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EU gas hub development and a comparison with US Henry Hub

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Objectives for today

- Highlight diversity of European gas market integration including on hub development
- Give an overview of EU gas hub development with a focus on leading hubs
- Show evolution of TTF and NBP hubs in comparison to Henry Hub

Context: competitive and secure wholesale gas markets are a vital part towards an EU internal energy market

- **Gas Target Model (GTM) provides a long term perspective in line with the Third Energy Package**
- **GTM aims to contribute to secure and competitive European gas market – development of gas hubs is a key goal**

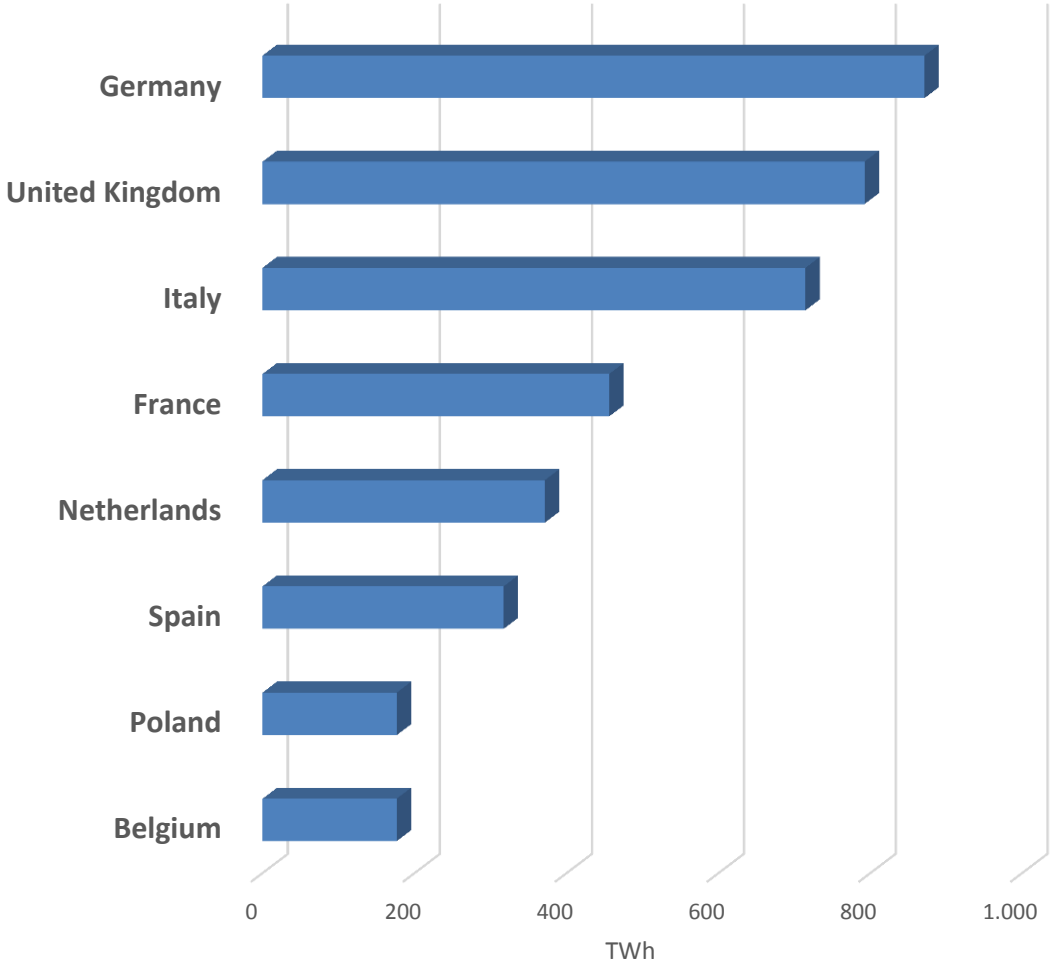
GTM's four objectives are:

- Enhance security of supply through marked-based measures
- **Facilitate wholesale market functioning which includes a liquid spot market and forward/futures markets**
- Ensure regulatory and market arrangements for efficient use of gas fired power plants
- Facilitate new uses of gas through appropriate and limited regulatory interventions

Source: ACER

Pro memorie: largest natural gas markets in the EU

Consumption of natural gas by country in 2015 (TWh)



