# The prospects for LNG in the Danube Region

Final Report

REKK

May 2016

This project is co-financed by the European Union.

**The discussion paper was prepared for the PA 2 Stakeholder Seminar of the Danube Region Strategy: "LNG – Dream or Reality for the Danube Region?" to be held in Brussels, 26.05.2016.**

**This discussion paper serves as a summary of main findings of the modelling analysis. Detailed results and assumptions are to be found in the slides prepared for the Stakeholder Seminar.**

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**May 2016.**

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# TABLE OF CONTENTS



# LIST OF TABLES



# LIST OF FIGURES



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# 1 INTRODUCTION

Following years of declining utilization rates, the fortunes of European regasification terminals are set for a reversal on the heels of a shift in global supply and demand conditions. Stagnant and declining Asian demand combined with massive liquefaction capacity additions in Australia and the US will sustain a soft market expected to transform Europe into the LNG destination of last resort in the short-term.

This is in stark contrast to the diminishing utilization trend of LNG regasification facilities in Europe, falling from 53% in 2010 to just 19% in 2014. The changing fundamentals already sent a strong signal in the first quarter of 2015, with the collapse of Asian spot natural gas prices pushing European LNG imports up 11% year-on-year.

However, it is increasingly evident that LNG access is significantly limited from reaching secondary and tertiary markets within Europe. This is the result of lingering physical and regulatory constraints that continue to obscure progress towards a single European natural gas market. For countries lacking direct access - in particular those of Central and Southeast Europe - these limitations have hamstrung the potential competitive and security of supply benefits that LNG can offer.

The European Commission explicitly recognizes this discrepancy and has responded by leading regional infrastructure investment efforts to improve integration and encourage LNG expansion. This is at the core of its recently published strategy for LNG and gas storage,[i] which concluded that select PCIs will disperse LNG from countries with existing LNG terminals and increase uptake in CSEE.[ii] In particular, the communication refers to the six priority projects identified by CESEC[iii] that have the potential to contribute to the region's LNG access, resting on two fortified corridors from Croatia and Greece.

The objective of this report is to assess the impact of global and regional gas market developments in the Danube Region (DR).[iv] First, the price effect of increasing LNG flows to Europe in 2016 and 2020 reference scenarios will be calculated and compared using REKK's dedicated European Gas Market Model (EGMM). Then infrastructure scenarios for 2020 will be grouped, modelled and evaluated. The groupings consist of existing infrastructure, the CESEC group priority projects[v] and other related PCIs with 2020 commissioning dates. In a layered fashion, the EGMM will show how additional projects affect utilization rates of existing and new infrastructure and ultimately calculate the social NPV of the new projects and clusters in this context. Lastly, the EGMM will measure the sensitivity of each scenario to the realization of Nord Stream 2.



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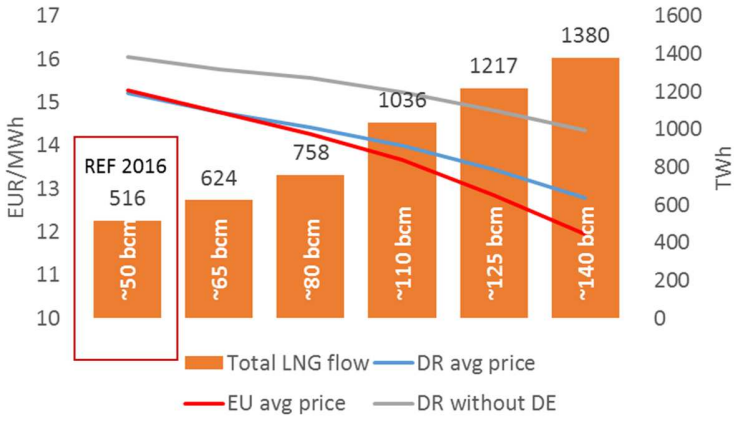
## 2 INCREASED LNG FLOWS TO EUROPE

The 2016 reference case is based on existing, 2015 conditions with LNG flows of 50 bcm/yr arriving to Europe. The main assumptions for the 2020 reference case are that LNG flows to Europe grow to 100 bcm/yr, supply and demand conditions reflect ENTSOG's 2020 forecast[vi], and only current FID projects to be commissioned by 2020 are added to European gas infrastructure.

