term, gas infrastructure will support the optimisation of the whole energy system via sector coupling and the development of green gas

- Gas storage brings **multiple benefits** to the current energy system in the form of **insurance and system value**:
  - However, these value of these benefits are not fully captured in market pricing i.e. they are positive *externalities*
  - Seasonal modulation of gas prices has traditionally delivered benefits to consumers but declining spreads has resulted in the worsening of economic conditions for storage operators
  - There is a risk that too much storage is decommissioned or at wrong places which would negatively impact security of supply and / or increase costs of the transition for customers

- This calls for **revisiting the market and regulatory framework**, and consider potential adjustments that will:
  - Establish enhanced market based pricing as the foundation for efficient gas storage use and allowing for innovative use of storage
  - Assess and implement specific measures for each country in form incentives, adjustments or guarantees that will allow SSOs to keep delivering the insurance and system value to the wider energy system
  - Ensure that the role of gas storage in the energy transition is considered via a holistic approach to optimisation and investment planning across the full energy system: toward "coupled regulation" to support efficient sector coupling.
  - If deemed necessary facilitate cost recovery to ensure SSOs can maintain a socially optimum level of storage

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