REGIONAL CENTRE FOR ENERGY POLICY RESEARCH

DANUBE REGION strategy Energy

Natural gas market integration in the Danube Region

Contribution of the Danube Region to the debate on the Energy Union

SZÉCHENYI 2020

HUNGARIAN GOVERNMENT

European Union
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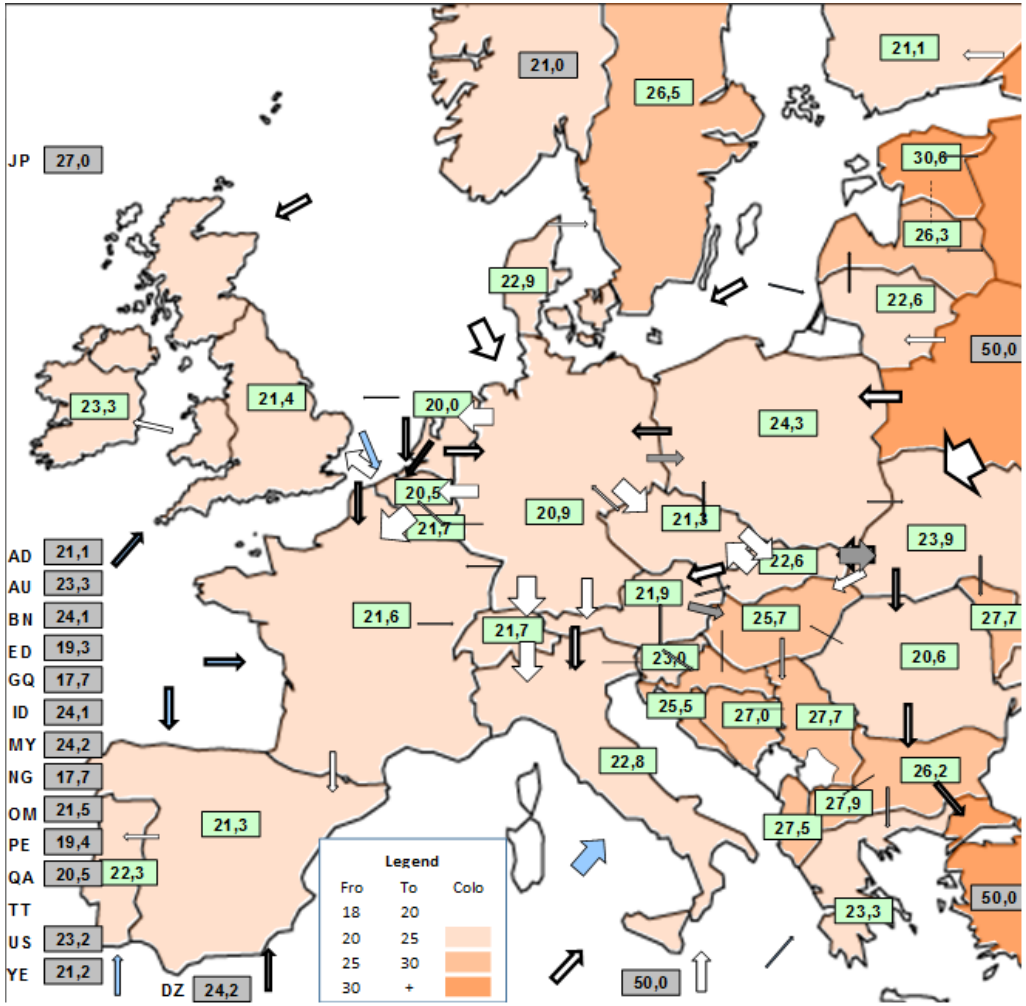
Research question and methodology

- The more efficient use of existing infrastructure, improved interconnectivity and increased supply source diversity are the key drivers for market integration and to support trading natural gas towards markets with a higher gas wholesale price.
- How can the following measures help to increase market integration in the DR?
  - Enabling reverse flow on existing pipelines
  - Better interconnectivity through PCIs
  - More LNG flow to Europe
- Methodology: Simulations by the European Gas Market Model

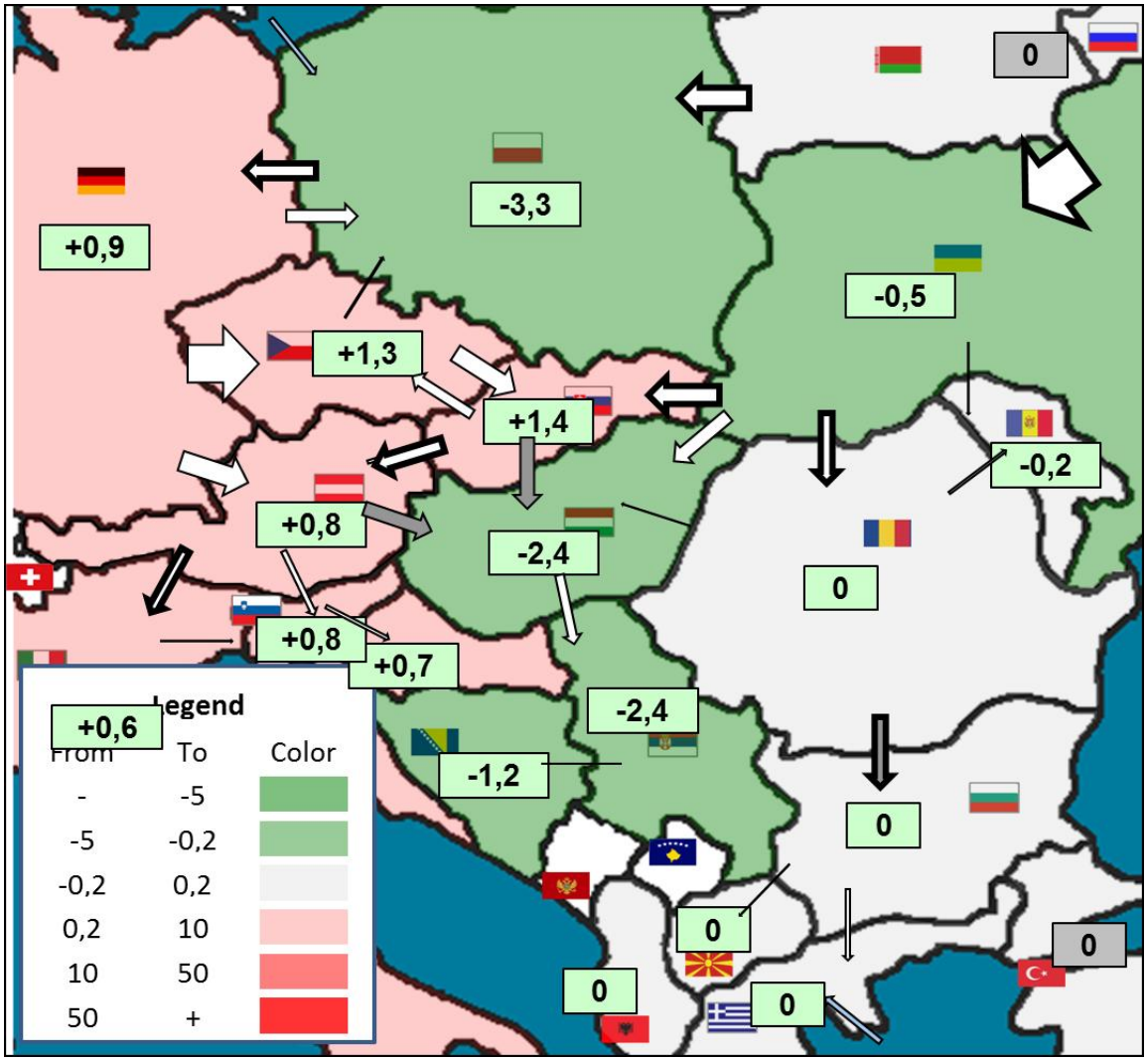
Modelled wholesale gas prices in 2015 (€/MWh) – operating infrastructure as of January 2015