8 countries out of 28 member states accounted for **83%** of overall natural gas consumption in the EU

Source: Eurostat

EU market is heterogeneous when it comes to hub development

A non-exhaustive benchmark of EU hubs by stage of development

Advanced hubs: NBP and TTF

Broad liquidity

Sizeable forward markets which contribute to supply hedging

Larger presence of financial players

Price reference for other EU hubs and for long-term contracts indexation

Advancing hubs: NWE region

Ongoing increasing liquidity

More reliant on spot products and balancing operations

Progress on supply hedging role but relatively **lower longer-term products liquidity levels** results in weaker price risk management role

Developing hubs: Poland and Czech R.

Improving liquidity from a lower base taking advantage of enhanced interconnectivity

Liquidity partially driven by market obligations imposed on incumbents

Still significant reliance on long-term contracts

Illiquid hubs: SEE, Iberia, Baltic

Reliance chiefly on long-term contracts

Embryonic organised market places

Source: ACER

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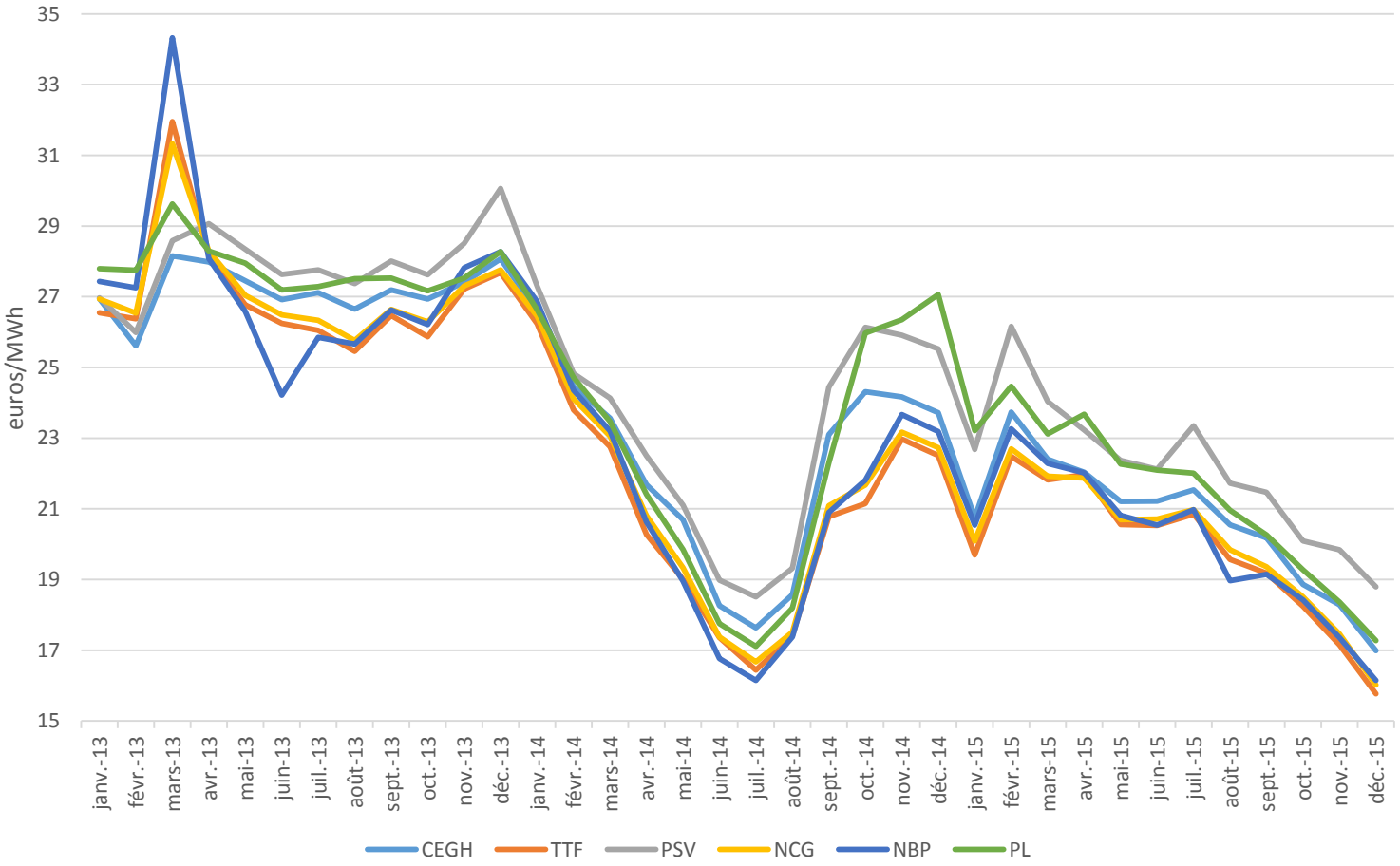
Where there is a hub, prices have over the last years shown a converging trend

