

# **Hub-Based Gas Sourcing for Market Liquidity and Continuity of Supply**

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### Disclaimer

This presentation is for discussion purposes only and not in any way binding on the CREG.

## Introduction

### Starting point:

- EU market design => hub-based gas sourcing
- EU network code balancing => implementation of market-based balancing
- system operator => residual balancing of gas deficits
- EU gas security of supply regulation => protected customers and solidarity

### Aim:

- improvement of gas balancing regime
- internalisation of security of supply in balancing regime
- industrial demand side response (DSR) through auction process
- cross-border solidarity through balancing regime in case of emergency

### Approach:

- empirical evidence from regulatory oversight in EU
- insights from revision EU Regulation 994/2010: security of gas supply
- micro-economic internalization of supply security in decision-making
- efficient use of regulatory tools => balancing regime and emergency framework

# Gas Market Design Based on EU Regulation

## INFRASTRUCTURE

### Regulated Market Access

- sufficient transmission capacity to get access to gas hubs
- European “Third Energy Package” and subsequent Network Codes: organise the access to markets
- legal provisions to cope with (contractual) congestion at interconnections
- regulatory tools for cross-border network development in EU (TEN-E)

### Entry-Exit Market Model: from Nodal to Zonal

- move to an EE network access model is beneficial for network users and markets => competition and trading => liquidity
- EE model together with balancing regimes => emergence of virtual trading points (VTPs, hubs)
- hub-based balancing and hub-to-hub trading