The Danube region is

- more expensive than the rest of Europe (DR average price is 24.2 €/MWh 0.4 €/MWh above whole European average)
- Differences within the region still exist. (7 countries above EU average, 6 under average. Price difference between cheapest (RO) and most expensive (SB) is 7,1 €/MWh
- The physical congestion on HAG (between Austria and Hungary) still prevents the Balkan region to trade on Western European hubs, and the dominance of a single supplier is reflected in higher prices.
- The gap between Western and Eastern prices is however closing, (Russian contract re-negotiations)
- Ukraine benefits from the new reverse flow deliveries through Slovakia
- Romania is less dependent on external sources and not interconnected

New infrastructure integrates markets



- When ongoing infrastructure construction (HU-SK and LNG in Poland) becomes operational, Poland will benefit from the spot LNG flows, while all other countries, colored green on the map will benefit from the better interconnectivity to the more liquid Western European market.
- Important to note: the better interconnectivity will have a slight price increase effect in Western Europe, from the Danube Region countries, this applies to the Czech Republic and Slovakia and to a lesser extent also to Germany, Austria and Slovenia.

Market integration effects of new infrastructure and reverse flows on existing pipelines benefit the DR

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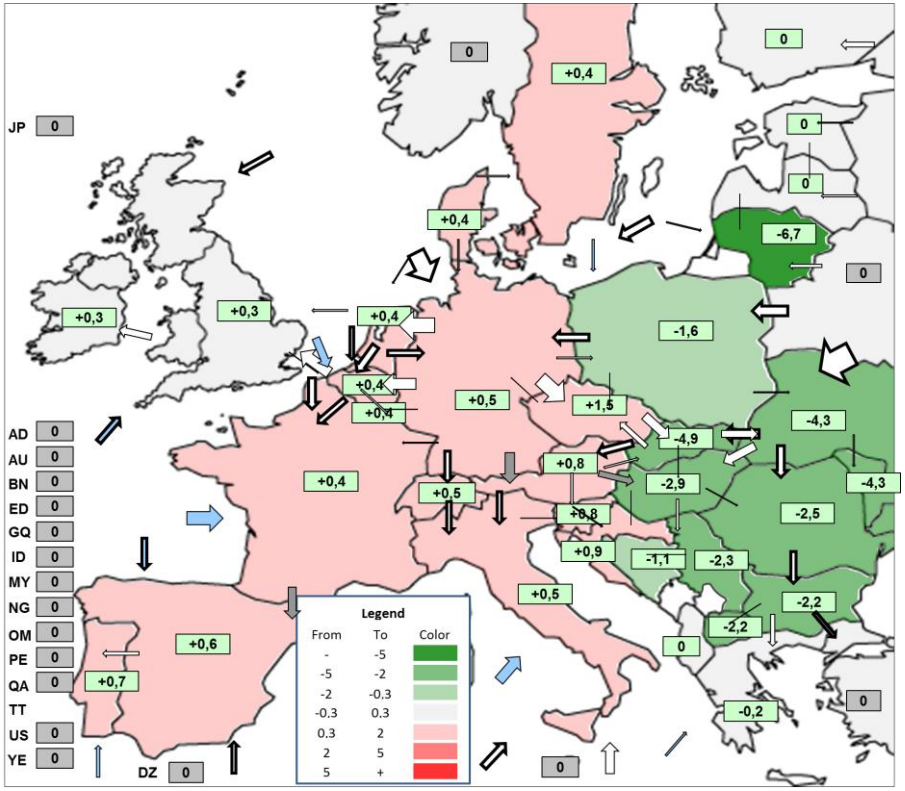
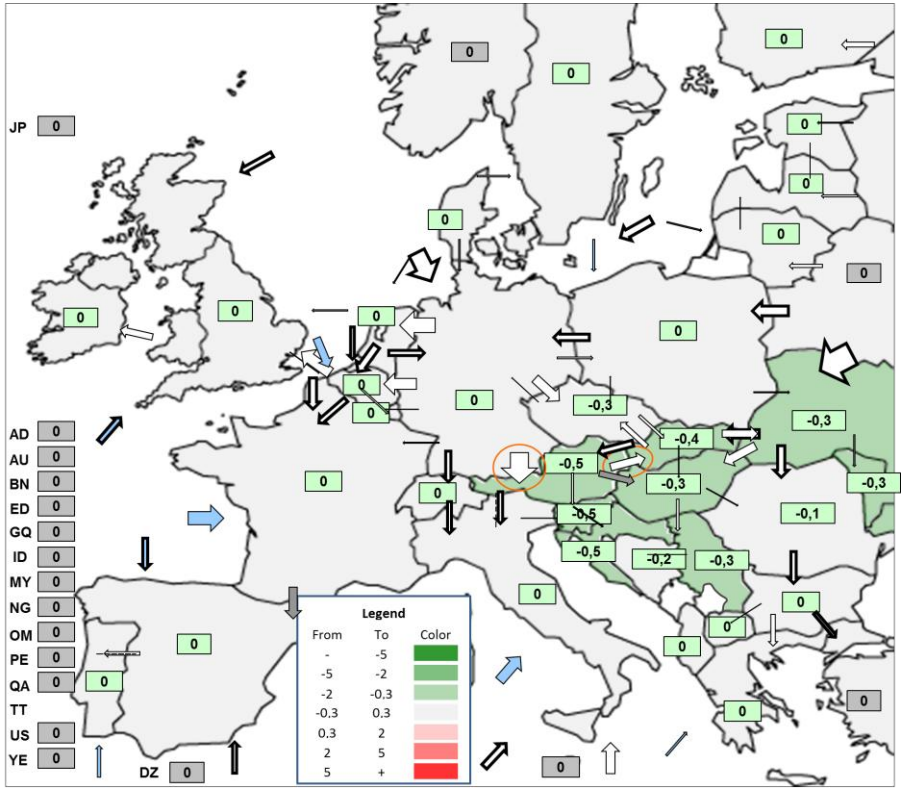
Price effect of new infrastructure + reverse flow built since 2009 (€/MWh)