In the 2016 reference, increasing LNG flows arriving in Europe correspond to a growing discrepancy between EU and DR average prices even though the average DR price is inflated by disproportionate benefits in Germany. If the effects of Germany are not considered in the DR price effect, we see a more marked price difference between the DR and the EU average price.

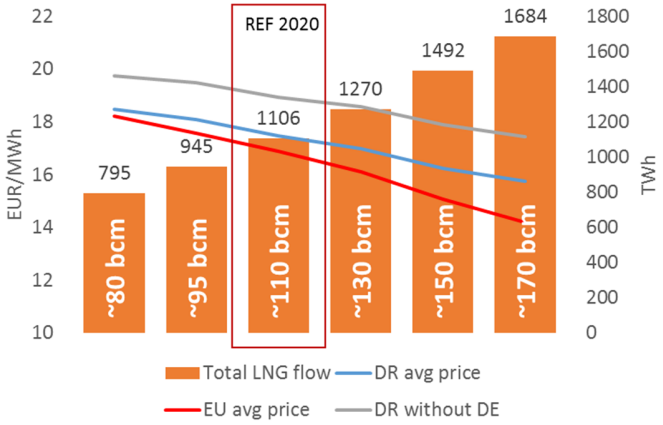
**Figure 1. Modelled price effect of increased LNG flows in 2016**




*Source: REKK modelling*

The 2020 reference scenario shows an even stronger price difference between Western Europe and the DR compared to 2016. LNG continues to add liquidity to Western European markets and put downward pressure on prices while volumes reaching CSEE are still constrained.

**Figure 2. Modelled price effect of increased LNG flows in 2020**




*Source: REKK modelling*



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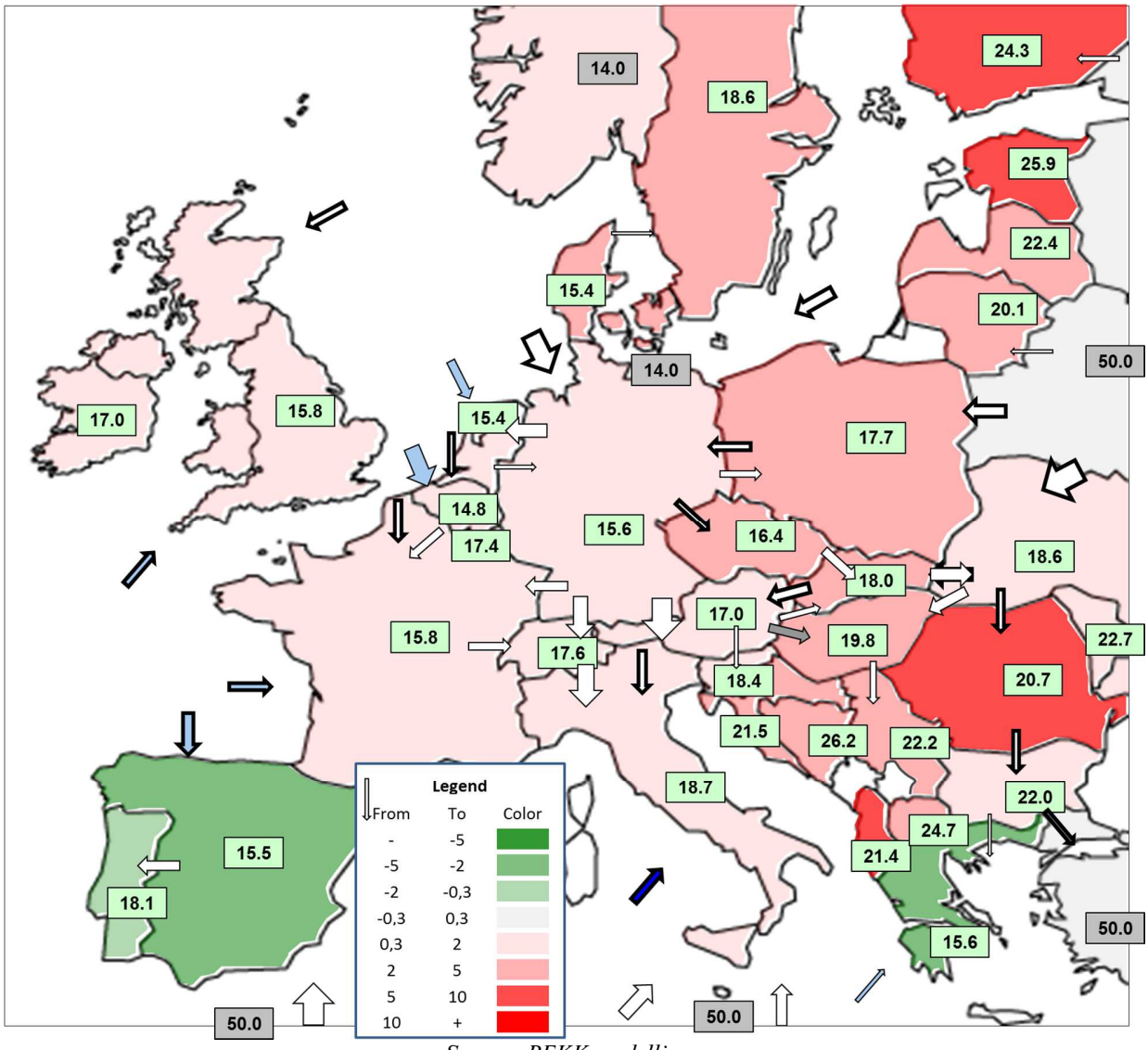
Major LNG importers such as Spain and Greece benefit the most in the 2020 scenario but inadequate infrastructure prevents broad price convergence in Europe. DR countries benefit less than the EU as a whole from growing global LNG supply. The general price increase in 2020 compared to 2016 is due to three factors: the forecasted higher oil prices[vii], the diminishing European gas production and the slightly stronger demand.[viii]