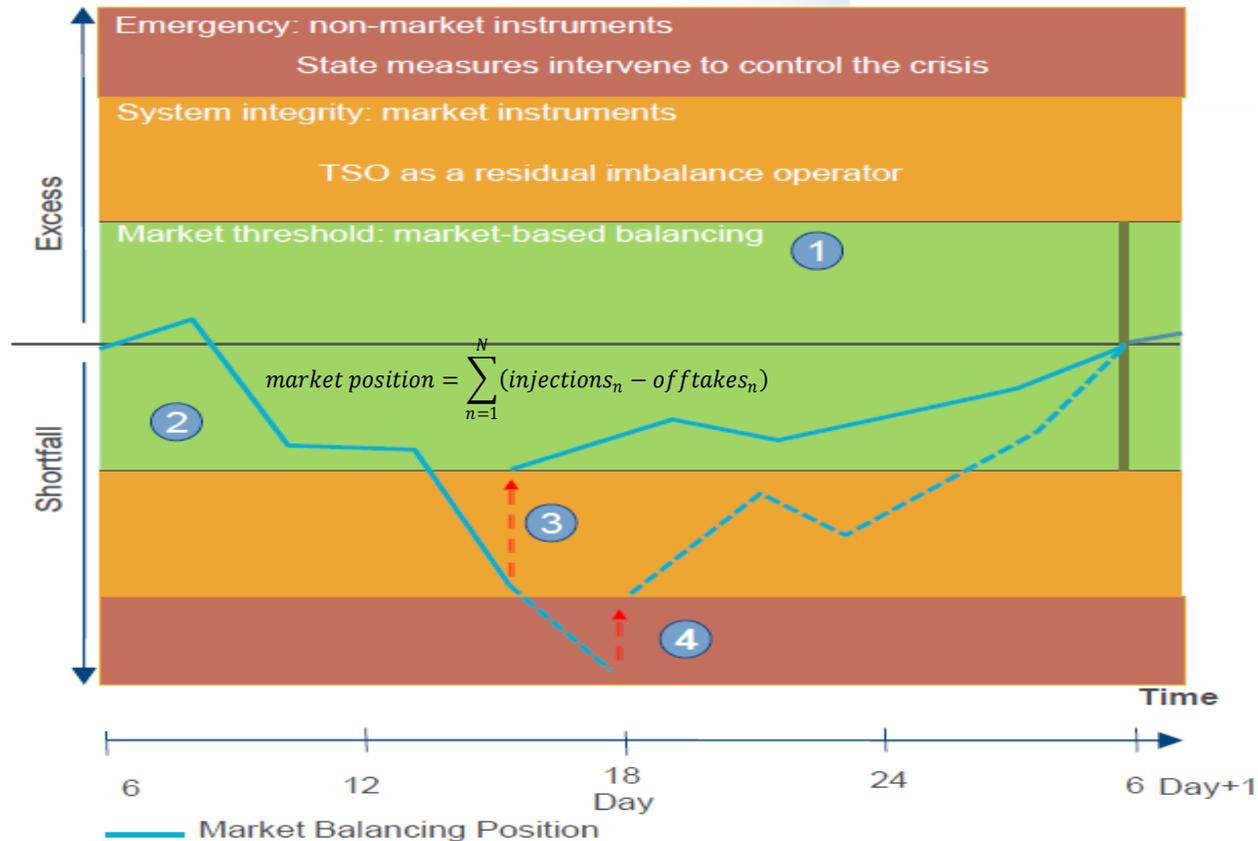
## TRADING

### Hub-based Gas Sourcing and Network Balancing

- market liquidity as guarantee for (short term) security of supply
- system operator (SO) = residual balancer => imbalances are penalized
- need for DSR balancing products
- incentives for suppliers to trade and change physical supplies

## BALANCING

# Market-based Gas Network Balancing



## Hub-based Gas Sourcing

- (1) & (2) market balancing position within thresholds, no actions needed => continuity of gas flows is guaranteed
- (3) market balancing position goes beyond the thresholds (+ or -), residual action is initiated by the system operator with cash compensation for the causing shippers/suppliers
- (4) system operator is not able anymore to residual balance (market instruments are exhausted) => state of emergency (crisis)

# Residual Gas Balancing

The balancing position of a network user:

**normal balancing**



**emergency balancing**

$$GBP_{g,t}^{market} = \sum_{k=0}^n EEA_{t,k}^{market} + \sum_{k=0}^n XEA_{t,k}^{market} + NCTT_t^{market}$$

gas deficit => drop of entry energy allocations, stable demand

voluntary demand curtailment => DSR

=> gas release and reshuffling of gas for protected customers

The market balancing position (MBP) for hour t in the market area:

$$MBP_t^{market} = \sum_{l=0}^n GBP_{t,k}^{market}$$

Operator intervenes as residual balancer if:

$$MBP_t^{market} > upper\ MT \Rightarrow operator\ sells\ gas\ on\ VTP\ for\ settlement$$

and alternatively,

$$MBP_t^{market} < lower\ MT \Rightarrow operator\ buys\ gas\ on\ VTP\ for\ settlement$$



**Gas Deficit Emergency (VTP not liquid)**

**Stage 1:** DSR in market area

system operator calls for market DSR option

**Stage 2:** DSR for cross-border solidarity

system operator calls for cross-border DSR

At the end-of-day each network user must be in balance:

$$GBP_{g, 6\ am}^{market} = 0 \quad \forall g$$

Consequently:

$$MBP_{6\ am}^{market} = 0$$

- GBP balancing position
- EEA entry energy allocations
- XEA exit energy allocations
- NCTT net confirmed title transfers
- MT market threshold
- g network user
- t hour, day

**DSR balancing products allow a market-based reshuffling of gas for continuing gas supply to protected customers and to apply cross-border solidarity.**

**Marginal pricing => suppliers face marginal costs of balancing the system.**

## Market-driven Security of Gas Supply

### Market Internalization

- value of supply security => incorporate into balancing regime (imbalance fee)
- price signals and incentives => keep the system in balance
- balancing incentives => rise to the marginal cost of curtailment
- proper trade-off => imbalance fee or hedging tools: storage, flexible contracts (demand response, fuel switching)
- market to choose the most efficient tools to hedge risks of supply

### Market Responsiveness (preventive market actions)

- signalling scarcity through price signals => attract liquidity (e.g. LNG cargoes) + demand response (fuel switching)
- arbitrage of companies => producing or selling contracted gas
- state interventions at this state => hamper market functioning
- approach accelerates moving to more mature gas markets
- contract-based provision of security of supply => service with market-value
- sufficient infrastructure, efficient use => access to markets is key
- liquidity attracts liquidity