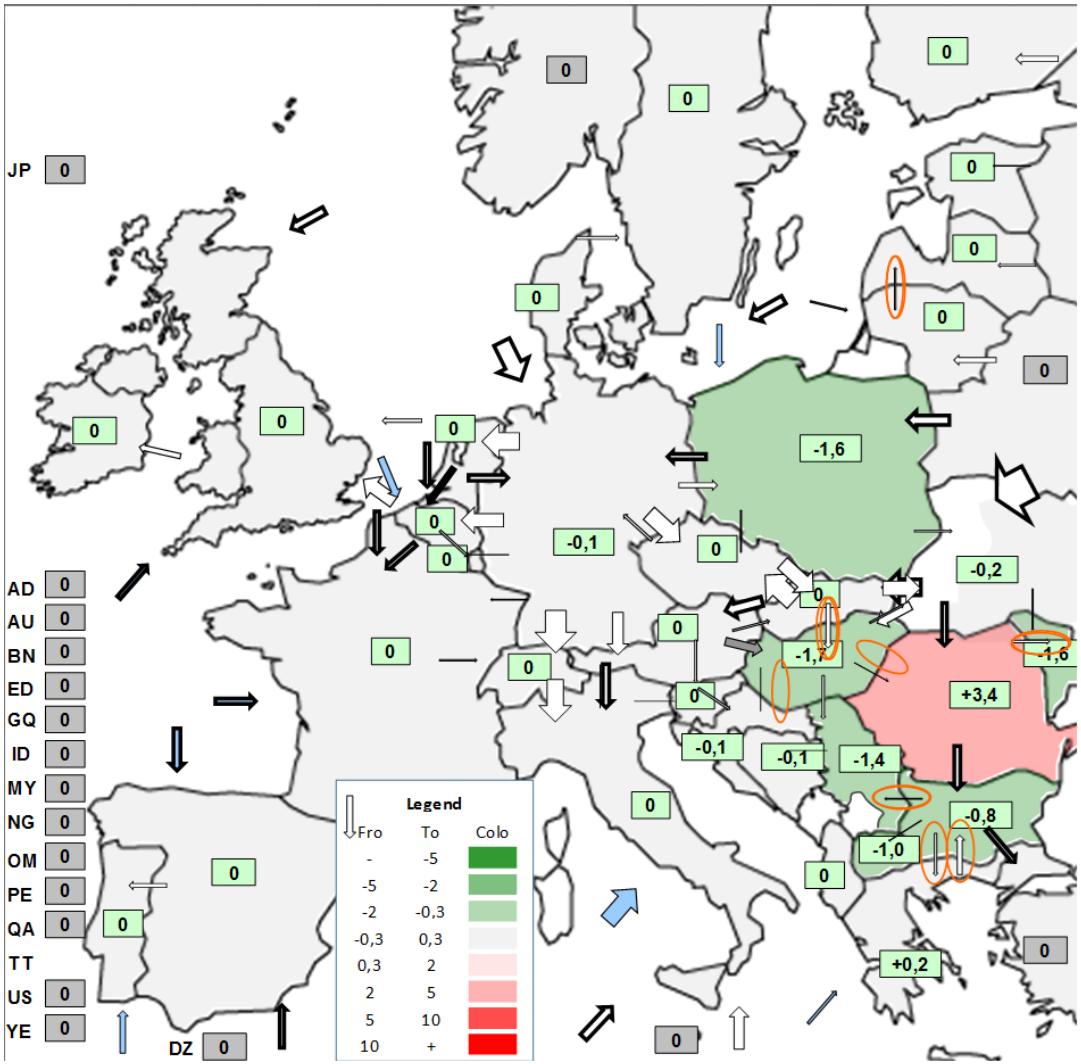


Price effect of allowing 100% reverse flow on all EU-EU border (€/MWh)



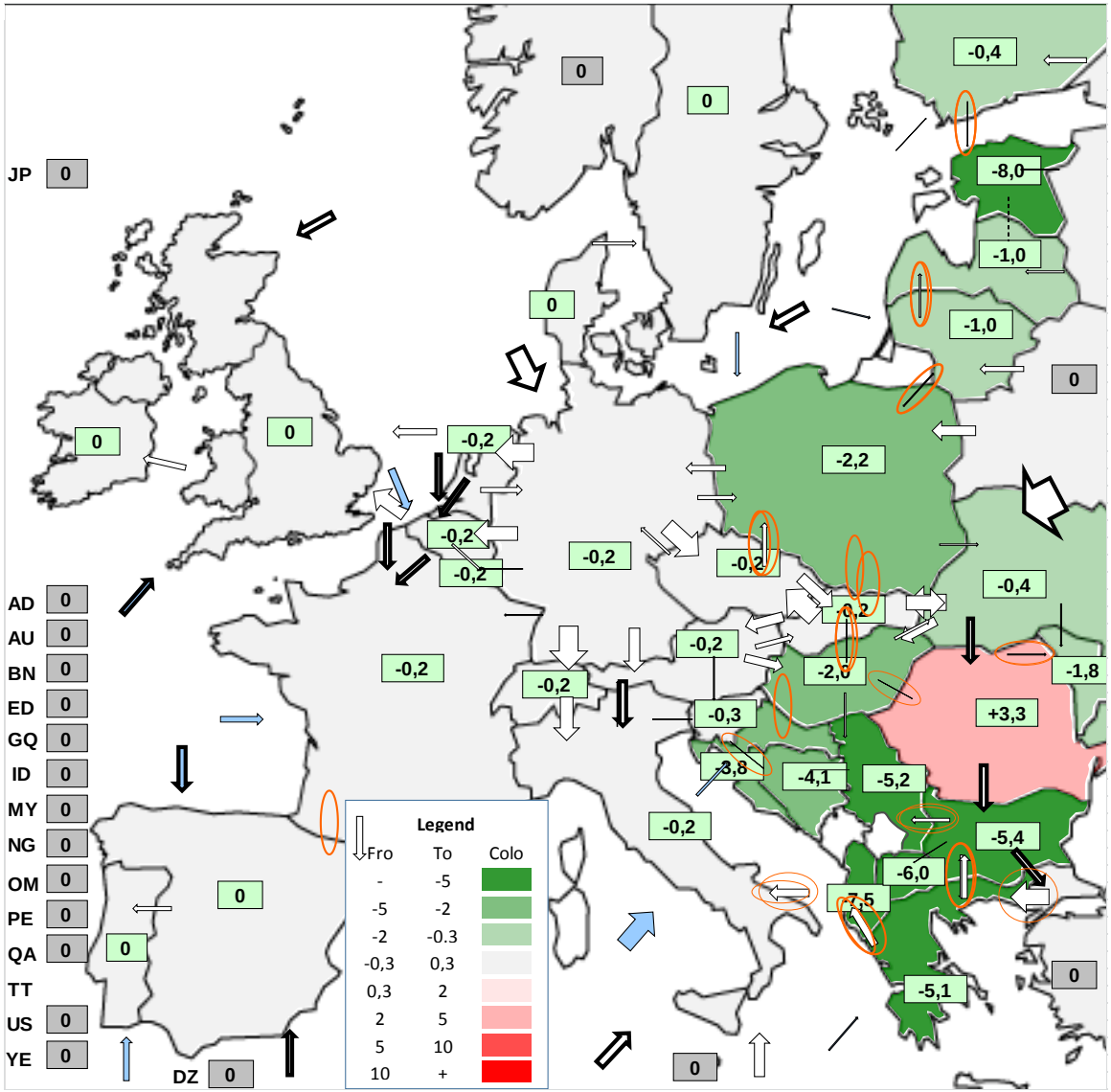
In normal scenario DE-AT and AT-SK additional reverse flows would be used