Monthly averages of DA prices for selected European hubs



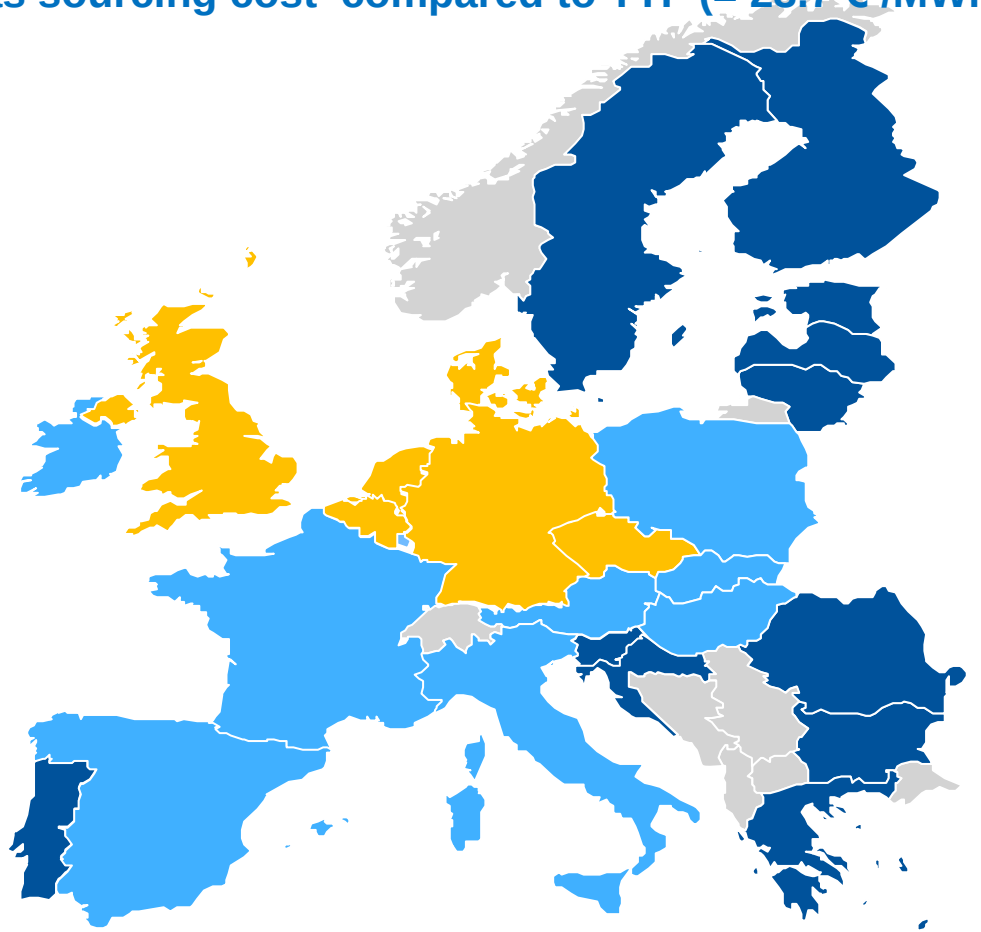
Wholesale price levels in countries without or with an embryonic hub can be up to 30% higher compared to TTF

Source: ACER

Supply sourcing costs have also been converging although differences persist

2014 Calculated gas sourcing cost* compared to TTF (= 23.7 € /MWh)

- <1 euro/MWh
- 1-3 euro/MWh
- >3 euro/MWh



Price levels are higher in those regions with

- less competitive market frames
- Less developed hubs
- weaker inter-connection

* Suppliers' sourcing costs take into account both border import and diverse hub product prices. A weighted average of monthly sourcing costs and demand is performed to obtain the yearly figure.