## Demand Side Response (DSR) for Balancing

### DSR as a Balancing Gas Product

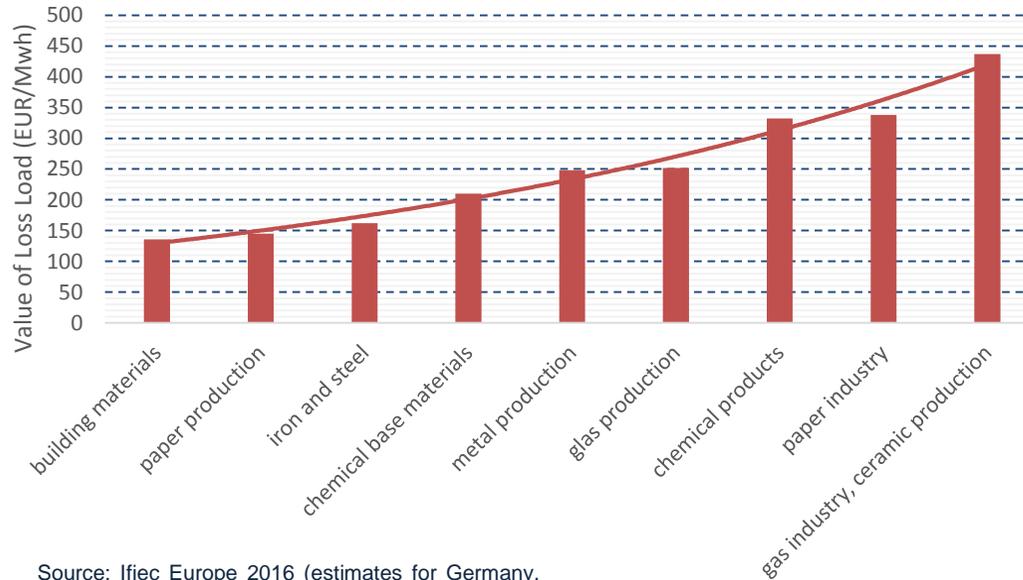
- allows large consumers (and their suppliers) voluntary reduction of consumption in return for a compensation
- willingness to release gas => auction based tool
- compensation in case the offer is called by system operator
- last resort market-based balancing tool if hub lacks liquidity
- system operator calls option in case of an emergency

### DSR for Solidarity between EU Member States

- DSR 'call option' is offered to neighbouring system operator in emergency
- market principles in case of DSR for solidarity
- costs of DSR for solidarity be covered by MS triggering solidarity
- international solidarity and compensations go together

DSR may provide additional network balancing volumes to avoid the system entering the stage of involuntary DSR (forced curtailment)

## Value of Lost Load (VoLL)



Source: Ifiec Europe 2016 (estimates for Germany, average production loss of curtailment)

### Estimate of DSR

- willingness to pay to avoid being interrupted in return for compensation
- willingness to accept being interrupted in return for compensation

⇒ create a market for industrial and commercial demand response through auction process

⇒ make payments for firm consumers for curtailment

⇒ cross-border solidarity in case of a gas deficit emergency => need for financial compensations (avoid free-riding)

## Hub Market Trading Maturity

### Hub-based Gas Sourcing

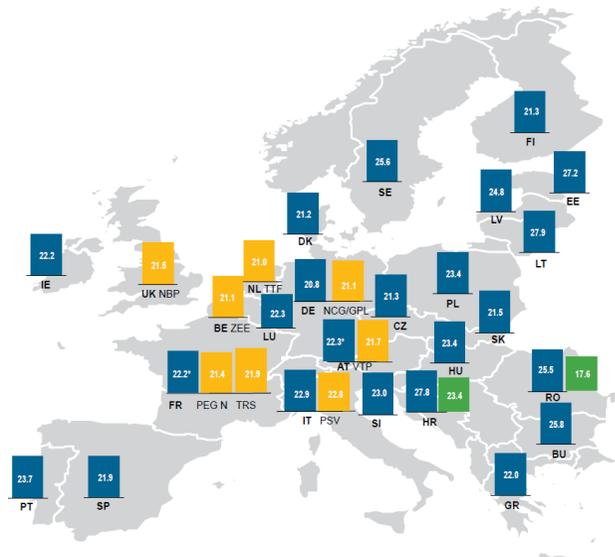
- gas market maturity varies considerably across EU
- concentrated markets => single supplier, single route
- full implementation of market regulation is precondition
- some countries will move more rapidly to an emergency while other countries have still a functioning market
- supply obligations may hamper progress towards a more mature market

### Cross-border Gas Sourcing in Emergency

- co-existence of countries in 'emergency status' and other in 'market status'
- price signals => supplies to market which values it highest
- demand changes => new S/D equilibrium
- price increase in market ('export' of gas scarcity) => overall impact on gas demand (gas release, demand response)
- DSR balancing products only available if liquidity on hub is not sufficient anymore to continue supplying protected customers (at least households)

# Hub-Based Gas Sourcing

Gas Sourcing Costs in EU 2015 (table for 2014)