Effect of the short term PCI projects of the Energy Security Strategy



- Average price change in the DR region is moderate: -0,2 €/MWh (-0,5%)
  - The only new source in the region is Romania (present domestic production)
- Romanian wholesale price goes up: Romanian producers benefit
  - Regulatory/physical barrier: RO-BG spot trade not possible
- All short term PCIs in DR are being used to some extent except for RO-HU and HR-HU reverse flows:
  - Exit tariff from RO to HU is very high
  - Little use of HR-HU reverse flow without Croatian LNG

Mid term projects – price difference compared to reference (€/MWh)



- Average price change in the region is -0,5 €/MWh (1,2%)
- Bulgaria and Serbia are the main beneficiaries in DR (above 5 €/MWh decrease in price)
- Several unused or underutilized infra: SK-PL and HU-SI
  - HR-HU is still not in use because of high tariff!
- New source: Croatian LNG combined with TAP brings benefit to the whole region
  - Regulatory push on backhaul transactions on TAP is essential for these results!

Summary of market integration effect of PCIs

Market	Reference	Short-term	Mid-term	Price change due to short-term PCI projects (€/MWh)	Price change due to mid-term PCI projects (€/MWh)	Price change due to short-term PCI projects (%)	Price change due to mid-term PCI projects (%)
AT	21.9	21.9	21.7	-0.03	-0.22	-0.1%	-1.0%
BA	27.0	26.9	23.0	-0.13	-4.07	-0.5%	-15.1%
BG	26.2	25.4	20.8	-0.76	-5.35	-2.9%	-20.5%
CZ	21.3	21.2	21.1	-0.04	-0.22	-0.2%	-1.0%
DE	20.9	20.9	20.7	-0.07	-0.24	-0.3%	-1.1%
HR	25.5	25.3	21.6	-0.15	-3.81	-0.6%	-15.0%
HU	25.7	24.0	23.7	-1.71	-2.03	-6.6%	-7.9%
MV	27.7	26.1	25.9	-1.62	-1.79	-5.8%	-6.5%
RO	20.6	24.0	23.9	3.43	3.25	16.6%	15.8%
SB	27.7	26.3	22.5	-1.44	-5.20	-5.2%	-18.7%
SI	23.0	23.0	22.8	-0.04	-0.26	-0.2%	-1.1%
SK	22.6	22.6	22.4	-0.04	-0.22	-0.2%	-1.0%
UA	23.9	23.7	23.5	-0.22	-0.40	-0.9%	-1.7%
DR average	**24.2**	**24.0**	**22.6**	**-0.22**	**-1.58**	**-0.9%**	**-6.5%**
Whole Europe	**23.7**	**23.6**	**22.1**	**-0.10**	**-1.60**	**-0.4%**	**-6.8%**