**Figure 3. 2020 reference price levels in €/MWh and change from 2016 reference**




*Source: REKK modelling*

*Note: Values in the green boxes are the modelled wholesale gas price. Arrows show the direction of the gas flow and their size is representative of the volume transmitted. Gray arrows indicate congestion along the pipeline and dark blue arrows indicate a fully utilized LNG terminal.*



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# 3 INFRASTRUCTURE ROUTES AND SCENARIOS

The analysed routes and scenarios stem from existing and potential LNG terminals in Poland, Greece, and Croatia and the identified PCIs projects that connect them throughout the DR, a de facto representation of the North-South Corridor. They are grouped accordingly in the following chart, with 'low' referring to a lower tariff scenario in line with average tariff prices. Of all of the tested scenarios, four resulted in a positive social NPV: IGB, IGB with TAP, Croatian LNG[ix] and low tariff Croatian LNG with the low tariff HR-HU interconnector.

**Table 1. Analysed routes and scenarios**

| |
|---|
| PL-SK |
| PL-SK + low PL LNG tariff |
| IGB |
| IGB+BG-RO |
| IGB+BG-RO+RO-HU |
| IGB+IBS |
| TAP +IGB |
| IT LNG + SI-HU |
| Low IT LNG tariff + SI-HU |
| HR LNG |
| HR LNG + HR-HU |
| HR LNG + low HR-HU |
| Low HR LNG + low HR-HU |


*The map indicates approximate routes and is included as illustration only. Base map from ENTSOG Capacity Map 2015*

## 3.1 MODELLING RESULTS: POLISH CORRIDOR

If then the Polish LNG regasification fee is reduced from its current level of 3.86 €/MWh to 1 €/MWh, utilization increases significantly while Lithuanian LNG utilization further decreases. It also reduces demand for spot gas in Germany via PL-DE reverse flow and even cuts into demand from Russia. The additional Polish LNG is consumed in Poland and transported along to Ukraine and Lithuania, increasing the use of GIPL and UA-PL reverse flow.

**Table 2. Effects of infrastructure and tariff scenarios on LNG flows in the Polish LNG terminal (TWh/year)**

| TWh | ref | PL-SK | PL-SK low |
|---|---|---|---|
| PL LNG | 14.3 | 14.3 | 46.2 |

*Source: REKK modelling*



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The PL-SK interconnector has no effect on Polish LNG utilization, and even if the tariff if reduced to 1 €/MWh the low spread between Slovakian and Polish markets do not induce spot trade flows to Slovakian and Hungarian markets. However, the low tariff scenario does draw Polish LNG to the Ukrainian market via UA-PL reverse flow, which consequently crowds out some of Slovakia's reverse flows to Ukraine.