MS/sourcing mechanisms	2014 sourcing cost
AT imports	25.4
AT hub	24.6
BE hub	21.9
BG imports	30.9
HR imports	24.3
CZ imports	24.1
DK imports	32.0
EE imports	28.2
FI imports	26.5
FR imports	24.7
FR hub	23.9
GR imports	28.2
HU imports	26.4
IE imports	22.1
IT imports	27.0
IT hub	25.7
LV imports	29.3
LT imports	27.8
LU imports	25.0
NL hub	23.7
PL imports	25.1
PT imports	31.8
RO imports	28.7
SK imports	25.4
SI imports	27.6
ES imports	26.2
SE imports	27.6
UK hub	24.1

securing gas supply to EU borders

- => trading places at major supply corridors to EU
- => producers active traders on EU hubs
- => integrate producers in the market

securing gas supply among EU Member States

- => market-based also in case of gas deficit emergency
- => operator as residual balancer
- => DSR balancing products
- => cross-border solidarity DSR for supplying protected customers

Minimise need for market intervention and involuntary curtailment  
Maximise price mechanism and price signalling

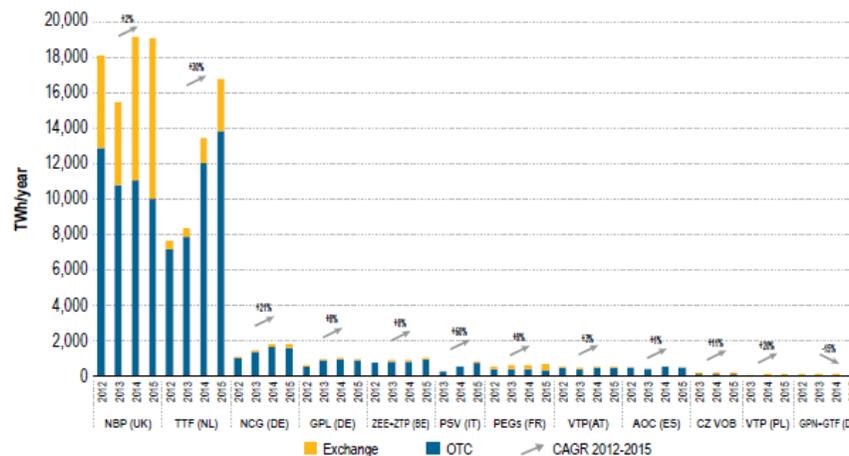
Source: ACER MMR 2016

There are different types of gas hubs according to the main activity:

- gas balancing hubs (VTP, EE zone) (e.g. NCG)
- gas trading hubs (e.g. TTF)
- gas transit hubs (e.g. CEGH-Baumgarten hub, ZEE Beach)

Not each MS must necessarily develop a liquid trading hub BUT access to liquid hubs should be guaranteed throughout Europe (infrastructure).

Traded Volumes at EU Gas Hubs 2012-2015 (TWh/year and % growth)



Source: ACER MMR 2016

## International Solidarity: Major Gas Crisis

### DSR Balancing Products for Solidarity

- MS with a gas deficit emergency triggers cross-border solidarity once all the balancing means in the market area/country are exhausted
- system operator => residual balancing for protected customers
- *action 1*: system operator buys gas on accessible (adjacent) hub to cover missing gas to balance the system => normal practice (price signalling scarcity)
- *action 2*: if action 1 is not sufficient => system operator buys cross-border DSR balancing products
- market dynamics of scarcity pricing lead to new S/D equilibria
- reshuffling of the gas flows in order to continue gas supply to protected customers
- provide sufficient additional system balancing volumes to avoid entering later stages of an emergency (involuntary curtailment if all market tools are exhausted)

## Concluding Remarks

- imbalance fees according to marginal costs of supply curtailment => market internalization of security of supply
- price signalling of scarcity => attracts liquidity (e.g. LNG cargoes) + demand response (fuel switching)
- market to choose the most efficient tools to hedge risks of supply (e.g. gas storage and interruptible contracts)
- market for DSR balancing products through auction process
- cross-border solidarity in case of gas deficit emergency through balancing regime and DSR balancing products
- international solidarity and financial compensations go together in case of a gas crisis => risk of free-riding (suboptimal investment in hedging tools)
- achieving market maturity across the EU is the best guarantee for security of gas supply within the EU
- integration of supply sources to Europe in EU hub gas trading in order to safeguard liquidity on an economic basis