Decreasing Japanese LNG price effect on wholesale price in Europe

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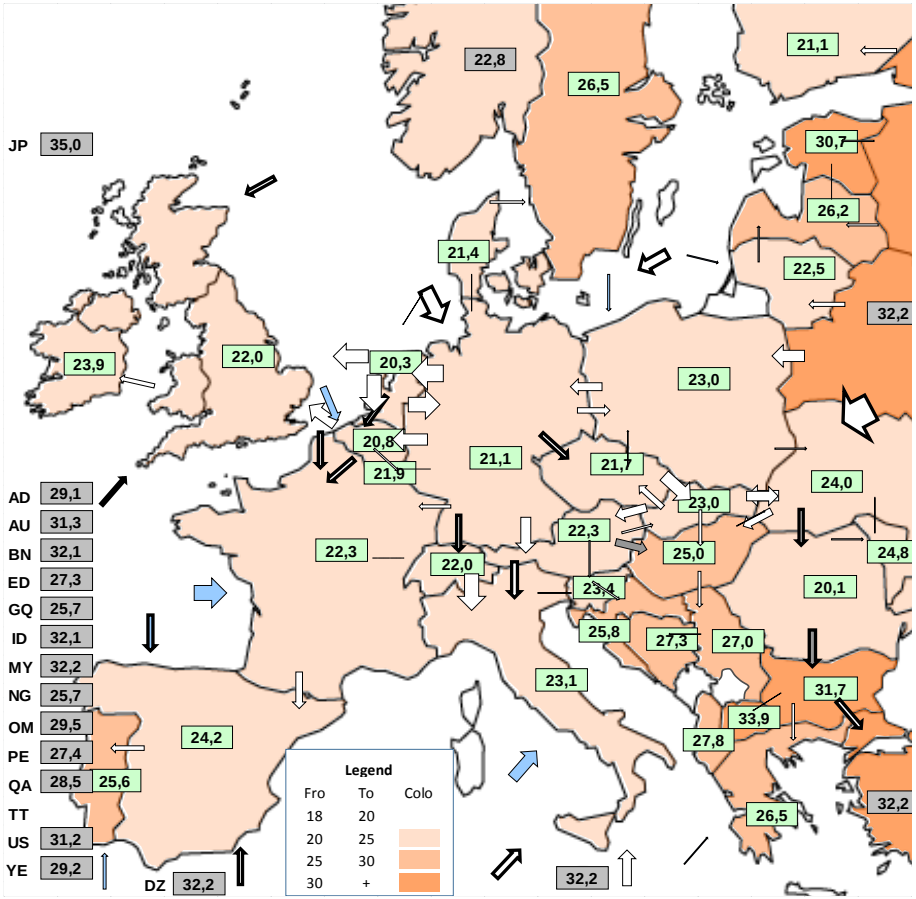
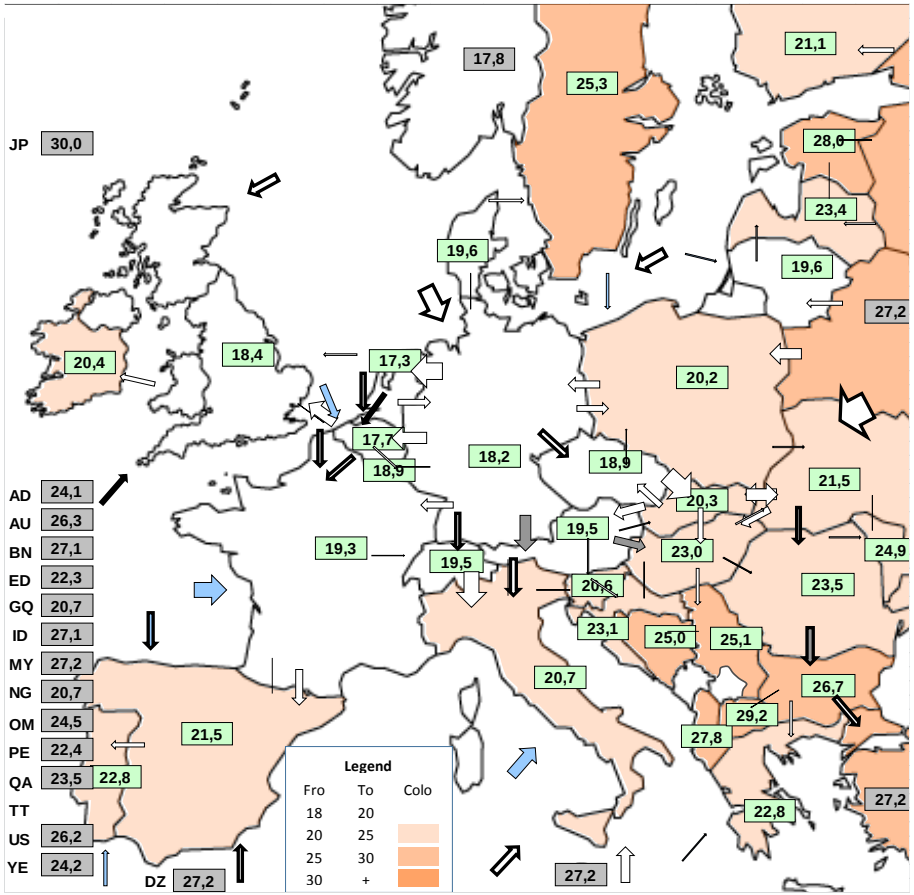
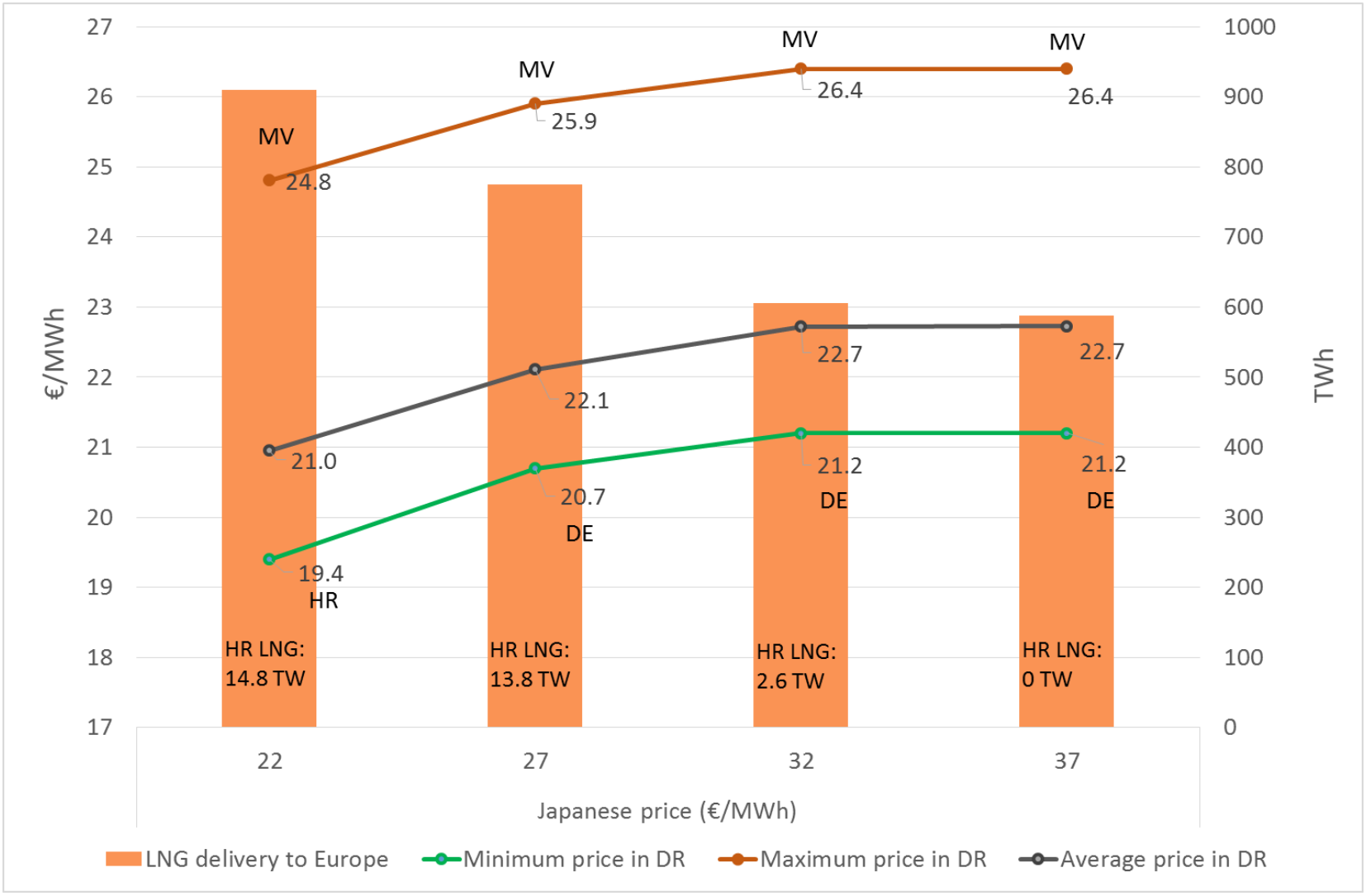
35 €/MWh Japanese price



30 €/MWh Japanese price



Effect of decreasing Japanese price on the LNG delivery to Europe and the wholesale prices in DR



Short- and mid-term PCI projects are assumed to be built

Conclusions

- The DR is a significant beneficiary of a more integrated European gas market and is fully supporting further integration efforts.
- The PCI process is key for the Danube Region. DR is ready to support the revision of the PCI list to arrive at the necessary level of regional interconnectivity at least cost (slightly reduced PCI list).
- Infrastructure upgrade and source diversification has already been effective to demolish the market power of the dominant supplier in several cases (CZ, SK, HU and UA)
- The regulatory scrutiny suggested by the Energy Union on transparency and access to pipeline capacities is key.
- Transmission tariff harmonisation would lessen regulatory barriers to trade across the Region and is key for market integration.
- Better regional interconnectivity provides for an effective spill-over of global LNG price changes towards landlocked countries in the Region. Therefore the development of an EU-level LNG policy, proposed by the Energy Union, is supported by the Danube Region.