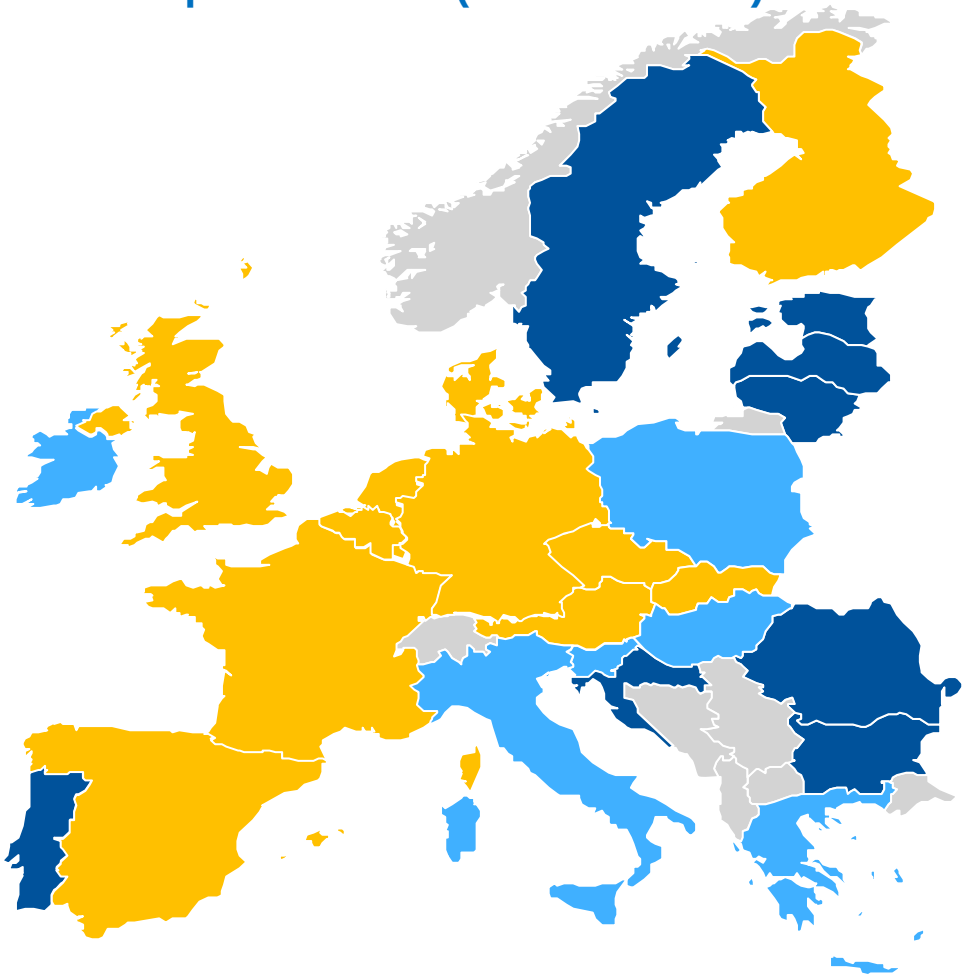
Source: ACER estimates based on NRA input, Eurostat Comext, BAFA, Platts.