### 3.2 Modelling Results: Greek Corridor

Looking at Greek LNG and various corresponding infrastructure, namely IGB, the BG-RO interconnector increases the utilization of both by allowing the Bulgarian market to consume the additional flows. Furthermore, the IBS had significantly higher positive effects for Greek LNG and IGB utilization. Meanwhile, the addition of the RO-HU interconnector did not improve the situation as it is unused and therefore LNG does not reach Hungary.

**Table 3. Effects of IGB, IBS, TAP and related infrastructure on LNG flows in the Greek LNG terminal (TWh/year)**

| TWh | ref | IGB | IGB+BG-RO | IGB+BG-RO+RO-HU | IGB+IBS | TAP + IGB |
|---|---|---|---|---|---|---|
| GR LNG | 22.4 | 33.1 | 34.6 | 34.6 | 49.4 | 24.3 |

*Source: REKK modelling*

The inclusion of TAP[x] has a negative effect on Greek LNG utilization, demonstrating competition between pipeline and LNG sources in the region. In the following table it can be observed that the boost in Greek LNG utilization resulting from IGB is almost completely crowded out by long term contracted flows via TAP.

### 3.3 Modelling Results: Croatian Corridor

The Croatian LNG corridor is highly sensitive to tariffs. Croatian LNG is underutilized at its planned tariff of 3.2 €/MWh, and the addition of the HR-HU interconnector at a high tariff level does not change the situation – it is all consumed domestically. If the HR-HU interconnector tariffs are reduced (to 1 €/MWh exit and 1 €/MWh entry), a very small amount (.5 TWh) flows to Hungary. Only when both the regasification, entry and exit tariffs are reduced to 1 €/MWh is there a significant flow of Croatian LNG to Hungary, amounting to 20 TWh/yr (~2 bcm/yr), which in turn maximizes Croatian LNG utilization.

**Table 4. Effects of infrastructure and tariff scenarios on LNG flows in the Croatian LNG terminal (TWh/year)**

| TWh | ref | HR LNG | HR LNG + HR-HU | HR LNG+HR-HU low | Low HR LNG+ low HR-HU |
|---|---|---|---|---|---|
| HR LNG | - | 15.7 | 15.7 | 16.2 | 35.6 |

*Source: REKK modelling*



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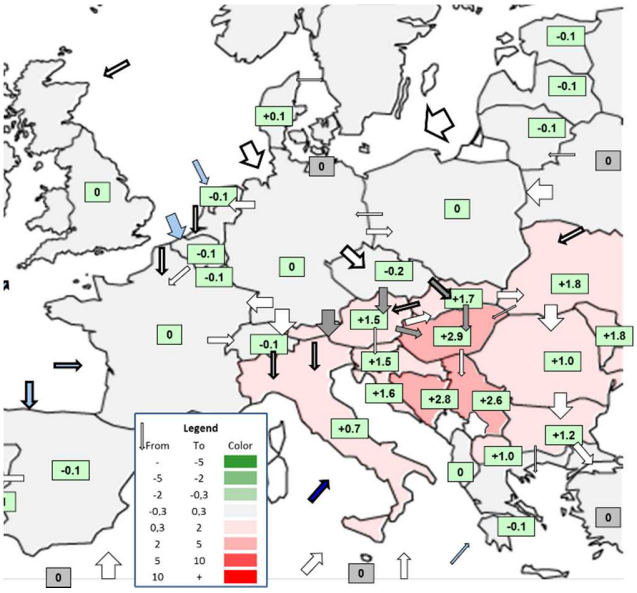
# 4 SENSITIVITY OF INFRASTRUCTURE SCENARIOS TO NORD STREAM 2

Nord Stream 2 enhances the broad price discrepancy in Europe by increasing prices in CSEE and marginally reducing prices in Western Europe.[xi]

**Figure 4. Price effects of Nord Stream 2 in the 2020 reference (€/MWh)**




*Source: REKK modelling*

The increase in DR prices raises the usage and value of infrastructure in the region, thus new infrastructure produces a greater welfare effect. Nord Stream 2 significantly increases the positive social NPV of the four projects mentioned above, and creates a positive social NPV in four additional scenarios: BG-RO (reverse flow), RO-HU, IBS and Croatian LNG plus HR-HU interconnector. This would raise the overall investment requirement from 890 million € without Nord Stream 2 to 1880 million € with Nord Stream 2.[xii]