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ANNEX

Short-term gas PCI projects

A	Short-term projects	(2014 – 2016)		
#	Name project	Details	Capacity	Finished by
Baltic gas market				
1	LT: LNG vessel	Vessel (not a PCI). Status: operational since Oct 2014	50 GWh/day	End 2014
2	Klaipėda-Kiemėna pipeline upgrade together with LT-TV upgrade	Capacity enhancement of the connection from Klaipėda to the LT-LV interconnector. Status: EIA and engineering design	57,4 GWh/day	2020
Gas optionality in Central and South-East Europe				
1	PL: LNG terminal	Terminal in Swinoujscie and connecting pipeline (not a PCI due to maturity). Status: under construction	150 GWh/day	End 2014
2	EL-BG interconnector	New interconnector to support diversification and deliver Shah Deniz gas in Bulgaria. Status: permitting, EIA (2 years delay)	134 GWh/day	2016
4	BG: storage upgrade	Increase storage capacity in Chiren; Status: pre-feasibility	up to 5,78 TWh/year mobil gas capacity	2017
5	HU-HR reverse flow	Reverse flow enabling gas flows from Croatia to Hungary. Status: feasibility studies.	76 GWh/day	2015
6	HU-RO reverse flow	Project to enable gas flows from Romania to Hungary. Status: feasibility studies	127 GWh/day	2016
7	BG-RS interconnector	New interconnector supporting SoS in Bulgaria and Serbia. Status: EIA, routing, financing (issued with Srbijagas unbundling to access finance)	80 GWh/day	2016
8	SK–HU interconnecter	New bi-directional pipeline. Status: construction	SK-HU: 126,8 HU-SK: 50,75 GWh/day	2015
9	RO-MV interconnector	Under construction (in delay)	30 GWh/day	2016

Mid-term gas PCI projects

B	Medium-term projects	(2017 – 2020)		
#	Name project	Details		Finished by
Baltic gas market				
1	PL-LT interconnector	New bi-directional pipeline (GIPL) ending isolation of the Baltic States. Status: feasibility/FEED	PL-LT: 73,4 GWh/day LT-PL:30,6 GWh/day	2019
2	FI-EE interconnector	New bi-directional offshore pipeline ("Balticconnector"). Status: pre-feasibility/permitting	80 GWh/day	2019
3	Baltic LNG terminal	New LNG terminal with location to be decided (EE/FI). Status: pre-feasibility, permitting	FI: 133 GWh/day	2017
Enabling gas from Spain to flow north				
1	ES-FR "Midcat" interconnector	New interconnection (including compressor) to enable bi-directional flows[1] between France and Spain. Status: feasibility study	ES-FR: 230 GWh/day	tbd
Cluster Gas optionality in Central and South-East Europe				
1	PL-CZ interconnector	New bi-directional pipeline between Czech Republic and Poland. Status: Feasibility/FEED, permitting (CZ)	153,2 GWh/day	2019
2	PL-SK interconnector[2]	New bi-directional pipeline between Slovakia and Poland. Status: final investment decision in 2014	PL-SK: 143,9 GWh/day, SK-PL: 174,5 GWh/day	2019
4	TANAP (TR-EL)	Trans-Anatolian Natural Gas Pipe bringing Caspian gas to the EU via Turkey and opening the Southern Gas Corridor. Status: feasibility/final investment decision	TR-GR: 348 GWh/day	2019
5	TAP (EL-AL-IT)	Intra-EU section of the Southern Gas Corridor. Direct connection to TANAP. Status: permitting	526,01 GWh/day (20 bcm/year)	2019
6	IAP (AL-ME-HR)	New interconnector part of the Balkan Gas Ring and connected to TAP. Status: feasibility/FEED	HR-AL:30, HR-BiH: 30, HR-ME:15 GWh/day	2020
7	HR – LNG terminal	New LNG terminal in Krk supporting SoS and diversification in the Region. Status: feasibility/FEED (financing issues)	170 GWh/day (6,5 bcm/year)	2019
11	EL: Alexandroupolis LNG terminal	New LNG terminal in Northern Greece. Status: permitting	455 GWh/day	2016[3]
12	EL: Aegean LNG terminal	New LNG floating terminal at Bay of Kavala. Status: feasibility/FEED, permitting	155 GWh/day	2016[4]

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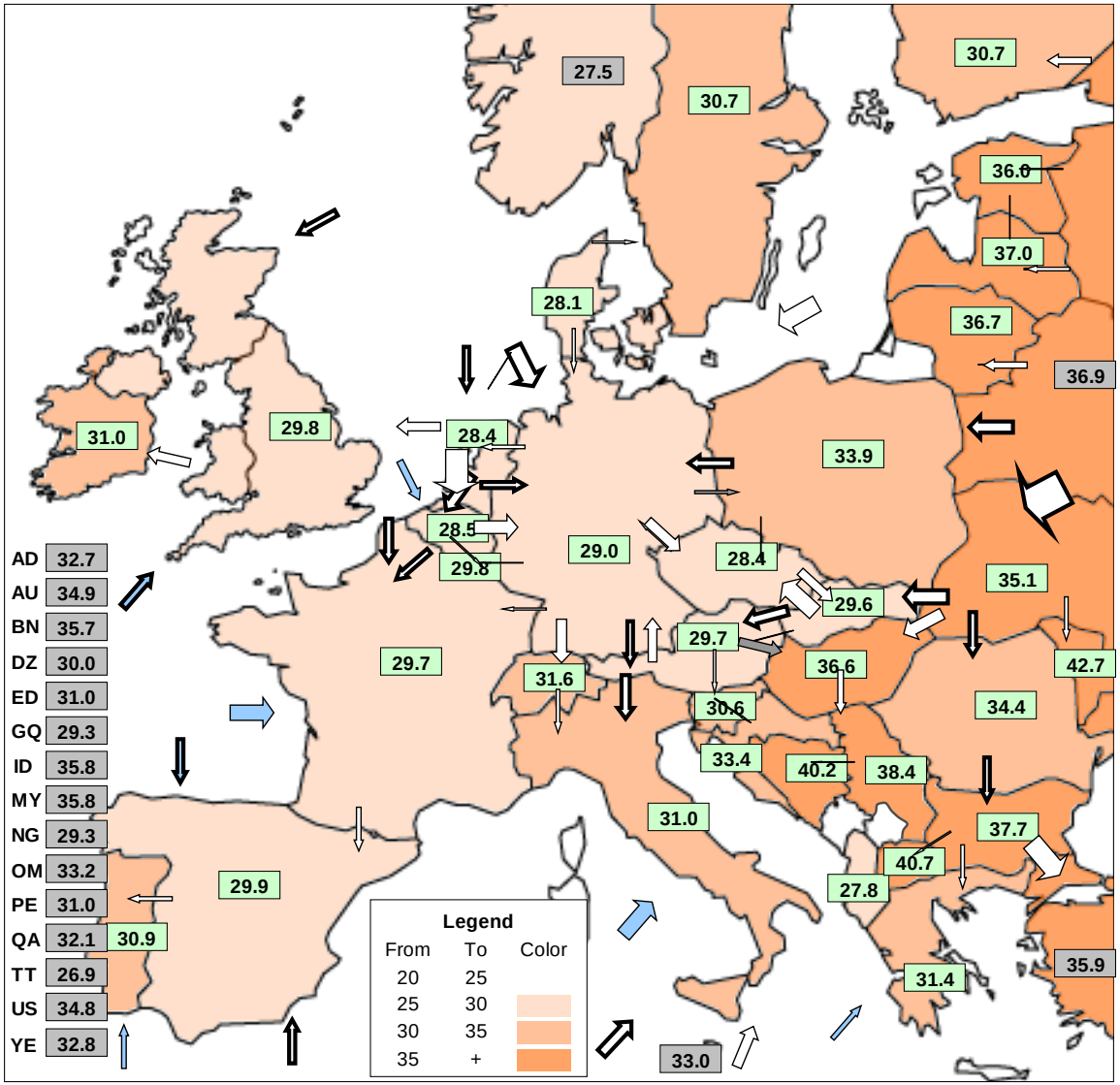
European Gas Market Model