…2015 sees further convergence

2015 Calculated gas sourcing cost* compared to TTF (= 21.0 € /MWh)

- <1 euro/MWh
- 1-3 euro/MWh
- >3 euro/MWh

1. Influence of lower oil price
2. Impact of reverse-flows
3. Improved LNG competitiveness



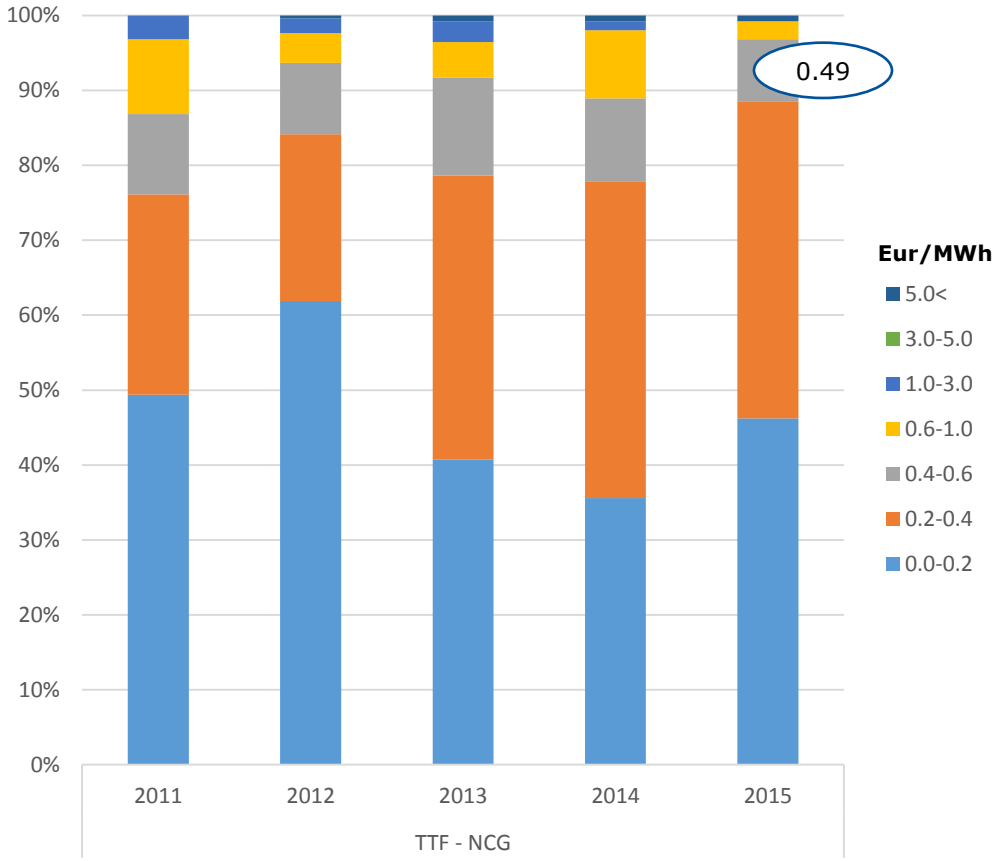
* Preliminary results

Source: ACER estimates based on NRA input, Eurostat Comext, BAFA, Platts.

There is almost complete price convergence among hubs in North West Europe…

Transmission cost in EUR/MWh

Example: Levels of DA price convergence between TTF and NCG hub by year



Price difference between hubs tends to be lower than the **cross border transmission cost eliminating** most of the time any **arbitrage opportunities**

Source: ACER

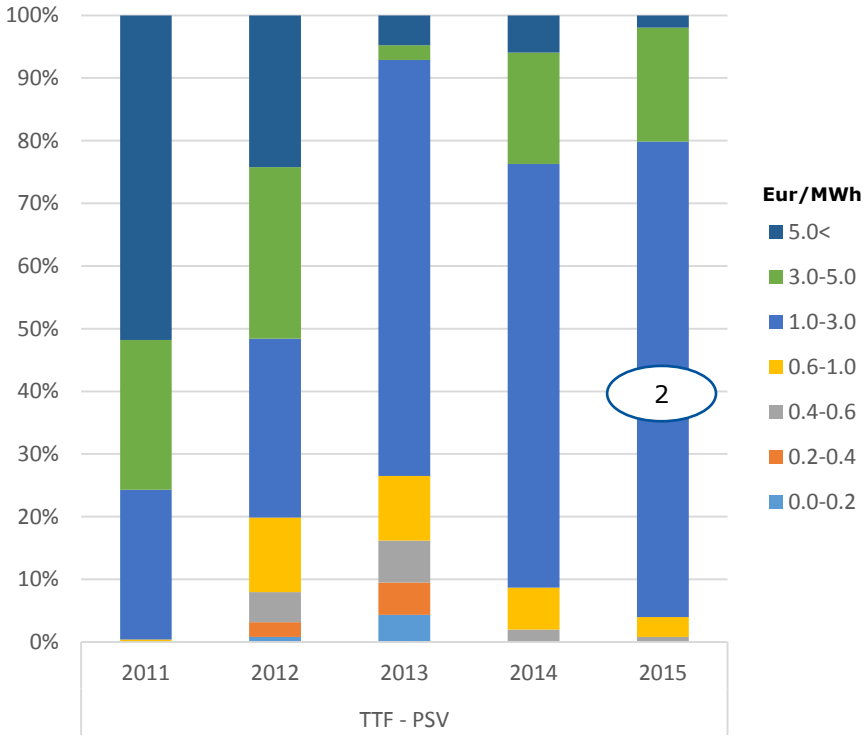
… comparing NWE with rest of Europe shows somewhat lower price convergence