**Table 5. Welfare effects of infrastructure development with and without Nord Stream 2 expansion in 2020 (Million € compared to reference)**

| | Social NPV, M€ | |
|---|---|---|
| | Without NS | With NS |
| PL-SK | -521 | -456 |
| PL-SK low | -702 | -514 |
| IGB | 261 | 1145 |
| IGB+BG-RO | -262 | 495 |
| IGB+BG-RO+RO-HU | -680 | 77 |
| IGB+IBS | -46 | 1296 |
| IGB (with TAP) | 236 | 1677 |

| | Social NPV, M€ | |
|---|---|---|
| | Without NS | With NS |
| IT LNG +SIHU | -128 | -74 |
| low IT LNG +SIHU | -303 | -74 |
| HR LNG | 36 | 857 |
| HR LNG + HR-HU | -293 | 528 |
| HR LNG+HR-HU low | -272 | 1267 |
| Low HR LNG+low HR-HU | 380 | 1625 |

*Source: REKK modelling*



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# 5 CONCLUSION

Under current conditions, the global surplus of LNG will bring price relief to Europe but the DR will only experience limited benefits. As more LNG reaches Europe, the price difference between Western Europe and the DR will also increase. This is due to a lack of proximal LNG terminals, missing interconnectors and underutilization of existing infrastructure due to exorbitant tariffs. Modelling suggests that for Polish LNG, the HR-HU interconnector and Croatian LNG, in particular, high tariffs undermine utilization and limit regional social benefits.

Steadily decreasing demand and a pervasive low price environment render a number of modelled PCIs obsolete. The only projects with positive social NPV in 2020 are IGB, IGB plus TAP, Croatian LNG alone and Croatian LNG plus HR-HU at low tariffs.

Nord Stream 2 would bring about a substantial enough price increase across the DR to justify investments in additional PCIs and facilitate greater cross-border trade. With BG-RO (reverse flow), RO-HU, IBS and Croatian LNG plus HR-HU interconnector (high tariff) generating positive social NPV, the required regional investment with Nord Stream 2 is 1880 million EUR, more than double investment without (890 million EUR).

Finally, Nord Stream 2 does not necessarily crowd out LNG from Europe as long as Russia does not start a price competition to retain market share. The pipeline/LNG competition that does arise in the scenario analysis is between Greek LNG and TAP, whereby utilization gains enabled by IGB in the former are significantly curtailed by long-term contracted gas of the latter.

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[i] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on an EU strategy for liquefied natural gas and gas storage. COM(2016) 49 final. https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_ACT_part1_v10-1.pdf

[ii] Central and South-East Europe

[iii] Central and South Eastern Europe Gas Connectivity High Level Group, covering the Member States Austria, Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovakia and Slovenia as well as non-EU Member states Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Moldova, Serbia and Ukraine

[iv] The area covered by the EU Strategy for the Danube Region stretches from the Black Forest (Germany) to the Black Sea (Romania-Ukraine-Moldova). Participating countries are Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Romania, Slovakia, Slovenia, Bosnia and Herzegovina, Montenegro, Serbia, Moldova and Ukraine.

[v] The CESEC group identified six key priority projects along two main corridors

[vi] ENTSOG Ten-Year Network Development Plan 2015 grey scenario

[vii] Based on World Bank Commodities price forecast, 01.20.2016.

[viii] Based on ENTSOG Ten-Year Network Development Plan 2015 grey scenario adjusted by REKK expert opinion

[ix] Croatian LNG defined as 4 bcm/yr capacity, cost of 300 million € and a 3 €/MWh tariff, and Croatia is only beneficiary

[x] The Azeri gas reaches Italy (8 bcm/yr), Greece (1 bcm/yr) and Bulgaria (1 bcm/yr) via long-term contract

[xi] When modelling Nord Stream 2, the following assumptions were made: all Western and Central-European long-term contracts are re-routed to the NS infrastructure bypassing Ukraine. Contracts via the Trans-Balkan corridor are unaffected (RO, MD, BG, MK, GR, TR). The importing European countries are paying the same price on the border as before, all cost of transit up to the delivery points is borne by Russia.

[xii] Investment cost reported by project promoters int he 2015 PCI list was used. If no investment cost was reported, ACER benchmark figures were used (ACER (2015): Report on unit investment cost indicators and corresponding reference values for electricity and gas infrastructure)



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