European Gas Market Model – major characteristics

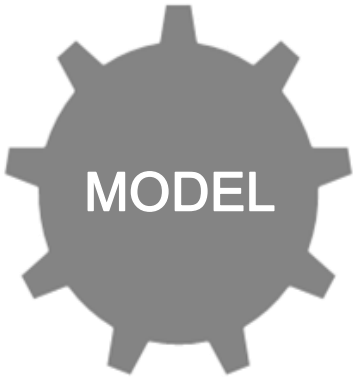


- Whole Europe (35 countries) is modelled
- Competitive prices by countries; 12 months
- Trade is based on long term contracts and spot trade within the EU and with exogenous countries (NO, RU, TR, LNG)
- Natural gas flows and congestions on interconnectors
- Physical constraints are interconnection capacities (transmission tariffs are also included)
- Trade constraints: TOP obligations
- Domestic production and storage facilities are included
- Arrows: modelled gas flows
- LNG market representation is linked to Asian LNG prices

One gas year – 12 months

INPUT

- Demand by countries (annual quantity, monthly distribution)
- Domestic production (annual quantity, minimum and maximum production)
- TOP contract (ACQ/DCQ), flexibility
- Infrastructure: Interconnectors, storage, LNG, tariffs
- External price: for LTC, LNG, NO, TR, RU



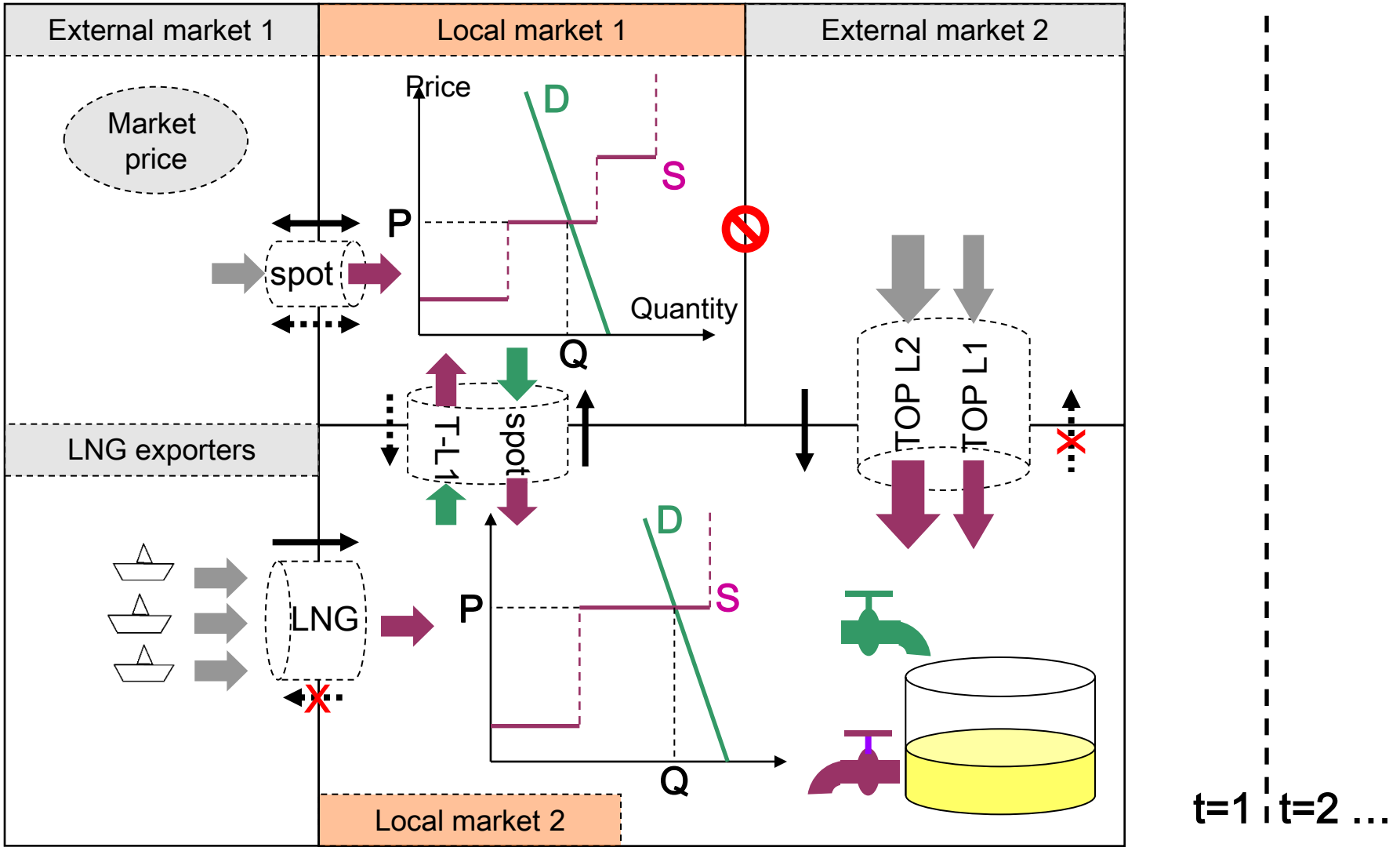
OUTPUT

- Wholesale gas price by country
- Consumption by countries
- Gas flows on interconnectors
- Storage stock change
- Import through long term contracts and spot trade