Transmission cost in EUR/MWh

Several different factors impact convergence levels, a.o.:

- Lower liquidity on the hub
- Oil-linked contracts
- Infrastructure challenges

Example: Levels of DA price convergence between TTF and PSV hub by year

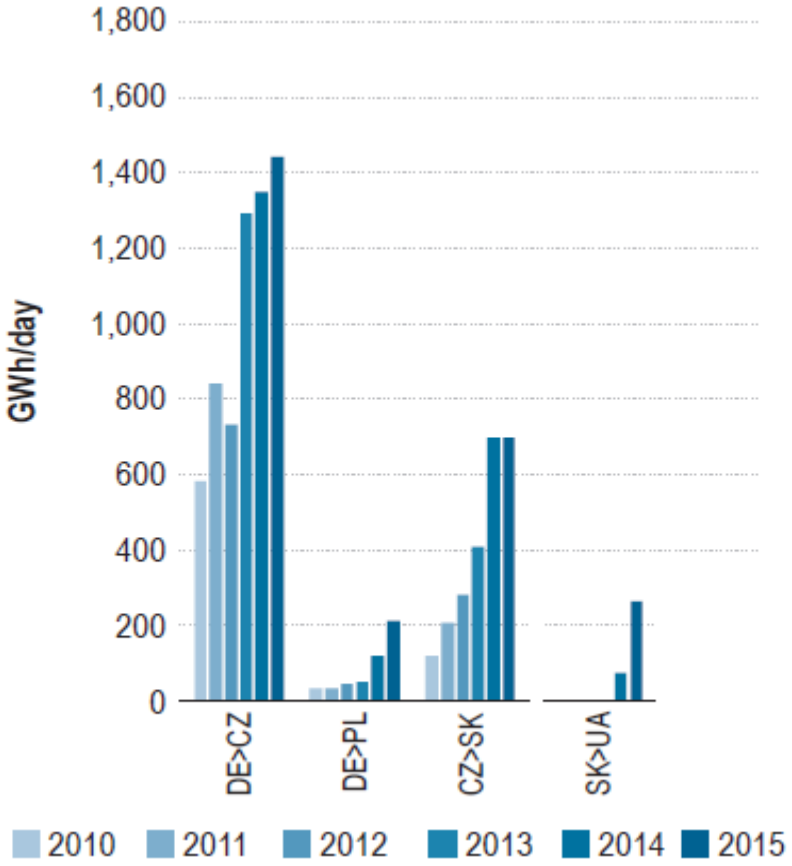


Price difference between hubs tends to be **higher** than the **cross border transmission cost** often resulting in **arbitrage opportunities**

Source: ACER

Infrastructure investments, in particular in reverse flow capabilities, also contribute to higher price convergence

Example: non traditional direction capacity expansion on key CEE borders – 2010-2015



CEE region is **more integrated** with other regions and sees **more competition**:

- Reverse-flow capabilities and new IPs **increase security of supply** through increased gas flow flexibility and facilitate **market integration**
- **Backhaul services** offered on physically uni-directional IPs **facilitate market functioning**

Source: ENTSOG

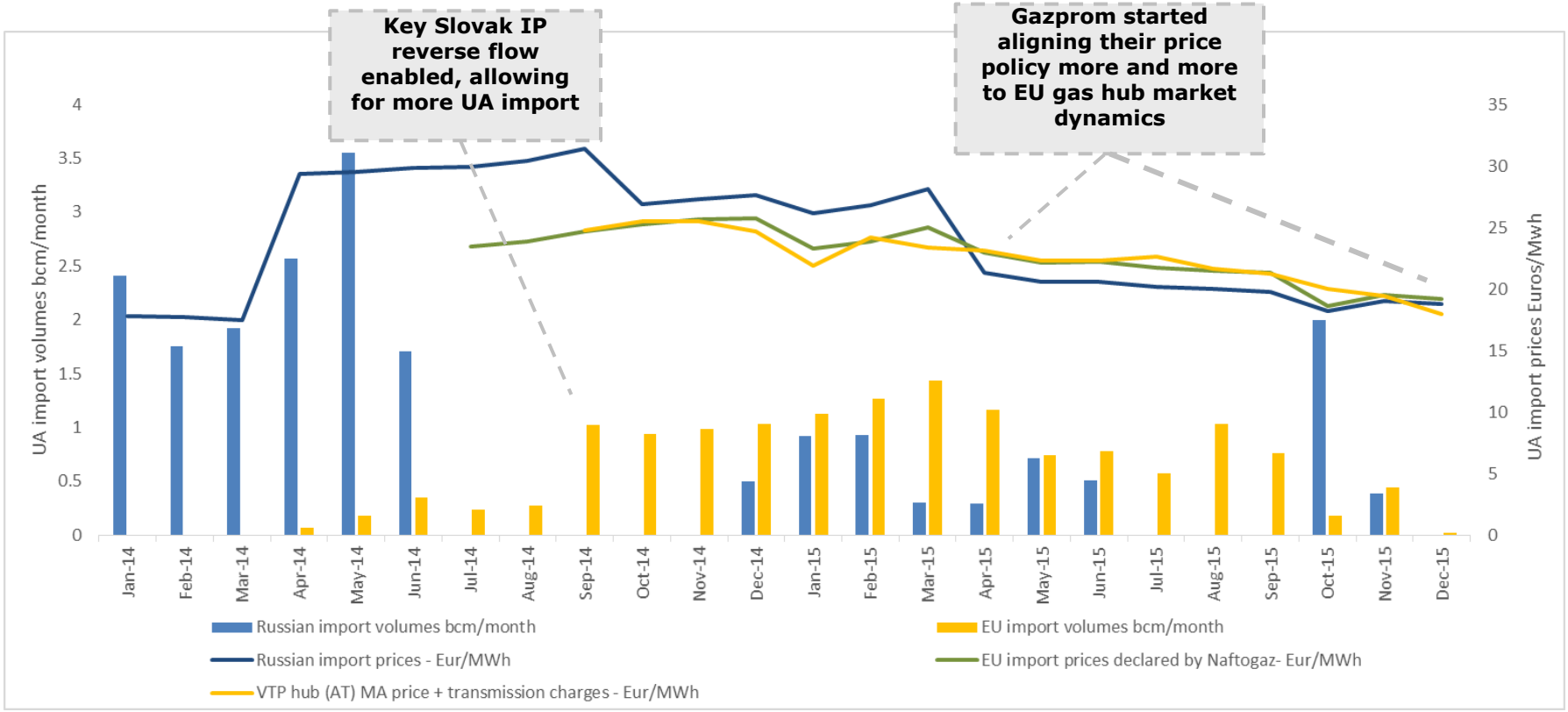
As a conclusion, despite ongoing progress gas wholesale market functioning in the EU still differs widely by region

Region	Characteristics	
Western European gas markets	• Except for UK and NL, lower levels of forward liquidity • liquid and transparent gas trading in large market zones • Several supply sources, also thanks to LNG, and diverse market stucture with imports from multiple firms and production by multiple firms (where applicable)	**Many consumers (mostly large consumers in largest markets) already benefit from wholesale gas competition**
Central and Eastern Europe	• Many gas markets without transparent hub trading and – according to GTM criteria – relatively small to develop into competitive wholesale markets • Often high concentration on the supply side • Early indication of developing competition in selected Central European Member States • Still often large reliance on largest supplier, i.e. Gazprom	**Lack of competition in smaller Member States should not be ignored**

Source: ACER

EU gas reverse flows legislation offers Ukraine - besides Russian gas – a 2nd gas source which is hub based

Ukraine gas imports (bcm/month) and estimated Ukrainian gas import prices - €/MWh