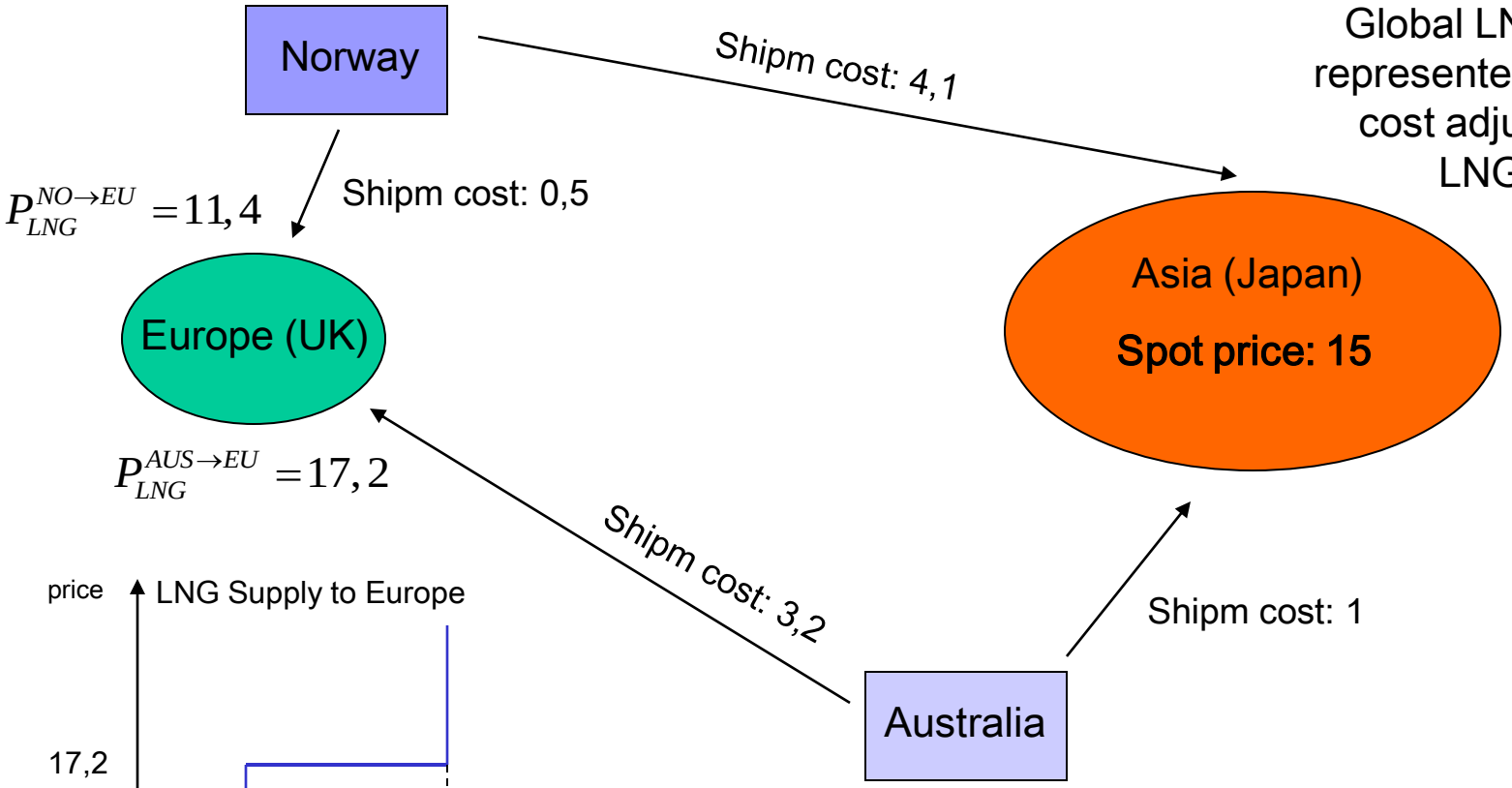
Social welfare:

- Consumer surplus
- Producer surplus
- Storage operation profit
- Storage arbitrage profit
- Net profit from long-term contracts
- TSO auction revenue
- TSO operation profit

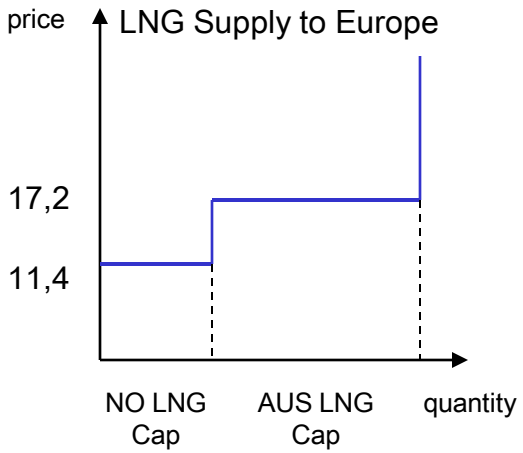
Model scheme



A simple model of spot LNG pricing for Europe (in $/MMBtu)



Global LNG market is represented by shipment cost adjusted Japan LNG prices



$$P_{LNG}^{AUS \to EU} = P_{SPOT}^{ASIA} - C_{SHIPM}^{AUS \to ASIA} + C_{SHIPM}^{AUS \to EU}$$

EGMM references

- Analysis of the CSEE gas storage market; the impact of system use charges on the demand for gas storage capacity (E.ON, 2012) and (MoFA, 2013)
- CBA of PECI projects for the Energy Community (2013)
- Latest significant upgrade supported by FGSZ (Hungarian TSO)(2013)
- The impact of gas infrastructure corridors on the regional gas market (MoFA RoBoGo, March 2014), FGSZ South Stream (April 2014)
- Supply Security analyses related to the Ukrainian crisis (2014, Atlantic Council, EFET, IDDRI)
- Towards2030 - Dialogue
- CBA of PCI projects for the Hungarian Energy and Public Utility Regulatory Authority (2014-2015)
- Measures To Increase The Flexibility And Resilience Of The European Natural Gas Market (2014, IEA)

Key modelling assumptions

- Infrastructure setup in the reference scenario:
  - Existing infrastructure
- Long term contracts
  - Price of LTCs is based on press information and on Quarterly report data
  - Flexibility of LTCs is uniform (30%), except for energy island countries
- New infrastructure is modelled with a uniform 2 €/MWh tariff
- Outside market prices are set exogenously
  - Japanese LNG Price is 27 €/MWh on average (seasonal fluctuation is assumed) LNG suppliers use Japanese price for their netback price
  - Turkish and Russian markets trade only through long term contracts the 50€/MWh price on the border is the spot trade price (we assume that there is no spot trade)
  - Norwegian spot price is 21 €/MWh on average (seasonal fluctuation is also assumed)