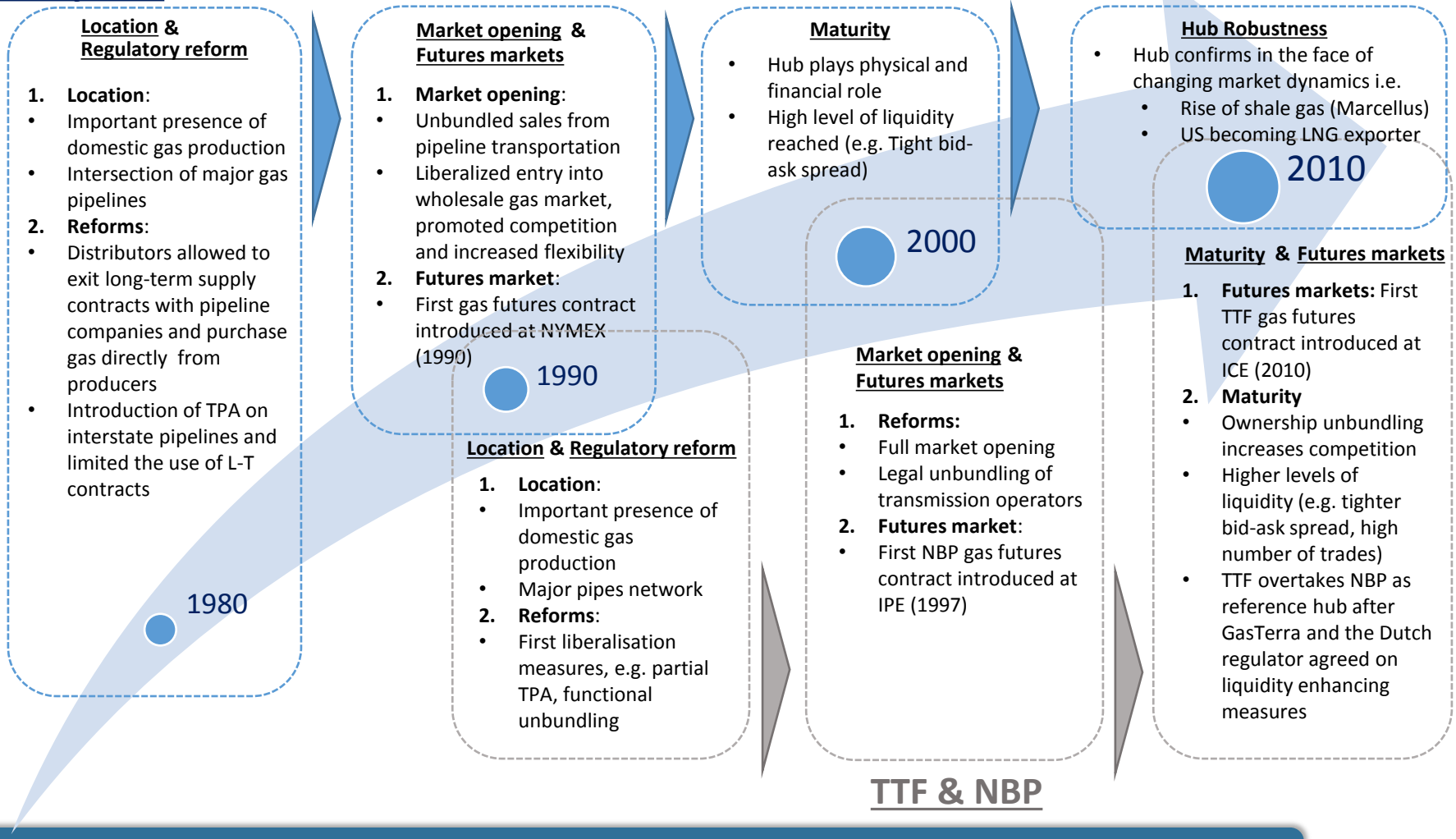
Ukraine market is getting more integrated into EU market

- Sourcing of gas from EU via hub trades
- New market for oversupplied EU shippers

Source: ENTSOG TP, IEA, Ukrtransgaz, ACER, Naftogaz, Platts

Leading US and EU hubs seem to go through similar stages of development

Henry Hub



Source: ACER, FERC

For discussion

1. Does the comparison of Henry hub with TTF/NBP resonate with you? Do you (dis)agree with drawing similar evolutionary trajectory?

2. Looking into the future, will TTF and NBP hubs show similar robustness when lower gas production hits NL and UK market? In other words will they remain the price reference hubs for respectively continental Europe and the British Isles?

3. Could in the future another hub phase emerge that no hub has gone through yet? For example one reference hub for North America and Europe?

4. Does Europe need two reference/leading hubs?

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Thank you for your attention!

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